Handbook on Supply, Use and Input-Output Tables with Extensions and Applications

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Department of Economic and Social Affairs

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Preface and Acknowledgements

The *Handbook on Supply, Use and Input-Output Tables with Extensions and Applications* has been prepared as part of a series of handbooks on national accounting in support of the implementation of the System of National Accounts 2008 (2008 SNA). The objective of this *Handbook* is to provide a step-by-step guidance for the compilation of Supply and Use Tables (SUTs) and Input-Output Tables (IOTs) and an overview of the possible extensions of SUTs and IOTs which increase their analytical usefulness.

The preparation of this *Handbook* started as an update of the 1999 United Nations publication entitled *Handbook of National Accounting: Input-Output Table Compilation and Analysis* (ST/ESA/STAT/SER.F/74, Sale No. E.99.XVII.9) to: incorporate changes in the underlying international economic accounting standards, most notably the 2008 SNA, and classifications; extend the scope of the *Handbook* to cover more prominently SUTs; and provide practical compilation guidance for countries with advanced and less advanced statistical systems. However, the compilation of the *Handbook* has also successfully evolved to provide an innovative approach to the compilation of SUTs and IOTs in the following three main areas: (a) the underlying use of an integrated approach to statistics; (b) the use of a business model for the compilation of SUTs and IOTs linking the various parts through an "H-Approach" compilation scheme; and (c) the mainstreaming of environmental considerations.

This *Handbook* builds on the experience, practices and guidance available at national and regional level, including the Eurostat *Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008). It provides a consistent numerical example of SUTs and IOTs that runs throughout the chapters (as far as practically possible) in order to facilitate the understanding of the various compilation steps. It also provides examples of best practices to further illustrate certain aspects of the compilation of SUTs as well as clear recommendations, principles and guidelines in order to meet best practice.

For the preparation and drafting of the *Handbook*, an Editorial Board was established in May 2013, comprising 12 Members and the United Nations Statistics Division (UNSD). The Members of the Editorial Board comprised leading international experts (including Members of the International Input-Output Association (IIOA)) with decades of knowledge and experience from different regions and from different institutions, such as national statistical offices, central banks, international organizations and academia.

An Editor (Sanjiv Mahajan, Office for National Statistics, United Kingdom) was appointed to lead the work of the Editorial Board and coordinate the contributions of experts for the various chapters. Initial drafts of the chapters were prepared by Members of the Editorial Board, including the Editor. These were further refined and aligned by the Editor in liaison with respective Members of the Editorial Board and UNSD into a coherent set of chapters. This was achieved through many bilateral electronic communications between the Editor and chapter authors, a face to face meeting of all Editorial Board Members in New York in May 2014, and a final Editorial Board review prior to a Global Consultation.

The *Handbook* is therefore the outcome of a collaborative team effort led by the Editor in liaison with UNSD and the Editorial Board. They are:

- Sanjiv Mahajan, Editor — Office for National Statistics, United Kingdom
- Joerg Beutel — Konstanz University of Applied Sciences, Germany

- Simon Guerrero — Central Bank of Chile
- Satoshi Inomata — IDE-JETRO, Japan
- Soren Larsen — Statistics Denmark
- Brian Moyer — Bureau of Economic Analysis, USA
- Isabelle Remond-Tiedrez — European Commission / Eurostat
- José M. Rueda-Cantuche — European Commission / Joint Research Centre
- Liv Hobbelstad Simpson — Norway
- Bent Thage — Denmark
- Catherine Van Rompaey — Statistics Canada
- Piet Verbiest — Statistics Netherlands
- Ilaria DiMatteo — UNSD

The Editorial Board Members contributed with initial draft chapters and a detail review of all the chapters in the various rounds of consultation. Substantive contributions to specific topics, including initial draft chapters, were provided by the Editorial Board Members as follows: Joerg Beutel (transforming SUTs into IOTs, compiling PSUTs and EE-IOTs, extension of SUTs and IOTs and modelling applications of IOTs); Simon Guerrero (examples of country practices); Satoshi Inomata (multi-country SUTs and IOTs); Soren Larsen (compiling the Use Table); Brian Moyer (compiling the Import Use Table and Domestic Use Table); José M. Rueda-Cantuche (transforming SUTs into IOTs and projecting SUTs and IOTs); Liv Hobbelstad Simpson (guidance for countries with limited statistical resources and examples of country practices); Bent Thage (classification of industries and products, compiling Supply Table, Use Table, valuation matrices, Import Use Table and Domestic Use Table, and transforming SUTs into IOTs); Catherine Van Rompaey (regional SUTs); and Piet Verbiest (compiling SUTs in volume terms and balancing). The Editor also provided substantive contributions to these topics, initial draft chapters and all other topics in the *Handbook*, and brought all of the material together through numerous iterations with Editorial Board Members reflecting many changes and improvements.

The contributions of the Editor and the Members of the Editorial Board and their commitment to the *Handbook* are very much acknowledged and appreciated. The following specific contributions are also acknowledged: Joerg Beutel, in formatting and standardizing tables, charts, boxes and figures throughout the *Handbook*; Ilaria Di Matteo in reorganizing the chapters and ensuring overall coherence and consistency of the *Handbook*; and Erwin Kolleritsch (Statistics Austria), in kindly providing, and checking, much of the empirical data supporting the SUTs and IOTs in Part A and B of this *Handbook*.

The *Handbook* also benefited from specific inputs provided by: Issam Alsammak (Statistics Canada), Gary Brown (Office for National Statistics, United Kingdom), Andrew Cadogan (Australian Bureau of Statistics), Duncan Elliot (Office for National Statistics, United Kingdom), Antonio F. Amores (European Commission / Joint Research Centre), Ziad Ghanem (Statistics Canada), Manfred Lenzen (University of Sydney, Australia), Bo Meng (IDE-JETRO, Japan), Louis de Mesnard (University of Bourgogne, France), Carol Moylan and Tom Howells (Bureau of Economic Analysis, USA), Jan Oosterhaven (University of Groningen, Netherlands), Ole Gravgard Pedersen (Statistics Denmark), Xesús Pereira (University of Santiago de Compostela, Spain), Joao Rodrigues (Technical University of Lisbon, Portugal), Jaroslav Sixta (Czech Statistical Office), Silke Stapel-Weber (European Commission / Eurostat), Umed Temursho (Temurshoev)

(European Commission / Joint Research Centre), Norihiko Yamano and Nadim Ahmad (OECD), and Herman Smith, Julian Chow, Gulab Singh, Benson Sim and Alessandra Alfieri (UNSD).

Feedback was also received from participants at various meetings and conferences, most notably the annual IIOA Conferences (2014, 2015 and 2016) and various regional national accounts meetings. The *Handbook* has benefited greatly from the numerous useful comments and suggestions made by national statistical offices, central banks, regional commissions, academic associations and international organizations as well as the Inter-secretariat Working Group on National Accounts (ISWGNA) during the global consultation in the period August to October 2017.

The *Handbook* was prepared under the supervision provided by Herman Smith (UNSD) and overall responsibility of Ivo Havinga (UNSD).

Contents

List of abbreviations

ANA	Annual National Accounts
BEC	Classification by Broad Economic Categories
BoP	Balance of Payments
CIF	Cost, insurance and freight
CPA	Classification of Products by Activity
CPI	Consumer price index
COFOG	Classification of the Functions of Government
COICOP	Classification of Individual Consumption According to Purpose
COPNI	Classification of the Purposes of Non-Profit Institutions Serving Households
COPP	Classification of the Outlays of Producers According to Purpose
CPC	Central Product Classification
CSPI	Corporate services price index
EBOPS	Extended Balance of Payments Services Classification
FISIM	Financial Intermediation Services Indirectly Measured
FOB	Free on board
GATS	General Agreement on Trade in Services
GFCF	Gross fixed capital formation
GCF	Gross capital formation
HHFCe	Household final consumption expenditure
ICPIs	Intermediate consumption price indices
IOTs	Input-Output Tables
ISIC	International Standard Industrial Classification of all economic activities
NCB	National Central Bank
NSO	National Statistical Offices
OECD	Organisation for Economic Co-operation and Development
PPI	Producer price index
PPP	Purchasing power parities
PSUT	Physical Supply and Use Table

PYPs	Previous years' prices
QNA	Quarterly National Accounts
ROW	Rest of the world
RPI	Retail prices index
SAM	Social accounting matrix
SITC	Standard International Trade Classification
SUTs	Supply and Use Tables
TLS	Taxes less subsidies on products
TTM	Trade and transport margins
WPI	Wholesale price index
WTO	World Trade Organization

Introduction

Chapter 1. Introduction

A. Introduction

1.1. The Supply and Use Tables (SUTs) are an integral part of the System of National Accounts 2008 (2008 SNA) forming the central framework for the compilation of a **single and coherent estimate of GDP** integrating all the components of production, income and expenditure approaches as well as providing key links to other parts of the SNA framework.

1.2. In their simplest form, the SUTs describe how products (goods and services) are brought into an economy (either as a result of domestic production or imports from other countries) and recorded in the Supply Table, and how those same products are used (as intermediate consumption, household final consumption, non-profit institutions serving households, general government final consumption, gross capital formation and exports) and recorded in the Use Table.

1.3. The SUTs also provide the link between components of Gross Value Added (GVA), industry inputs and industry outputs. Although typically shown only by the industry dimension, SUTs can also be formulated to show the role of different institutional sectors (for example, non-financial corporations, government, etc.) providing an important mechanism to link to the different accounts of the SNA framework (the goods and services account, production account, generation of income account and the capital account).

1.4. Importantly, and by design, these inter-linkages facilitate data confrontation and the examination of the consistency of data on goods and services obtained from different statistical sources such as business surveys, household surveys and administrative data within a single detailed framework. As such, they provide a powerful feedback mechanism on the quality and coherency of primary data sources.

1.5. The SUTs do not just provide a framework to ensure the best quality estimates of GDP and its components, the SUTs are also an important analytical resource in their own right, showing the interaction between producers and consumers. When measured in volume terms, the SUTs provide the basis for a rich stream of analyses, notably in the field of structural analysis, and in particular productivity, where in recent years SUTs have been widely accepted as an important tool for KLEMS-type productivity measures. Just as important is their growing use as the basis for deriving the Input-Output Tables (IOTs).

1.6. In many respects, the IOTs, which show the links between final uses and intermediate uses of goods and services defined according to industry outputs (Industry by Industry Tables) or according to product outputs (Product by Product Tables) predate the SUTs. The IOTs also show separately the consumption of domestically produced and imported goods and services. However, the widespread availability of SUTs has meant that the SUTs form the starting point for constructing IOTs, and in turn, the swathe of related analytical products and indicators, for example, the Leontief Inverse and other type of analyses such as output multipliers, employment multipliers, etc.

1.7. The SUTs and IOTs are compiled by many countries as part of their 'core' National Accounts production thereby improving the coherency and consistency of their National Accounts' estimates. The ability to readily create IOTs from SUTs (as shown in Chapter 12) has helped to reinforce the momentum behind the evolution, the role and the use of SUTs.

1.8. SUTs and IOTs have received much attention in recent years. This is because of their analytical properties allow for a much wider set of analyses not only of the national economy and the regions within a nation but also of the inter-linkages of economies at global level as well as environmental impacts.

1.9. Further momentum has been generated for the role of SUTs and IOTs as the impact of globalization and the international fragmentation of production has rapidly increased. Increasingly, to fully understand international inter-dependencies, and their impact informing important policy areas, for example, trade, competitiveness and sustainable development, one requires a prism that looks at production and consumption through a 'global value chain' type lens. In other words, multi-country and regional SUTs and IOTs have become essential tools to inform policy and policy makers. Over the past five years, a number of efforts have been made by the international statistics community to meet these needs, for example, the OECD-WTO Trade and Value Added database, WIOD and the UN Expert Group on International Trade and Economic Globalization Statistics.

1.10. With these developments in mind, and in particular the heightened importance of SUTs and IOTs, the timing of this Handbook is important and highly relevant. To motivate the detailed chapters that follow, this Chapter provides an introduction for this Handbook. Section B in this Chapter provides a general overview of the roles and uses of SUTs and IOTs. Section C covers the SNA and links to SUTs and IOTs. Section D covers the objectives of this Handbook and the new features of this Handbook compared to previous manuals on the subject. Finally, Section E provides a description of the outline and content of this Handbook.

B. Uses of SUTs and IOTs

1.11. The uses of SUTs and IOTs are multiple and their statistical and analytical importance has increased with time also in response to new emerging issues such as globalization and sustainable development with its three pillars of social, economic and environmental development. To some extent, the analytical uses of SUTs and IOTs are presented below in parallel. The SUTs constitute the basis for the compilation of IOTs, so the uses of one versus the other are not clearly delineated in this section.

1.12. As mentioned above, the SUTs combine into a single framework the three approaches to measuring GDP according to the production approach, the income approach and the expenditure approach. All three approaches are based on sets of data with various levels of detail and a range of different sources. Combining the data in one statistical framework compels compilers to use harmonised and unique classifications of producers, users and income receivers, as well as harmonised and unique classifications and definitions of products and income categories. Under these conditions, corresponding data can be related and compared in a well organised way. Combining the three data sets provides the opportunity to analyse the causes of discrepancies, make necessary adjustments and fill data gaps when necessary.

1.13. An important objective of the National Accounts is to estimate year-to-year and quarter-to-quarter changes of several macroeconomic variables. When dealing with production, use and the generation of value added, it is important to divide the current price changes into volume changes ("real" growth) and price changes. When SUTs are compiled simultaneously in current prices and in volume measures (as recommended in this Handbook, using the "H-Approach"), there are considerable advantages in the overall quality and consistency of the information provided. During the entire statistical process - from the processing and analysis of the source data through to, and including, the balancing of the SUTs - data in current prices and deflated data are obtained simultaneously and consistently with each other.

1.14. In addition to the annual National Accounts, SUTs can be used in the compilation of quarterly National Accounts. This may range from compiling and balancing quarterly SUTs to just using the SUTs framework to highlight where quarterly product supply and use discrepancies may exist. The annual estimates of GVA can, for example, be used as weights in quarterly estimate of GDP in volume terms to reflect the most recent period. Also SUTs can provide weighting schemes for price and volume indices.

1.15. The SUTs and IOTs serve also as the basis for compiling a range of accounts such as regional accounts, environmental accounts, labour accounts, tourism accounts, etc. The clear links of these satellite systems with the SUTs (and IOTs) ensure the consistency of the satellite systems with the concepts and methods of the core National Accounts and allow for feedback loops with the SUTs during the compilation and balancing process of the frameworks involved. For instance, the SUTs can support the compilation of regional accounts by including clear links to variables like regional GVA. When physical environmental flows are linked to the SUTs and IOTs in the environmental accounts, they provide feedback loops to the compilation of SUTs by contrasting physical and monetary measures of the supply and use of products. When SUTs are linked to labour and capital, they can be used for productivity analyses that link economic growth to the use of intermediate inputs. Finally, social accounting matrices (SAMs) elaborate the linkages between SUTs and sector accounts. They capture transactions and transfers between all economic agents in the accounting system and measures effects of macroeconomic policies on distribution.

1.16. The SUTs and IOTs also provide the basis for different types of analytical uses at micro and macro level (see, for example, United Nations 2002, Mahajan 2004a and 2006). Various examples are included in the Additional Reading section at the end of this Handbook. Examples include the following:

- Economic analyses: Export shares, import penetration, concentration ratios, links between prices and costs, links between energy production, consumption and emissions, etc.
- Impact and policy analyses: Sensitivity analyses and impacts of taxation changes, price changes, introduction of a minimum wage, specific economic crisis, earthquakes, etc. as well as consumption/demand based accounting and analyses of air emissions, material flows, energy, water, etc.
- Industrial and sectoral analyses: Changes to specific sectors over time like information and communications technology (ICT), oil and gas, food, sport, creative sector, tourism, health, etc., and more recently, analyses covering the digital economy, sharing economy and collaborative economy as well as product-specific global value chains.
- Local government type investment planning: Construction projects, shopping centres, new motorways, rural planning, etc.

- Base structures for modelling: Computable General Equilibrium (CGE) models, environmental analyses, supply-side based models, etc.

1.17. The role of SUTs and IOTs in understanding the Global Value Chains (GVCs) is of particular importance given the interconnected links of today's global economy. The SUTs constitute the centre piece of the internationally compatible accounting framework for a systematic and detailed description of the economy, its various components on the supply and use side and its relations to other economies. The construction of international SUTs and IOTs allows, together with trade statistics, to follow the Trade in Value Added (TiVA) and understand who ultimately benefits from the trade of finished goods in terms of value added, employment, etc. The compilation of international or global SUTs and IOTs tables poses a number of compilation challenges (including, for example, the recording of goods sent abroad for processing and the recording of the production abroad and merchanting affecting SUTs and IOTs) and relies on the availability of national SUTs and IOTs on a comparable basis.

1.18. In addition, the inclusion of the environmental dimension in the SUTs and IOTs further enhances the usefulness of these tables by allowing the integration and consistency of the economic and environmental information and the understanding of the inter-linkages between the economy and the environment. Incorporating considerations on the environment as part of the regular compilation of SUTs improves the quality, coherence and consistency of the related outputs and the process provides powerful feedback loops for identifying improvements.

C. The System of National Accounts

1.19. The System of National Accounts (SNA) provides an internationally compatible framework for a systematic and detailed description of a total economy (that is, a region, country or group of countries), its components and its relations with other total economies. The 2008 SNA (United Nations *et al.* 2009) is the latest version of the SNA, which was adopted by the United Nations Statistical Commission in 2008.

1.20. The SNA describes the basic features of the accounting system in terms of concepts, principles, statistical units and their groupings, etc. The SNA gives an overview of the sequence of accounts, the balancing items associated with each account, a brief description of key aggregates and the role of SUTs and the Input-Output (I-O) framework. The key accounting sequence include: production of goods and services, transactions with regard to products (goods and services) as well as non-produced assets, transactions which distribute and re-distribute income and wealth, financial transactions and balance sheets.

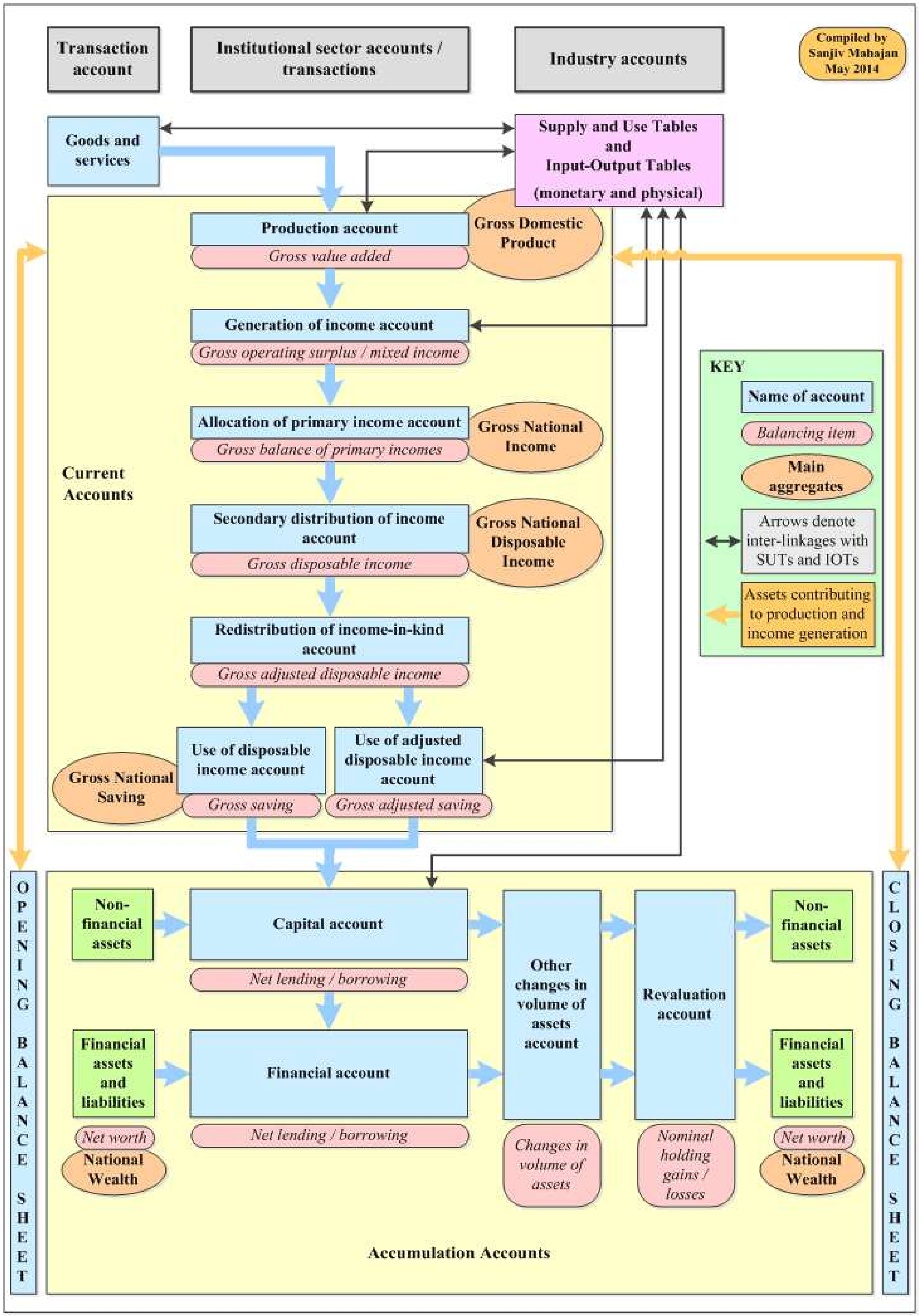
1.21. The SNA framework also draws in other aspects such as price and volume measurement, population, labour market measures, regional accounts and various specific conceptual issues. Figure 1.1 provides an overview of how SUTs and IOTs fit within the SNA framework. In particular, it shows which accounts in the SNA sequence of accounts are more directly linked with SUTs and IOTs, namely production account, generation of income accounts, use of disposable income accounts and capital accounts.

1.22. Producing annual SUTs simultaneously both in current prices and in volume terms not only ensures consistency for price volume measures, it also allows for the estimation of the volume of GVA through "double deflation", which is recommended in the 2008 SNA.

1.23. As mentioned, the SUTs are an integral part of the SNA, determining **a single estimate of GDP** both in current prices and in volume terms and linked to the institutional sector accounts. For example, the goods and services account for the total economy can directly be compiled from the SUTs through appropriate aggregation. In addition, by using the breakdown of GVA by components in the Use Table, the production account and the generation of income account can easily be compiled from the SUTs and linked to the institutional sectors.

1.24. Another important aspect linking the SUTs and the institutional sector accounts is the statistical unit. The SNA uses two types of units and two corresponding ways of sub-dividing the economy, which are quite different and serve separate analytical purposes. The units can be classified to an industry for use in the SUTs and to an institutional sector for use in the institutional sector accounts.

Figure 1.1 Overview of the links between SUTs and the SNA framework



1.25. The first purpose of describing production, income, expenditure and financial flows, and balance sheets, is met by grouping institutional units into institutional sectors on the basis of their principal functions, behaviour and objectives. The SNA enables a complete set of flow accounts and balance sheets to be compiled for each sector, and sub-sector, as well as for the total economy. The five institutional sectors distinguished in the SNA are the following:

- Non-financial corporations;
- Financial corporations;
- General government;
- Households; and
- Non-profit institutions serving households.

1.26. The SNA also describes the transactions between these five institutional sectors and the Rest of the World. These institutional sectors can be further split into sub-sectors, for example, general government can be split between central government and local government.

1.27. The second purpose of describing processes of production and for I-O analysis is met by the system grouping local kind-of-activity units (local KAUs) (or establishments) into industries, on the basis of their type of activity. An activity is characterised by an input of products, a production process and an output of products.

1.28. In order to ensure consistency between SUTs and the institutional sector accounts, a link table is compiled as an integrated part of the system. In this link table, a cross-classification of output, intermediate consumption, components of value added (and possible other variables of industries) between the industries and the institutional sectors is shown. Thus, this table links the main macroeconomic variables from the SUTs to the institutional sector accounts, providing a picture of local kind-of-activity units and on the basis of institutional units. As both units are classified differently, the link table also provides a picture of the relations of output, intermediate consumption, value added, etc., originating in the different industries and institutional sectors.

1.29. The SUTs - consistent with the National Accounts, are normally produced in connection with the final or benchmarked versions of the macroeconomic data around 2-3 years after first preliminary results of the National Accounts are published. However, the SUTs should play a more vital role at the heart of National Accounts in the production of preliminary annual or even quarterly accounts. Once the SUTs compilation system is in place on an annual basis, the statistical benefits are significant.

1.30. The role of SUTs in the National Accounts can take various forms. One is, for example, to update SUTs – eventually in a more aggregated version – from the last year with information available for the preliminary estimates in order to have a complete set of SUTs available that are consistent with the National Accounts. This procedure is a good method for revealing inconsistencies in the aggregated preliminary National Accounts. Another role of SUTs could arise from new information in a situation in which new, and more, detailed information on total supply and exports is available at an early stage, the structure and relationships in the SUTs of the previous year could be used to project SUTs for domestic output and imports.

1.31. The compilation of SUTs was in the past associated solely with the construction of IOTs. The SUTs were therefore seen as an intermediate step in the compilation of IOTs. This practically implied that the compilation of SUTs was carried out after the compilation of the National Accounts had been completed. This approach, in fact, has significant limitations because the independently calculated National Accounts aggregates had to be kept unchanged despite inconsistencies identified through the SUTs system.

1.32. The role of SUTs is now viewed more than just as a step towards the construction of IOTs. It is the SUTs that provide the ideal framework guaranteeing the coherency and consistency of supply and use of products in the system in current prices, and in volume terms, thereby improving the quality of the National Accounts, and in turn the key economic aggregates.

1.33. The compilation of SUTs is thus recommended as part of the regular annual compilation of National Accounts. The annual compilation of SUTs is also one of the recommended data sets used in assessing the scope of implementation of the 2008 SNA[1]. There is also a role for SUTs on a quarterly basis to help improve the quality and coherence of quarterly National Accounts (more on the role of SUTs for quarterly National Accounts is elaborated in Chapter 14).

1.34. The approach and guidelines for compiling SUTs as an integral part in the production of National Accounts can be formulated in general terms as follows:

- SUTs are produced as a central element of the National Accounts compilation to provide a key link to various parts of the SNA framework.
- SUTs provide the most efficient way and the statistical framework to incorporate all basic data – aggregated or detailed – covering the components of the three approaches to measuring GDP, and linking to the institutional sector accounts in a systematic way.
- SUTs effectively ensure the consistency and reconciliation of results at a detailed level and thereby improve the overall quality of the National Accounts.
- SUTs are compiled and balanced in both current prices and in volume terms.
- SUTs are produced annually, and ideally, if possible, on a quarterly basis.
- SUTs can provide a powerful feedback mechanism on coherency and consistency of source data such as business surveys as well as feedback on classifications of units on the business register.

1.35. When balanced, the SUTs provide a coherent, consistent and wholly integrated suite of statistics for a single period (for example, a year), which include:

- A single estimate of GDP in current prices and in volume terms, which is underpinned with components of the production, income (only in current prices) and expenditure approaches to measuring GDP.
- Detailed Goods and Services Account in current prices and in volume terms (not by institutional sector).
- Production Accounts by industry and by institutional sector in current prices and in volume terms.

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[1] See Table 2 of the report (E/CN.3/2011/6) to the United Nations Statistical Commission at its forty-second session (2011) available online at: http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf

- Generation of Income Accounts by industry and by institutional sector (both in current prices only).
- Link to the Use of Disposable Income Account through the flows of final consumption expenditures and Capital Account through gross capital formation (GCF) (and the components of GCF) balanced via SUTs.

1.36. These guidelines should form part of the strategic drivers for improving the quality of the National Accounts.

D. Objectives of this Handbook

1.37. The theoretical development of IOTs has long history. Box 1.1 provides a description of the evolution of both IOTs and SUTs within the context of National Accounts. The United Nations Statistics Division (UNSD) followed the theoretical development and the practical work of National Statistical Offices (NSOs) on IOTs and SUTs from the outset. It prepared a number of publications, under the guidance of the United Nations Statistical Commission, since 1966 (see, for example, United Nations 1966, 1973 and 1999) to share practices, update the methodology in line with the updates of the SNA, and provide guidance on the compilation of IOTs.

1.38. This Handbook continues those efforts in cooperation with other international organizations and experts, providing a practical and step-by-step guidance for the compilation of SUTs and IOTs based on the latest international statistical standards set out in the *System of National Accounts 2008* (2008 SNA) and the Sixth Edition of the IMF's *Balance of Payments and International Investment Position Manual* (BPM 6) (IMF, 2009).

1.39. This Handbook can, therefore, be viewed as an update of the UN *Handbook of Input Output Table, Compilation and Analysis* (United Nations, 1999). However, with the ever-increasing importance of SUTs in their own right, this Handbook extends the scope of the previous publication by providing a more detailed description and compilation guidance for SUTs. As the 2008 SNA states, “only supply and use tables provide a sufficiently rigorous framework to eliminate discrepancies in the measured flows of goods and services throughout the economy to ensure the alternative measures of GDP converge to the same value” (2008 SNA, paragraph 14.15).

1.40. The Handbook builds on the experience, practices and guidance available at national and regional level, such as the *Eurostat Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008). However, it provides an innovative approach to the compilations of SUTs and IOTs in the following three main areas:

- the underlying use of an **integrated approach** to statistics;
- the use of a **business model** for the compilation of SUTs and IOTs linking the various parts through an “H-Approach” compilation scheme; and
- the mainstreaming of **environmental considerations**, through the inclusion of the environmental focus of Chapter 13 within the core of Part B of the Handbook.

1.41. The compilation guidance provided in this Handbook relies on an *integrated statistics approach* whereby the production of statistics in the various domains is not seen in isolation but as part of an integrated process which uses common concepts, definitions, business registers and frames, statistical units, estimation methods and data sources to improve the consistency of the statistics compiled, to reduce the respondent burden, and potentially to reduce the statistical agency costs. In particular, the consistency of the basic economic information (that feeds into the National Accounts and in the SUTs) with the classifications, concepts and definitions of the 2008 SNA greatly reduces the discrepancies across data from different sources thus facilitating their reconciliation as part of the integration process. The integrated statistics approach is described in the *Guidelines on Integrated Economic Statistics* (United Nations, 2013).

1.42. This Handbook follows the Generic Statistical Business Process Model (GSBPM) (UNECE, 2013) to describe the production of statistics in a general and process oriented approach. The underlying concepts and principles of the GSBPM have been to describe the business process and stages of the statistical production processes underpinning the compilation of SUTs and IOTs. Chapter 3 of this Handbook describes these links in more detail in the context of SUTs and IOTs. In addition, the chapters in Part A and B of the Handbook are linked to the different parts of these stages of the statistical production process.

1.43. With the adoption of the *System of Environmental-Economic Accounting* (SEEA) (UN *et al.*, 2014) by the United Nations Statistical Commission, the extension of SUTs and IOTs to include environmental flows in monetary and physical terms has become an internationally agreed standard. Including environmental consideration from the outset in the compilation of SUTs brings a number of advantages. It facilitates the integration and reconciliation of the information, it enhances the quality of the information, and it significantly increases the uses of the tabulations.

Box 1.1 Evolution of the SUTs and IOTs within the National Accounts

The evolution of the national accounting system across the various domains continuously evolve to reflect developments and improvements to the quality of economic statistics and the evolution of economies in order to provide a relevant measurement of the economy. There have been many people from various disciplines and countries over the past four centuries that have provided major contributions to the development of the system as it stands today and how the system relates to SUTs and IOTS. Below is a short description of this evolution.

Wassily Leontief (1905-1999) is often referred to as the pioneer of Input-Output based economics with the first of many key contributions when he published his article on '*Quantitative input and output relations in the economic system of the United States*'. This article discussed the construction of an economic transactions table that Leontief based on the Tableau Economique, proposed by François Quesnay in 1758.

The framework was developed and applied as an economic tool with the construction of the first IOTs for the USA covering the years 1919 and 1929 published in 1936. Later, Leontief developed the first I-O based model, which was based on theories developed by Leon Walras published in 1874 and 1877. Leontief was recognized for his pioneering work receiving the Nobel Prize in 1973. As a result, I-O analysis has become a major tool in developing quantitative economics as a science

The role of SUTs and IOTs has evolved within the National Accounts. The 1953 SNA (United Nations, 1953) contained no reference to SUTs or IOTs. However, the 1968 SNA (United Nations, 1968) presented the integration of an Input-Output framework into the integrated economic accounts of the SNA. The conceptual development of the integrated economic accounts of the SNA earned Professor Richard Stone, the Nobel prize in Economic Science in 1984, "for having made fundamental contributions to the development of the SNA and hence greatly improved the basis for empirical economic analysis".

Alongside Leontief and Stone, other Noble laureates include, for example, Ragnar Frisch and Jan Tinbergen in 1969, Paul Samuelson in 1970, Simon Kuznets in 1971, John Hicks in 1972 and James Meade in 1977 who have all contributed to the foundations of today's System of National Accounts measurement and the inter-linkages between various sectors and activities in an economy.

The latest evolution of SUTs was recognized in the 1993 SNA (United Nations *et al.* 1993), whereby Chapter XV of the 1993 SNA covered Supply and Use Tables and Input-Output Tables. With the latest version of the SNA, the 2008 SNA, the role and need for SUTs has been further enhanced, which in turn will help to meet many analytical needs, as reflected in Chapters 14 and 28 of the 2008 SNA.

1.44. In line with the United Nations Statistical Commission[2], this Handbook recommends the annual compilation of SUTs. In addition, the Handbook promotes the compilation of these tables as an integral part of the compilation of the National Accounts in order to ensure full consistency of the basic data and also a full consistency of the macroeconomic estimates that are derived from the accounts.

1.45. The Handbook provides a consistent numerical example of SUTs and IOTs that runs throughout the chapters (as far as practically possible) in order to facilitate the understanding of the various compilation steps. It also provides examples of best practices to further illustrate certain aspects of the compilation of SUTs. It should be noted that in the numerical examples provided in this Handbook the numbers may not add up exactly to the totals due to rounding.

1.46. The target audience for this Handbook mainly includes compilers of SUTs and IOTs with a basic knowledge and understanding of the SNA. However, since the Handbook provides an overview of the whole statistical production process, managers or staff in charge of the programme of National Accounts, economic and environment accounts would also benefit from the Handbook to get an overall understanding of the requirements for the compilation of SUTs and IOTs. Finally, analytical users may also benefit from reading the Handbook as it would provide them with a better understanding of the compilation steps, thus increasing their analytical applications.

E. Structure of this Handbook

1.47. The Handbook consists of four main Parts.

- **Introduction** provides an introduction to the Handbook covered by Chapter 1.
- **Part A** describes the overview of SUTs and IOTs, the fundamental building blocks required, cross-cutting issues as well as the main stages of the GSBPM - namely, designing, building and collection phases. Part A is covered by Chapters 2 to 4.
- **Part B** describes the compilation, balancing and dissemination phases of SUTs and the IOTs. Also included are the physical SUTs, Environmentally Extended IOTs and the SUTs links to the Quarterly National Accounts. Part B is covered by Chapters 5 to 15.
- **Part C** provides examples of the extensions and applications of SUTs and IOTs. Part C is covered by Chapters 16 to 21.

Introduction

1.48. As described above, Chapter 1 provides an introduction to the Handbook; it describes the importance of SUTs and IOTs for statistical purposes (for example, compilation of annual and quarterly National Accounts, etc.), for policy making and for analytical purposes (for example, economic forecasting, assessing

[2] See report (E/CN.3/2011/6) to the United Nations Statistical Commission at its forty-second session (2011) available online at: http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf

the impact of globalization). It also provides a general description of the System of National Accounts (SNA) and where the SUTs fit within the SNA framework. This chapter also describes the overall approach of the Handbook (also in comparison to previous handbooks) to the compilation of SUTs and IOTs and describes the outline of the Handbook.

Part A

1.49. Chapter 2 provides a conceptual overview of SUTs and IOTs and describes the basic elements that affect the structure and compilation of SUTs and IOTs. These elements include the accounting principles of the SNA, the classifications of economic activities and products, the choice of the statistical units and how it impacts on SUTs and IOTs, and the valuation in SUTs and IOTs. This chapter also describes the advantages of compiling SUTs as an integral part of the National Accounts and how the SUTs are used to obtain consistent estimates of GDP. This Chapter also describes in more detail the approach taken in this Handbook to take an extended SUTs and IOTs perspective with the environmental dimension incorporated allowing an integrated overview of the framework at the outset.

1.50. Chapter 3 provides the overview of the different phases that are undertaken in the statistical production process of SUTs and IOTs based on the stages of the GSBPM and linked to the UN Guidelines on Integrated Economic Statistics (United Nations, 2013). This chapter also provides an overview of the different institutional set-ups that exist in countries and which may have an impact on the compilation process. The compilation phases specific to SUTs and IOTs are presented in this chapter together with a link to the relevant chapters of the Handbook.

1.51. Chapter 4 covers specific phases of the GSBPM, namely the specify needs, design, build and collect phase. It provides a description of the elements that should be considered and carefully evaluated at the beginning of the compilation process such as level of detail of the industry and products in the tables, the schedule of compilation, the revision policy, resources, typical data sources, etc. These and other issues are covered in this Chapter to provide the foundation for the compilation of SUTs and IOTs.

Part B

1.52. Chapter 5 describes the conceptual and practical aspects of the compilation of the Supply Table and how the “unbalanced” Supply Table is put together from the typical data sources for SUTs, such as business surveys, administrative data, etc.

1.53. Chapter 6 describes the conceptual and practical aspects of the compilation of the Use Table. As in Chapter 5, this Chapter shows how an “unbalanced” Use Table is constructed based on typical data sources.

1.54. Chapter 7 describes how to compile the valuation matrices which are necessary to bridge the different valuation concepts of the product flows. This Chapter covers the main concepts and methodologies of compiling matrices for trade margins, transport margins, taxes on products and subsidies on products.

1.55. Chapter 8 describes the structure of the Imports Use Table and the Domestic Use Table and the steps necessary to disaggregate the Use Table into the Imports Use Table and the Domestic Use Table. Historically the compilation of these tables was mainly considered as an intermediate step towards the compilation of IOTs (though not an essential step). However, the Imports Use Table and the Domestic Use Table are becoming increasingly important in their own right for analytical purposes.

1.56. Chapter 9 covers the compilation of SUTs in volume terms. It follows the recommendation to simultaneously compile SUTs in current prices and in volume terms. The compilation of SUTs in volume terms can start after the SUTs have been compiled in current prices (although the current price tables do not need to be balanced) but do need simultaneous presentation of volume and price indices.

1.57. Chapter 10 describes the importance of linking SUTs and the institutional sector accounts, which involve data by industry to be sub-divided according to the institutional sectors to which the units within each industry are classified. The Chapter provides guidance on how to compile the cross tabulation between industries and institutional sectors and presents various approaches to establish the link between the SUTs and the institutional accounts and describe some issues that may arise in the compilation of the linking table.

1.58. Chapter 11 describes the manual and automated balancing procedures of SUTs in both current prices and in volume terms. This is important for a full consistency of the detailed information. The various checks related to product, industry and macro identities, benchmarking with National Accounts, and comparison with previous SUTs, if available, are explained. It is recommended to produce and balance SUTs simultaneously at basic prices and purchasers' and also for domestic and imported products, all of which should be both in current prices and in volume terms. A further dimension, and challenge to add, is to cover both annual SUTs, and if possible, quarterly SUTs.

1.59. The sequence of chapters provides a preferred scenario for the compilation of SUTs. However, different variants can be developed. An increasing number of countries have achieved the preferred scenario. It is recommended that the preferred scenario of compiling SUTs and IOTs may be seen as ambitious but can realised through gradual improvements in source data, production processes and IT environment.

1.60. Chapter 12 provides an overview of the IOTs (Product by Product and Industry by Industry) and describes the methods and the underlying assumptions for transforming SUTs into IOTs. The compilation of IOTs is quite different in nature from the compilation of the SUTs and it relies on the availability of SUTs. The compilation of IOTs is considered more as an analytical step rather than a compilation process and for this purpose viewed as a step from statistics to modelling.

1.61. Chapter 13 describes the structure of the SUTs in physical units where additional rows and columns are added to show flows from the environment to the economy and vice versa. This Chapter also describes typical data sources for the compilation of these tables and examples of specific issues in which the SEEA and SNA differ (for example, the treatment of international flows, and the treatment of goods for processing), and how to extend standard economic IOTs in monetary units to include information on the environment in physical units in the EE-IOTs. Physical Input-Output Tables (PIOTs) are also an extension of the SUTs framework to take into accounts environmental considerations. They consist of a transformation of the PSUTs into PIOTs. However, because of the conceptual and practical issues in the compilation of PIOTs, the focus of SEEA (2012) - and thus this Chapter - has shifted more towards the compilation of EE-IOTS rather than PIOTs. Examples of two country practices are also presented in this Chapter.

1.62. Chapter 14 provides an overview of how SUTs can be used to improve the QNA. Since there are various scenarios that can be used in practice, this Chapter focuses only on three main situations which describe using SUTs in various degrees in the compilation of the QNA.

1.63. Data dissemination is an important activity for any statistical production process as it provides the users with a range of statistics produced to internationally agree guidelines. Presenting SUTs and IOTs to the users in a clear, transparent and user-friendly manner is thus an important task of the statisticians. Chapter 15 provides an overview of the elements that should be considered when disseminating SUTs and IOTs, such as the identification of users' needs in order to tailor the dissemination to the main types of users of SUTs and IOTs, the importance of having a dissemination strategy and the elements that should be covered in the strategy. Reference to the Statistical Data and Metadata Exchange (SDMX) for SUTs and IOTs is also provided in this Chapter.

Part C

1.64. Chapter 16 describes the methods for compiling regional (sub-national) SUTs and the main compilation issues such as the disaggregation of the information at sub-national level, etc. Different issues and challenges are covered through a bottom-up and top-down compilation approach.

1.65. Although the focus of this Handbook is mainly on the compilation of national SUTs and national IOTs, there is an increasing demand for the instruments to capture the structure and mechanism of cross-border fragmentation of production activities. Chapter 17 provides an overview of multi-country SUTs and IOTs, the main compilation issues, and a simplified compilation procedure. This Chapter also provides a review of current international initiative in this area.

1.66. Chapter 18 deals with the projections of SUTs and IOTs. Many users require comparable I-O products as well as for comparable frequencies and similar timeliness. For example, some countries produce quarterly SUTs, some countries produce annual SUTs and some countries produce less regular SUTs. Consequently, there is a variety of methods, techniques and approaches in projecting SUTs and IOTs and dealing with the data gaps. These techniques also can help producers, for example, dealing with periods between benchmarked years. This Chapter provides an examination of various methods and techniques used as well as a range of literature available to overcome the problem of incomplete data thus allowing the estimation and projection of IOTs. The Chapter also presents a numerical example for three methods: Generalised RAS, SUT-RAS and Euro methods.

1.67. Chapter 19 describes the main extensions of Supply, Use and Input-Output Tables as part of a satellite system which are regularly used for economic analysis. Several examples for the disaggregation of the Use Table and various satellite accounts are reviewed including extensions like Social Accounting Matrices, Extended Input-Output Tables and other examples of satellite systems.

1.68. Chapter 20 describes examples of the different types of I-O models and provides a broad overview illustrating the benefits and the approaches used. The traditional quantity model and price model of I-O analysis are presented for monetary IOTs and physical IOTs. Input and output coefficients, Leontief inverse, price and quantity models, indicators, multipliers and inter-industrial linkages were developed for an empirical extended IOT with extensions for gross fixed capital formation, capital stock, employment, energy, air emissions, waste, sewage and water.

Chapter 21 provides examples of compilation practices from various countries with different statistical systems. In general, the compilation practices can greatly vary depending on the resources available, the statistical infrastructure, registers, surveys, methodologies, etc. This Chapter provides some guidance for countries with limited statistical resources and illustrates differences and challenges in the compilation of SUTs and IOTs.

Part A

Chapter 2. Overview of the Supply and Use Tables and Input-Output tables

A. Introduction

2.1. Before providing step-by-step guidance on the compilation of SUTs and IOTs, it is important to have a general understanding of SUTs and IOTs. The main objective of this chapter is therefore to provide an overview of SUTs and IOTs in Sections B and C, respectively. Section D introduces the fundamental elements of the SUTs and IOTs such as the underlying classifications, the statistical units and the valuation methods. Some of these elements are further discussed in more detail in subsequent chapters. Finally, Section E elaborates on the importance of compiling SUTs as an integral part of the National Accounts.

2.2. Although this chapter covers a wide-range of challenges and issues to address when planning and building a new system of SUTs and IOTs, all aspects may not be achievable in countries with limited resources. It is worth recognising that it is possible to establish a system with a moderate level of ambition using available data and/or incomplete data. Nonetheless, it is preferable to have a SUTs-type environment for reconciliation of the various statistical sources compared to only having unbalanced series of National Accounts aggregates.

B. Overview of SUTs

2.3. The SUTs describe the whole economy by industry (for example, motor vehicles industry) and products (for example, sports goods). The tables show links between components of GVA, industry inputs and outputs, and product supply and use. The SUTs link different institutional sectors of the economy (for example, non-financial corporations) together with detail of imports and exports of goods and services, final consumption expenditure of government, household and non-profit institutions serving households (NPISHs), and capital formation.

2.4. As the name suggests, SUTs consist of two interlinked tables: the Supply Table and the Use Table. The Supply Table shows the supply of goods and services by type of product and by type of industry distinguishing between the supply by domestic industries and imports of goods and services. In other words, the Supply Table provides information on the output (by product) generated by economic activities and the imports (by product) from abroad. The totals in the last column represent the total supply by products and the totals in the bottom row represent the total output by economic activity and total imports. A simplified Supply Table is presented in Table 2.1.

Table 2.1: Simplified structure of the Supply Table

Industries / Products	Industries				Imports	Total
	Agriculture, forestry, etc.	Mining and quarrying	…	Services		
Agriculture, forestry, etc. Ores and minerals; etc. … Services	Output by product by industry				Imports by product	Total supply by product
Total	Total Output by Industry				Total imports	Total supply

2.5. The second table is the Use Table which provides information on the uses of the different products. The Use Table shows the use of goods and services by type of product and by type of use, i.e. as intermediate consumption by industry, final consumption, gross capital formation or exports. Furthermore, the table shows the components of gross value added by industry - namely, compensation of employees, other taxes less subsidies on production, consumption of fixed capital and net operating surplus. While the totals by row represent the total uses by product, the total by column represent the total output by economic activity, total final consumption, total gross fixed capital formation and total exports. Table 2.2 shows the simplified structure of the Use Table.

Table 2.2: Simplified structure of the Use Table

Industries / Products	Industries				Final uses			Total
	Agriculture, forestry, etc.	Mining and quarrying	…	Services	Final consumption	Gross capital formation	Exports	
Agriculture, forestry, etc. Ores and minerals; etc. … Services	Intermediate consumption by product and by industry				Final uses by product and by category			Total use by product
Value added	Value added by component and by industry							Value added
Total	Total Output by industry				Total final uses by category			

Empty cells by definition

2.6. The classification of products, in practice, is often more detailed than the classification of industries thus generating rectangular SUTs. For example, the output of the dairy industry is separately shown in the SUTs for the products of processed milk, butter, yoghurt, cheese, etc. and not as only one aggregate product for all dairy products.

2.7. There are three basic identities that hold between the Supply Table and the Use Table. The first identity corresponds to the fundamental identity in National Accounts whereby for each economic activity the following holds:

Identity (1) Output = Intermediate consumption + Gross Value added (GVA)

2.8. The second identity is that the total supply by product is equal to the total use by product. This means that the amount of products available for use in an economy must have been supplied by either domestic production or by imports, and the same amount of products entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation or exports. This means that for each product (or group of products):

Identity (2) Output + Imports = Intermediate consumption + Final consumption + Capital formation + Exports

2.9. Another important identity which is also key when linking the production and income approaches to calculating GDP and the industry and institutional sector dimension through the SUTs, is the following:

Identity (3) For each industry, the Gross Value Added (GVA) using the production approach equals the GVA estimate using the income approach.

2.10. These identities are fundamental in the balancing process that is carried out when compiling SUTs both in current prices and in volume terms, all through a time series dimension.

2.11. Once balanced, the Supply Table and the Use Table can be integrated into a single matrix - often referred to as the Supply and Use Tables (SUTs) framework, which is shown in Table 2.3. This table clearly shows the two basic identities linking the SUTs. The total supply by product (left part of bottom row of Table 2.3) equals the total use by product (the top part of last column of Table 2.3) and the total output by industry are identical in both SUTs (the middle part of bottom row equals middle part of last column). The schematic view of SUTs in Table 2.3 also serves as the underlying matrix for projection methods (see Chapter 18).

Table 2.3: Supply and Use Tables framework

		Products				Industries				Final uses			Total
		Agriculture, forestry, etc.	Ores and minerals; etc.	...	Services	Agriculture, forestry, etc.	Mining and quarrying	...	Services	Final consumption	Gross capital formation	Exports	
Products	Agriculture, forestry, etc. Ores and minerals; etc. ... Services					Intermediate consumption by product and by industry				Final uses by product and by category			Total use by product
Industries	Agriculture, forestry, etc. Mining and quarrying ... Services	Output by product by industry											Total output by industry
Value added						Value added by component and by industry							Value added
Imports		Total imports by product											Total Imports
Total		Total supply by product				Total output by industry				Total final uses by category			

Empty cells by definition

2.12. SUTs thus bring together the components of each of the three approaches to measuring GDP - namely, the production, income and expenditure approaches.

Production approach:

GDP = Output (at basic prices) - Intermediate consumption + Taxes less subsidies on products

Income approach:

GDP = Compensation of employees + Gross operating surplus + Other taxes less subsidies on production + Taxes less subsidies on products

Expenditure approach:

GDP = Final consumption + Gross capital formation + Exports - Imports

2.13. When balanced, SUTs show by definition, a single estimate of GDP both in current prices and in volume terms. This underlines the importance of the recommendation to compile SUTs as part of the annual regular compilation of the National Accounts as they ensure the consistency and coherence of the National Accounts components, that is, goods and services accounts, production account (by industry and by institutional sector) and generation of income account (by industry and by institutional sector), and enables a single estimate of GDP to be derived. The institutional sector links are covered in more detail in Chapter 10.

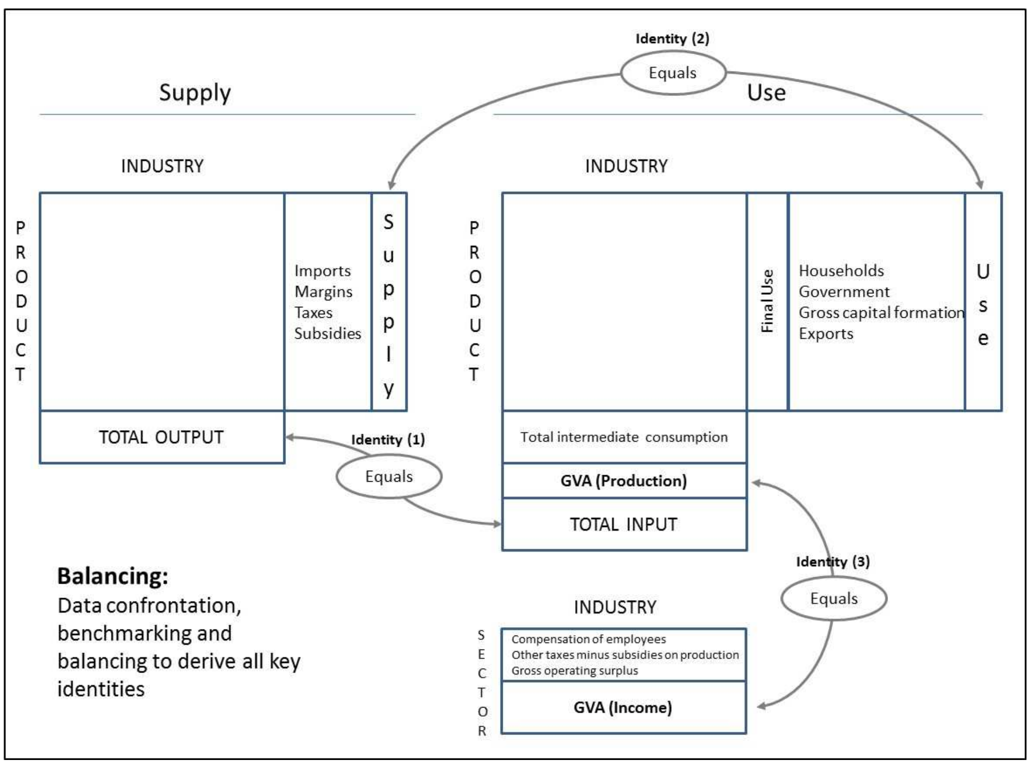
2.14. The SUTs also have links to other accounts such as the use of disposable income account (covering variables like household final consumption expenditure) and the accumulation accounts (covering variables like gross fixed capital formation as part of the capital account).

2.15. Producing annual SUTs simultaneously both in current prices and in volume terms (preferably, when two successive years of current price SUTs are available) ensures coherency and consistency for both price and volume measures. In addition, this approach allows for the estimation of the volume of GVA through "double deflation", where GVA is derived by deducting intermediate consumption in volume terms from total output in volume terms. This can be achieved on the basis of an individual unit, industry, institutional sector, and for the whole economy.

2.16. SUTs can also be compiled on a quarterly basis to derive official estimates of quarterly GDP. Developing quarterly SUTs may be highly demanding in terms of resources, time and data availability but the benefits would improve the quality of the estimate of quarterly GDP.

2.17. Figure 2.1 provides a graphical overview of the SUTs explicitly identifying the main identities that are ensured in balanced SUTs. Box 2.1 presents a numerical example of balanced SUTs.

Figure 2.1: Graphical overview of Supply and Use Tables



2.18. The Use Table records the intermediate consumption and final uses by type of product but it does not distinguish between the consumption of domestically produced goods and services from the imports of goods and services. Although such a split is not a necessary condition for the creation of balanced SUTs in current prices, it is a key step linking SUTs and IOTs. The disaggregation of the Use Table into two tables: the Domestic Use Table and the Imports Use Table. Box 2.2 shows these two tables with a numerical example.

2.19. The compilation of the Imports Use Table is necessary to have good quality volume estimates (in particular, GVA by industry) and are becoming increasingly important over time due to the growing impact of globalization and the need to measure global value chains and trade in value added.

Box 2.1 Numerical example of the SUTs system

Supply Table

		Industries			Imports	Total supply
		Agriculture	Manufacturing and Construction	Services		
Products	Agriculture	270	30	50	20	370
	Manufacturing	6	380	87	42	515
	Construction	4	50	13	8	75
	Trade, transport and communication	10	15	210	7	242
	Finance and business services	6	17	240	11	274
	Other services	4	8	100	12	124
	Total	300	500	700	100	1 600

Use Table

		Industries			Final use			Total use
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	34	59	93	131	21	32	370
	Manufacturing	97	107	57	122	73	59	515
	Construction	9	12	4	17	30	3	75
	Trade, transport and communication	42	24	11	140	20	5	242
	Finance and business services	14	53	42	116	31	18	274
	Other services	14	35	22	35	10	8	124
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	2 430

Supply and Use Tables Framework

		Products						Industries			Final use			Total
		Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture							34	59	93	131	21	32	370
	Manufacturing							97	107	57	122	73	59	515
	Construction							9	12	4	17	30	3	75
	Trade, transport and communication							42	24	11	140	20	5	242
	Finance and business services							14	53	42	116	31	18	274
	Other services							14	35	22	35	10	8	124
Industries	Agriculture	270	6	4	10	6	4							300
	Manufacturing and Construction	30	380	50	15	17	8							500
	Services	50	87	13	210	240	100							700
	Taxes *less* subsidies on products							4	5	12	52	6	1	80
	GVA							86	205	459				750
	Imports	20	42	8	7	11	12							100
	Total	370	515	75	242	274	124	300	500	700	613	191	126	4 030

= Zero by definition

The **Supply Table** shows the supply of goods and services by product and by type of supplier, distinguishing supply by domestic industries and imports of goods and services. The domestic output of industries is shown by products. The vector of imports comprises total imports goods and services of the nation by product.

The **Use Table** shows the use of goods and services by product and by type of use, i.e. as intermediate consumption by industry, final consumption expenditure, gross capital formation and exports of goods and services. The intermediate uses and final uses reflect consumption of domestically produced goods and services as well as imported goods and services. Furthermore, although the table is shown in summary form, it should be noted there are components underlying the headings, for example, gross value added can be split between compensation of employees, other taxes less subsidies on production, consumption of fixed capital and net operating surplus.

Note that, for illustrative purposes, it is assumed that the SUTs presented here are compiled on a consistent valuation basis.

2.20. Once the Imports Use Table is constructed, the estimation of the Domestic Use Table can be done by subtracting the Imports Use Table from the Use Table. The Imports Use Table and the Domestic Use Table form the basis for the construction of Input Imports Table and Domestic IOTs respectively. See Chapters 8 and 12 for more detail.

Box 2.2 Numerical example showing Use Table split between consumption of domestic production and imports

Supply Table

		Industries					
		Agricul-ture	Manufact. and Construction	Services	Output	Imports	Total supply
Products	Agriculture	270	30	50	350	20	370
	Manufacturing	6	380	87	473	42	515
	Construction	4	50	13	67	8	75
	Trade, transport and communication	10	15	210	235	7	242
	Finance and business services	6	17	240	263	11	274
	Other services	4	8	100	112	12	124
	Total	300	500	700	1 500	100	1 600

Use Table

		Industries			Final use			
		Agricul-ture	Manufact. and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total use
Products	Agriculture	34	59	93	131	21	32	370
	Manufacturing	97	107	57	122	73	59	515
	Construction	9	12	4	17	30	3	75
	Trade, transport and communication	42	24	11	140	20	5	242
	Finance and business services	14	53	42	116	31	18	274
	Other services	14	35	22	35	10	8	124
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	2 430

Domestic Use Table

		Industries			Final use			
		Agricul-ture	Manufact. and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total use
Products	Agriculture	30	50	90	130	20	30	350
	Manufacturing	85	90	51	120	70	57	473
	Construction	5	10	3	16	30	3	67
	Trade, transport and communication	40	20	10	140	20	5	235
	Finance and business services	10	50	40	115	30	18	263
	Other services	10	30	20	35	10	7	112
	Imports	30	40	15	5	5	5	100
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Output	300	500	700	613	191	126	2 430

Imports Use Table

		Industries			Final use			
		Agricul-ture	Manufact. and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Products	Agriculture	4	9	3	1	1	2	20
	Manufacturing	12	17	6	2	3	2	42
	Construction	4	2	1	1			8
	Trade, transport and communication	2	4	1				7
	Finance and business services	4	3	2	1	1		11
	Other services	4	5	2			1	12
	Total	30	40	15	5	5	5	100

Empty cells by definition

The **Domestic Use Table** is derived by subtracting the Imports Use Table from the total Use Table shown in Box 2.1.

The imports of goods and services are then shown separately as a new row denoted as “Imports” in the Domestic Use Table. The Domestic Use Table shows the input requirements of industries in terms of domestic intermediates, imported intermediates and primary inputs (GVA). It also shows the use of domestic output of products for intermediate uses and final uses.

The **Imports Use Table** includes information on the use of imported products for intermediate consumption and final uses and the column totals which match the estimates shown in the “Imports” row.

1. Supply and Use Tables in current prices and in volume terms – “H-Approach”

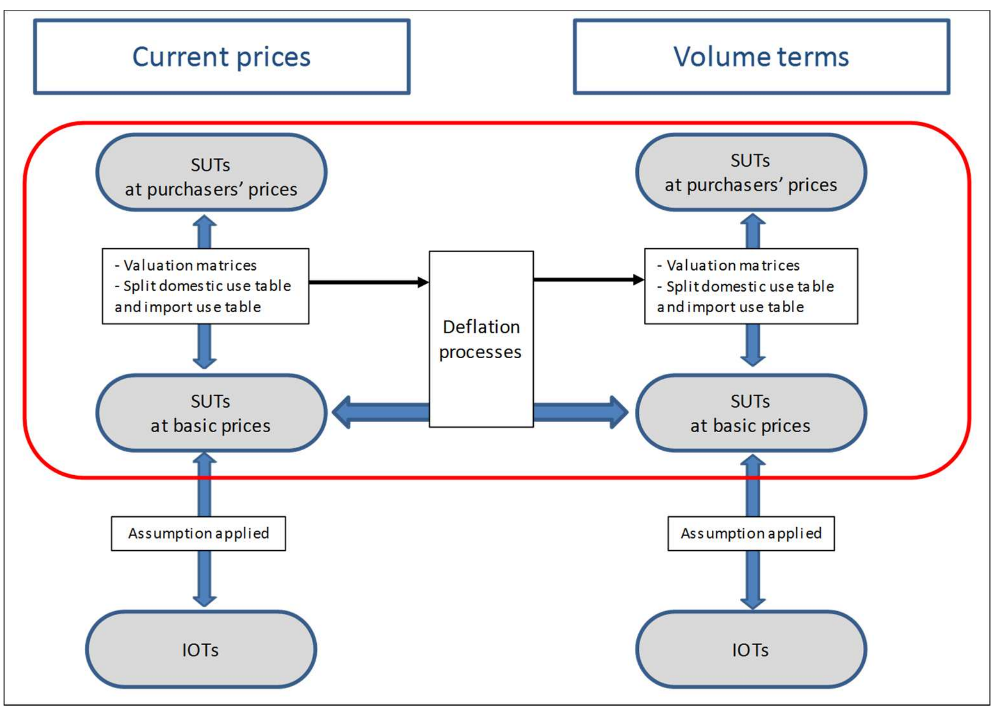
2.21. The SUTs framework not only constrains the current value estimates of supply and use of products to balance exactly. It also provides a way to ensure that the corresponding volume estimates in previous years’ prices are balanced and that the series of prices implied by the existence of one table in current prices and one in volume terms are strictly consistent. In general, the best way to ensure mutual consistency is to prepare the SUTs in current values and in volume terms at the same time (2008 SNA, paragraph 14.136).

2.22. The compilation and balancing of SUTs in current prices and in volume terms for a sequence of years also helps to balance the changes in volumes, values and prices in the best possible way (the key condition for this to be followed requires SUTs in current prices to be available for the current year and for the previous year). This approach ensures a high degree of quality in terms of coherency and consistency over time – and recommended as the best approach for the production of SUTs. Producing annual SUTs simultaneously both in current prices and in volume terms also allows estimation of the volume of GVA through “double deflation”. Whereby GVA in previous years’ prices is derived by deducting intermediate consumption in previous years’ prices from total output in previous years’ prices. Then, the change in volume of GVA between each pair of consecutive years is given by the change of GVA in previous years’ prices compared to GVA of previous year at current prices of that year.

2.23. The SUTs at purchasers’ prices and at basic prices in current prices and in volume terms can be compiled and balanced sequentially or simultaneously. In both cases, powerful feedback loops covering quality in terms of consistency and coherency are available. More details are covered in Chapters 9 and 11.

2.24. Figure 2.2 shows an overview of the “H-Approach” for an integrated compilation of SUTs (and IOTs) in current prices and volume terms. The “H-Approach” is the recommended compilation approach which brings together the compilation of SUTs in current prices and volume terms, the valuation at basic prices, producers’ prices and purchasers’ prices, as well as the links with the compilation of IOTs. The matrices covering other taxes on production, other subsidies on production, trade margins and transport margins are the valuation matrices which link between basic prices, producers’ prices and purchasers’ prices.

Figure 2.2 A schematic overview of the compilation of SUTs and IOTs – “H-Approach”



2.25. The diagram in Figure 2.2 can be visualised as the letter “H” with the left vertical arm representing SUTs and IOTs in current prices and the right vertical arm representing the SUTs and IOTs in previous years’ prices. The horizontal transition represents the deflation process using, for example, a combination of prices, volume indicators and rates of the previous year applied to the volumes.

2.26. The SUTs in current prices are decomposed into the component parts (imports and the valuation matrices on the left-hand side of the "H-Approach"), each of which is deflated separately as appropriate (the join in the middle), and then added back to get to a purchasers' prices valuation in previous years' prices (the right-hand side). This means that basic prices play the dominant role in the process, and the initial compilation flow is from top-left to middle-left and deflation to middle-right, and then onto top-right.

2.27. If for final use components at purchasers' prices, final use deflators are deemed to be better, then the "H-Approach" allows for the use of higher quality, perhaps more appropriate deflators. It is possible to work with purchasers' prices where these are believed to be more reliable, making appropriate adjustments, working from top-right to middle-right, then onto middle-left and then onto top-left. Similarly, if high quality volume indicators are available, then this can better inform, for example, the step between the middle-left and middle-right.

2.28. For balancing purposes, areas like VAT on products and changes in inventories may" be separated out as balanced matrices (whereby the impact on production, income and expenditure is equal and the matrices are in balance) to avoid any balancing adjustments but this may over-complicate the system.

2.29. It is important to note that the scheme presented in Figure 2.2 should not be taken as to be implemented as a whole. In practice, for example, if a country only wants to focus on the compilation of annual SUTs only, the focus should be on the compilation steps of the SUTs within the bold line box in Figure 2.2 which are recommended in order to achieve balanced SUTs in current and in volume terms. However, if a country wants to compile SUTs and IOTs, all the steps in Figure 2.2 should be completed in order to guarantee important feedback loops and increase the quality of the tabulations.

2.30. When planning for the compilation of SUTs, it is useful to keep in mind the compilation approach in Figure 2.2 since it naturally links to the production of time series of SUTs (and IOTs) both in current prices and in previous years' prices using chain-linked volumes. More detail is covered in Chapter 9. Although SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators, the preferred approach contains a time-series dimension and the following principles:

- To compile SUTs in volume terms, one needs the following:
    i. balanced set of SUTs at purchasers' prices in current prices for the present year and the previous year; and
    ii. deflators for each flow.
- Previous year's SUTs in current prices of that year are needed to derive volume estimates. For illustrative purposes of Figure 2.2 only, the SUTs are balanced, even though in reality, they may be unbalanced and an iterative balancing process may be necessary. This allows for the first SUTs in previous years' prices to be compiled.
- Each transition stage is created in a 'balanced' format which provides a much easier systematic process and build. This implies each of the transition matrices covering taxes, subsidies, trade and transport

margins and import of goods and services will be balanced, that is the supply-side row total will equal the use-side row total.

- For some of the variables, like Household final consumption expenditure, there are already present deflation approaches using consumer price indices to generate the corresponding estimates in previous years' prices. These estimates are likely to be different from those generated from the "H-Approach" but would also feature in the reconciliation and balancing process of the estimates, and form an example of working from right-to-left through balanced adjustments.

2.31. The "H-Approach" provides a transparent, coherent and consistent approach for compilation and balancing SUTs. For example, balancing adjustments to one part of the SUTs can be assessed in terms of impact on other areas of the SUTs as well as in terms of time series.

2. Physical SUTs

2.32. The SUTs described in the previous sections are part of the 2008 SNA framework. As such, they reflect the production boundary of the SNA and they are compiled in monetary units. The tables, however, can be extended to include the environment as providers of natural inputs into the economy and as absorber of residuals from the economy. The extension of these tables and, more in general, of the accounting framework of the SNA to include environmental considerations is done in the System of Environmental-Economic Accounting (SEEA) 2012 (United Nations *et al.*, 2014). The SEEA enables the analyses of the interaction between the environment and the economy such as the assessment of the use of natural resources, the generation of waste by the economy and waste flows into the environment.

2.33. The SEEA central framework comprises a sequence of accounts - namely, the SUTs in monetary and physical units, the asset accounts in physical and monetary units, and environmental activity accounts and related flows. This Handbook covers the SUTs of the SEEA and, in particular, since the monetary SUTs of the SEEA are the same as the SNA, the Handbook focuses on the physical SUTs of the SEEA. For additional information on the complete set of accounts of the SEEA, the reader is directed to the publication United Nations *et al.* (2014).

2.34. Physical Supply and Use Tables (PSUTs) are used to assess how an economy supplies and uses energy, water, materials as well as theirs changes in production and consumption patterns over time, and therefore, in combination with data from monetary SUTs, changes in productivity and intensity in the use of natural inputs and the release of residuals can be examined. The structure of PSUTs is based on the monetary SUTs with extensions to incorporate a column for the environment and rows for natural inputs and residuals.

2.35. Table 2.4 and Table 2.5 provide the simplified structure of the physical Supply Table and Use Table, respectively. In order to address specific environmental domains (for example, accounting for water, energy, timber etc.), these tables are compiled for a disaggregation of products and industries which is relevant for the particular environmental domain of interest. In the case of energy, for example, the products of interest that can be explicitly shown in the table include coal, peat and peat products, natural gas, etc. The industries of interest include the main suppliers of energy products (for example, electricity generation, manufacture of gas, etc.) and the main users of energy products (for example, manufacturing, transportation, etc.). These tables are compiled in monetary units - within the SNA context - and in physical units as shown in Table 2.4 and Table 2.5.

2.36. In the PSUTs, the SUTs of the SNA are augmented to include a block of rows for "natural inputs" and a block or rows for "residuals". The block for natural inputs is used to describe the flows from the environment to the economy; in other words, this block describes the extraction of natural inputs (for example, water, energy resources, etc.) from their location in the environment as a part of economic production processes or that are directly used in production. Natural inputs may be (a) natural resource inputs, such as mineral and energy resources or timber resources, (b) inputs from renewable energy sources, such as solar energy captured by economic units, or (c) other natural inputs such as inputs from soil (for example, soil nutrients) and inputs from air (for example, oxygen absorbed in combustion processes) (SEEA 2012, paragraph 2.89). When an industry, for example, extracts water as part of the economic production process, this is recorded in the block of natural inputs in the Use Table in Table 2.5. It is assumed that the environment provides (i.e. supplies) all the natural inputs that are used into the economic production process.

2.37. The blocks for "residuals" represent the flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted to the environment (for example, emission to air) by establishments and households through processes of production, consumption or accumulation but may also flow within the economy, as is the case when, for example, solid waste is collected as part of a waste collection scheme (SEEA 2012, paragraph 2.92).

2.38. The block for residuals in the Supply Table (Table 2.4), represents the flows of waste from the economy to the environment and thus it includes the generation and disposal of waste during economic production activities (generation of waste by industries) and generated during final consumption (mainly by households). While the block of residuals in the Use Table (Table 2.5) shows, for example, the collection and treatment of waste and other residuals by economic activities, the accumulation of waste in controlled landfills and the residuals flows direct to the environment.

Table 2.4 Schematic view of the physical Supply Table

	Industries	Industries				Imports	Final consumtpion	Gross capital formation/ Accumulation	Environment	Total
		Agriculture, forestry, etc.	Mining and quarrying	…	Services					
Natural inputs	Mineral and energy resource Water …								Flows from the environment	Total supply by natural inputs
Products	Agriculture, forestry, etc. Ores and minerals; etc. … Services	Output by product by industry				Imports by product				Total supply by product
Residuals	Solid waste Wastewater …	Residuals generated by industry					Residuals generated by final consumtpion	Residuals from scrapping and demolition of produced assets		Total supply by residuals

Empty cells by definition

Cells may contain relevant flows

Table 2.5 Schematic view of the physical Use Table

	Industries	Industries				Exports	Final consumtpion	Gross capital formation/Accumulation	Environment	Total
		Agriculture, forestry, etc.	Mining and quarrying	…	Services					
Natural inputs	Mineral and energy resource Water …	Extraction of Natural inputs								Total use by natural inputs
Products	Agriculture, forestry, etc. Ores and minerals; etc. … Services	Intermediate consumption by product and by industry				Final uses by product and by category				Total use by product
Residuals	Solid waste Wastewater …	Collection and treatment of waste and other residuals						Accumulation of waste in controlled landfilled	Residual flows direct to the enviornment	Total use by residuals

Empty cells by definition

Cells may contain relevant flows

2.39. The supply and use identity applies to both physical and monetary flows. For each product measured in physical terms (for example, cubic metres of timber), the quantity of output and imports (total supply of products) must equal the quantity of intermediate consumption, household final consumption, gross capital formation and exports (total use of products). The equality between supply and use also applies to the total supply and use of natural inputs and the total supply and use of residuals. In addition to the supply and use identity, the PSUTs incorporate the input-output identity, implying that the total flows into the economy either are returned to the environment or accumulate in the economy.

C. Overview of IOTs

2.40. For many analytical purposes, a transformation from a pair of SUTs into a single IOT where total input (row totals) and total output (column totals) are equal brings considerable advantages. IOTs have algebraic properties that make them particularly suitable for analyses that enable estimates of the effects of changing relative prices, labour and capital requirements in the face of changing output levels, the consequences of changing patterns of demand and so on. They may also be used as the basis for an expanded version that may be used to estimate the demands made by the economy on the environment (2008 SNA, paragraph 28.35).

2.41. An IOT is essentially derived from the Use Table where either the columns representing industries are replaced by products or where the rows representing the products are replaced by industries through a transformation process which involves a range of assumptions. The resulting intermediate consumption matrix is then square, showing products in both rows and columns or industries in both. In both cases, the row totals for the complete matrix match the column totals for the complete matrix, Product by Product matrix or Industry by Industry matrix as the case may be. (2008 SNA, paragraph 28.32). Of course, the classifications in the IOTs coincide with those in the SUTs, as the former is a transformation of the latter.

2.42. It is recommended that the IOTs are derived from SUTs. The IOTs derived from the SUTs further describe the inter-relationships between industries and products as well as the sale and purchase relationships between producers and consumers within an economy. They can be produced to illustrate flows between the sales and purchases (final and intermediate) of industry outputs (which is referred to as Industry by Industry Tables) or to illustrate the sales and purchases (final and intermediate) of product outputs (which is referred to as Product by Product Tables).

2.43. The derivation of IOTs from the system of SUTs may also reveal inconsistencies and weaknesses in the SUTs. In this respect, there is a powerful quality-related feedback from the IOTs to the SUTs and vice versa.

2.44. Table 2.6 provides a simplified IOT where the columns of the original Use Table referring to industry base structures are transformed into product based structures. The relations between output and input are now relations between products and primary inputs necessary to produce products in similar units of production. Primary inputs are inputs that are not outputs of other industries. They include the imports of goods and services and the components of GVA such as compensation of employees, etc. They are necessary to the production process but are not produced anywhere in the domestic economy.

Table 2.6 A simplified Input-Output Table (Product by Product)

Products (columns) / Products (rows)	Products				Final uses			Total
	Agriculture, forestry, etc.	Ores and minerals; etc.	…	Services	Final consumption	Gross capital formation	Exports	
Agriculture, forestry, etc. Ores and minerals; etc. … Services	Intermediate consumption by product				Final uses by product and by category			Total use by product
Imports	Intermediate consumption of imported products				Final use of imported products			
Value added	Value added by component							Value added
Total	Total supply				Total final uses by category			

Empty cells by definition (shaded): Value added row, Final uses columns

2.45. For the transformation of SUTs into IOTs, various assumptions have to be made or adjustments are required based on Industry by Industry or Product by Product assumptions:

- **Product by Product IOTs** can be compiled using either the product technology assumption (whereby each product is produced in its own specific way, irrespective of the industry where it is produced) or the industry technology assumption (whereby each industry has its own specific way of production, irrespective of its product mix).

- **Industry by Industry IOTs** can be compiled using either the fixed industry sales structure assumption (whereby each industry has its own specific sales structure, irrespective of its product mix) or the fixed product sales structure assumption (whereby each product has its own specific sales structure, irrespective of the industry where it is produced).

A mixture of both assumptions can also be applied by implementing a hybrid technology assumption. The correct use and understanding of the terminology, transformation process and assumptions applied are covered in more detail in Chapter 12 of this Handbook.

2.46. The selection of the appropriate type of IOTs - Product by Product or Industry by Industry - depends on a number of statistical and practical considerations. For example, Industry by Industry IOTs are closer to statistical sources and actual market transactions. Product by Product IOTs are believed to be more similar in terms of cost structures and production activities. However, changes introduced in the 2008 SNA, for example, the strict implementation of changes in economic ownership have weakened this belief.

2.47. In the IOTs, two identities of the SUTs system are reduced to one type of identity. It is typical for IOTs that, for each product or industry the input equals output and total input equal total output.

2.48. The figures of total output and total input by product are the same as total supply and total use by product of the SUTs – this holds for Product by Product IOTs. The industry based structures are transformed into product based structures. In this transformation, the final use data are left unchanged. The transformation only rearranges on the basis of the production matrix of the intermediate use table by applying certain analytical assumptions to the relations between primary and secondary outputs.

2.49. In general, and for analytical purposes, it is recommended to separate the Use Table into the Use Table for domestic output and the Imports Use Table. More detail on the compilation of the Domestic Use Table and the Imports Use Table are in Chapter 8.

2.50. Box 2.3 and Box 2.4 show a simplified numerical example of a sequence of tables - based on the SUTs shown in Box 2.1 and Box 2.2 - necessary for compiling Product by Product IOTs and Industry by Industry IOTs, respectively.

Box 2.3 Supply and Use Tables and Product by Product Input-Output Tables

Supply Table

		Industries			Domestic supply	Imports	Total supply
		Agriculture	Manufacturing and Construction	Services			
Products	Agriculture	270	30	50	350	20	370
	Manufacturing and construction	10	430	100	540	50	590
	Services	20	40	550	610	30	640
	Total	300	500	700	1500	100	1600

Use Table

		Industries			Final use			Total use
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	34	59	93	131	21	32	370
	Manufacturing and construction	106	119	61	139	103	62	590
	Services	70	112	75	291	61	31	640
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	

Empty cells by definition

Use Table for Domestic Output

		Industries			Final use			Total
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	30	50	90	130	20	30	350
	Manufacturing and construction	90	100	54	136	100	60	540
	Services	60	100	70	290	60	30	610
	Imports	30	40	15	5	5	5	100
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	

Imports Use Table

		Industries			Final use			Total
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	4	9	3	1	1	2	20
	Manufacturing and construction	16	19	7	3	3	2	50
	Services	10	12	5	1	1	1	30
	Total	30	40	15	5	5	5	100

Input-Output Table for Domestic Output (product by product)

		Products			Final use			Output
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	34.08	52.23	83.69	130.00	20.00	30.00	350.00
	Manufacturing and construction	113.17	111.84	18.99	136.00	100.00	60.00	540.00
	Services	73.23	114.19	42.58	290.00	60.00	30.00	610.00
	Imports	37.73	46.07	1.20	5.00	5.00	5.00	100.00
	Taxes *less* subsidies on products	4.58	4.83	11.59	52.00	6.00	1.00	80.00
	GVA	87.21	210.84	451.95				750.00
	Total	350.00	540.00	610.00	613.00	191.00	126.00	

Input Table for Imports (product by product)

		Products			Final use			Total
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	4.91	10.75	0.34	1.00	1.00	2.00	20.00
	Manufacturing and construction	20.22	21.68	0.11	3.00	3.00	2.00	50.00
	Services	12.60	13.65	0.74	1.00	1.00	1.00	30.00
	Total	37.73	46.07	1.20	5.00	5.00	5.00	100.00

In **Product by Product IOTs**, all inputs are allocated to similar production units. They are derived from the SUTs system on the basis of analytical assumptions (see Chapter 12 for detail on the derivation of IOTs).

Product by Product IOTs are further away from statistical sources than Industry by Industry IOTs.

Box 2.4 Supply and Use Tables and Industry by Industry Input-Output Tables

Supply Table

		Industries					
		Agriculture	Manufacturing and Construction	Services	Domestic supply	Imports	Total supply
Products	Agriculture	270	30	50	350	20	370
	Manufacturing and construction	10	430	100	540	50	590
	Services	20	40	550	610	30	640
	Total	300	500	700	1500	100	1600

Use Table

		Industries			Final use			
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total use
Products	Agriculture	34	59	93	131	21	32	370
	Manufacturing and construction	106	119	61	139	103	62	590
	Services	70	112	75	291	61	31	640
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	

= Zero by definition

Use Table for Domestic Output

		Industries			Final use			
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Products	Agriculture	30	50	90	130	20	30	350
	Manufacturing and construction	90	100	54	136	100	60	540
	Services	60	100	70	290	60	30	610
	Imports	30	40	15	5	5	5	100
	Taxes *less* subsidies on products	4	5	12	52	6	1	80
	GVA	86	205	459				750
	Total	300	500	700	613	191	126	

Imports Use Table

		Industries			Final use			
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Products	Agriculture	4	9	3	1	1	2	20
	Manufacturing and construction	16	19	7	3	3	2	50
	Services	10	12	5	1	1	1	30
	Total	30	40	15	5	5	5	100

Input-Output Table for Domestic Output (industry by industry)

		Industries			Final use			
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Industries	Agriculture	26.78	43.70	72.72	112.31	19.25	25.24	300.00
	Manufacturing and construction	78.17	90.47	55.30	138.46	85.28	52.32	500.00
	Services	75.05	115.83	85.97	305.23	75.47	42.45	700.00
	Imports	30.00	40.00	15.00	5.00	5.00	5.00	100.00
	Taxes *less* subsidies on products	4.00	5.00	12.00	52.00	6.00	1.00	80.00
	GVA	86.00	205.00	459.00				750.00
	Total	300.00	500.00	700.00	613.00	191.00	126.00	

Input Table for Imports (industry by industry)

		Industries			Final use			
		Agriculture	Manufacturing and Construction	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Industries	Agriculture	3.71	7.69	2.61	0.86	0.86	1.61	17.34
	Manufacturing and construction	13.74	16.69	6.16	2.54	2.54	1.83	43.50
	Services	12.55	15.62	6.23	1.60	1.60	1.56	39.17
	Total	30.00	40.00	15.00	5.00	5.00	5.00	100.00

In **Industry by Industry IOTs**, inputs are allocated to industries. They are derived from the SUTs system on the basis of pragmatic assumptions. The intermediate input of industries consists of output of industries rather than products (of industry adjusted products) (see Chapter 12 for detail on the derivation of IOTs).

Industry by Industry IOTs are closer to statistical sources and actual observations than Product by Product IOTs.

D. Structure of SUTs and IOTs: basic elements

2.51. Defining the structure of SUTs and IOTs is a principal first step and depends on a number of basic elements which form the backbone of these tabulations. These elements include:

- the principles of the accounting system underlying the SNA applied to SUTs and IOTs;
- the classification of economic activities (and its level of detail);
- the classification of products (and its level of detail);

- the choice of the statistical units; and
- the valuation.

2.52. Considerations on these elements reflect the specific context in which the tables are compiled which include, among other things, the analytical objectives, the data availability, the economic structure of the country etc. Each of these elements is described below.

1. Principles of the accounting system underlying the SNA applied to SUTs and IOTs

2.53. The accounting system underlying the SNA is derived from broad bookkeeping principles and is applied to the structure and links in the SUTs and IOTs. There are three bookkeeping principles underlying the SNA accounting system:

- Vertical double-entry bookkeeping, also known as double-entry bookkeeping;
- Horizontal double-entry bookkeeping; and
- Quadruple-entry bookkeeping.

2.54. The main characteristic of vertical double-entry bookkeeping is that each transaction leads to at least two entries, traditionally referred to as a credit entry and a debit entry. This principle ensures that the total of all credit entries and all debit entries for all transactions are equal, thus permitting a check on consistency of accounts for a single unit. Each transaction requires two entries.

2.55. The concept of horizontal double-entry bookkeeping is useful for compiling accounts that reflect the mutual economic relationships between different institutional units in a consistent way. It implies that if unit A provides something to unit B, the accounts of both A and B show the transaction for the same amount: as a payment in A's account and as a receipt in B's account. Horizontal double-entry bookkeeping ensures the consistency of recording for each transaction category by counterparties. For example, dividends payable throughout the economy should be equal to dividends receivable throughout the economy once transactions with the rest of the world are taken into account.

2.56. Simultaneous application of vertical and horizontal double-entry bookkeeping results in quadruple-entry bookkeeping - which forms the accounting system underlying the SNA. It deals in a coherent way with multiple transactors or groups of transactors, each of which satisfies vertical double-entry bookkeeping requirements. A single transaction between two counterparties thus gives rise to four entries. In contrast to business bookkeeping, National Accounts deal with interactions among a multitude of units in parallel, and thus require special care from a consistency point of view.

2.57. An account records and displays all of the flows and stocks for a given aspect of economic life. In each account, the sum of resources is equal to the sum of uses with a balancing item to ensure this equality. Normally the balancing item will be an economic measure which is itself of interest.

2.58. The accounts can be built up for different areas of the economy by employing a system of economic accounts which highlight, for example, production, income and financial transactions. In many cases, these accounts can be elaborated and set out for different institutional units and groups of units (or institutional sectors). Usually a balancing item has to be introduced between the total resources and total uses of these units or sectors and, when summed across the whole economy, these balancing items constitute significant aggregates.

2.59. The accounting structure is uniform throughout the system and applies to all units in the economy, whether they are institutional units, sub-sectors, sectors or the whole economy, although some accounts (or transactions) may not be relevant for some institutional sectors.

2.60. The National Accounting system uses two types of units and two corresponding ways of sub-dividing the economy, which are quite different and serve separate analytical purposes:

- The first purpose of describing production, income, expenditure and financial flows, and balance sheets, is met by grouping institutional units into institutional sectors on the basis of their principal functions, behaviour and objectives. The national accounting system enables a complete set of flow accounts and balance sheets to be compiled for each sector, and sub-sector, as well as for the total economy.
- The second purpose of describing processes of production and for input-output analysis is met by the system grouping establishments into industries on the basis of their type of activity. An activity is characterised by an input of products, a production process and an output of products.

2.61. Figure 2.3 shows in matrix form an overview of the structure of the SNA. The degree of sub-divisions of the columns and rows using the relevant classifications determines the degree of detail of the accounts. The shaded rows and columns for goods and services and production by industry indicate those parts of the system relevant for the compilation of SUTs and IOTs, and clearly indicate that SUTs are at the core of the National Accounts system.

2.62. The three approaches to measuring GDP (production, income and expenditure) are shown in Box 2.5 and can be derived from the data in Figure 2.3 generating a single estimate of GDP.

2.63. All the aggregate components and detailed components are included in the SUTs and IOTs related part of the system.

Figure 2.3 The System of National Accounts in matrix form

Million Euro

Expenditures / Assets Receipts / Liabilities		Opening balance	Goods and services	Production by industry	Income and consumption	Accummu-lation	Rest of the world	Closing balance	Total excl. balance
		1	2	3	4	5	6	7	8
Opening balance	1					Assets of domestic sectors (real and financial)	Financial assets of the RoW		
Goods and services	2			303 492 Intermediate consumption	226 258 Final consumption	74 612 Gross capital formation	165 648 Exports of goods and services		770 009
Production by industry	3		578 360 Output at basic prices						578 360
Income and consumption	4		33 778 Taxes less subsidies on products	274 868 Value added at basic prices			38 023 Primary incomes and current transfers from RoW		346 670
Accummulation	5	Liabilities of domestic sectors			79 669 Gross savings		- 5 057 Deficit on the balance of payments	Liabilities of domestic sectors	74 612
Rest of the world	6	Financial liabilities of the RoW	157 871 Imports of goods and services		40 743 Primary incomes and current transfers to the RoW			Financial liabilities of the RoW	198 614
Closing balance	7					Assets of domestic sectors (real and financial)	Financial assets of the RoW		
Total excl. balance	8		770 009	578 360	346 670	74 612	198 614		

Austria 2011

Box 2.5 The three approaches to measuring GDP

Production approach

Million Euro

Variable	Value
Output at basic prices	578 360
- Intermediate consumption	- 303 492
= Gross value added at basic prices	274 868
+ Taxes less subsidies on products	33 778
= Gross domestic product	308 647

Income approach

Million Euro

Variable	Value
Compensation of employees	144 343
+ Other taxes less subsidies on production	4 858
+ Consumption of fixed capital	53 469
+ Net operating surplus	72 198
= Gross value added at basic prices	274 868
+ Taxes less subsidies on products	33 778
= Gross domestic product	308 647

Expenditure approach

Million Euro

Variable	Value
Final consumptipon	226 258
+ Gross capital formation	74 612
+ Exports of goods and services	165 648
- Imports of goods and services	- 157 871
= Gross domestic product	308 647

Austria 2011

2. Classification of economic activities

2.64. The International Standard Industrial Classification of All Economic Activities (ISIC) (United Nations, 2008) is the international reference classification of economic activities (also referred to as "industries"). The fourth revision, ISIC Rev. 4, was released by the United Nations in 2008. Its main purpose is to provide a set of activity categories that can be utilised for collecting and presenting internationally comparable statistics by economic activity.

2.65. In general, the scope of ISIC covers productive activity, that is, all economic activities within the production boundary as described in the SNA (with one exception for activities in Class 9820 Undifferentiated service-producing activities of private households for own use). The classification is used to classify statistical units such as establishments or enterprises, according to the economic activity in which they mainly engage. All categories at each level of the classification are mutually exclusive. The ISIC Rev. 4 is the reference classification of production activities of the 2008 SNA.

2.66. The structure of ISIC consists of 21 Sections, 88 Divisions, 238 Groups and 419 Classes. The principles and criteria used to define and delineate the categories are based on the inputs of goods, services and factors of production, the process and technology of production, the characteristics of outputs, and the use to which the outputs are put. At the class level of the classification, preference has been given to the process and technology of production to define individual ISIC classes, particularly in the classes related to services. The list of products that defines a class is called the principal products of that class. At the division and group levels, characteristics of outputs and the use to which outputs are put become more important to create analytically useful aggregation categories.

2.67. At national and regional levels, there may be the need to use a level of detail that reflects specific national and regional circumstances. However, it is important that these classifications are compatible with ISIC Rev. 4 at an aggregated level of detail. At its thirty-seventh session, the United Nations Statistical Commission recommended that countries adapt their national classifications in a way that allows them to report data at least at the two-digit level of ISIC, Rev. 4 without loss of information[3] Examples of regional classifications is the industrial classification used in the European Union - the General Industrial Classification of Economic Activities within the European Communities (NACE) Rev. 2, which is identical with ISIC Rev. 4 up to the two-digit level (divisions) of the classification. At lower levels, NACE has created more detail suitable for the European users of the classification. The additional detail can always be aggregated to ISIC categories at the three-digit level and four-digit level, within the same structure. The North American Industry Classification System (NAICS), although it has a substantially different structure from ISIC, has been designed in a way that statistical data collected according to NAICS can be re-aggregated into the two-digit divisions of ISIC, Rev. 4. The Australian and New Zealand Standard Industrial Classification (ANZSIC) has been revised in 2006. The ANZSIC structure broadly follows the ISIC structure, so that categories at the division and more detailed levels can be aggregated into the two-digit categories of ISIC.

[3] See *Official Records of the Economic and Social Council, 2002, Supplement No.4* (E/2006/24), chapter I, paragraph. 3, item 37/105 (*b*).

2.68. An economic unit may engage in a variety of production activities. The classification of the economic unit is done according to the importance of the production activities. In this regard, the activities of an economic unit are distinguished into principal activity, secondary activity and ancillary activities. The *principal activity* of an economic entity is the activity that contributes most to the value added of the entity, as determined by the "top-down method". The top-down method follows a hierarchical principle whereby the process starts with the identification of the relevant category at the highest level (section) and progresses down through the levels of the classification to the lowest level (classes). As a result of the top-down method, it is not necessary that the principal activity account for 50 per cent or more of the total value added of an entity or even that its generated value added exceed that of all other activities carried out by the unit, although in practice it will do so in the majority of cases. (United Nations 2008, paragraph 57).

2.69. However, in practice, it is often impossible to obtain the information on GVA of the different activities performed and the activity classification has to be determined by using substitute criteria such as employment and/or turnover.

2.70. Products resulting from a principal activity are either *principal products* or *by-products*. By-products are products that are necessarily produced together with principal products, for example, hides produced when producing meat by slaughtering animals. Since normal patterns of horizontal integration have been taken into account when defining the ISIC classification, such commonly integrated activities are usually included in the same ISIC class even though the outputs produced have quite different characteristics. Thus the ISIC Class 1010 "processing and preserving of meat" also includes hides, skins, wool and feather originating from slaughtered animals (United Nations 2008, paragraphs 57 and 120).

2.71. A *secondary activity* is each separate activity that produces products eventually for third parties and that is not the principal activity of the entity in question. The outputs of secondary activities are called *secondary products* including any by-products associated with these outputs. Most economic entities produce at least some secondary products.

2.72. Traditionally the existence of by-products has been seen as creating problems in I-O analysis as they would disturb supply and use relationships. Thus additional demand for the principal product would also result in more output of the by-product for which there would not automatically be any additional demand. When it comes to more complex production processes than meat and hides, for example in chemical and electronic industries, it will, however, be very difficult or in the absence of special technical insight, impossible for the compilers of SUTs to identify by-products separately.

2.73. A distinction is made between principal and secondary activities on the one hand and *ancillary activities* on the other. All economic units require some basic, routine services to support their production activities. When they are provided in-house, they are called ancillary activities. In general, an ancillary activity is a supporting activity undertaken within an enterprise in order to create the conditions within which the principal and secondary activities can be carried out (2008 SNA, paragraph 5.36). Ancillary activities typically produce services that are commonly found as inputs into almost any kind of economic activity. These outputs are always services and intended for intermediate consumption within the same entity. They include for example: maintaining records, files or accounts in written form or on computers; purchasing materials and equipment; providing electronic and traditional written communication facilities; hiring, training, managing and paying employees; storing materials or equipment; warehousing; providing security and surveillance; etc.

2.74. Some of these activities are found in every economic entity. The output of an ancillary activity is not explicitly recognized and recorded separately in the SNA. It follows that the use of this output is also not recorded. All the inputs consumed by an ancillary activity, materials, labour, consumption of fixed capital, etc., are treated as inputs into the principal or secondary activity that it supports.

2.75. The following activities are not to be considered ancillary: producing goods or services as part of Gross fixed capital formation (GFCF) and research and development activities, which are considered to be part of GFCF in the 2008 SNA. These items will therefore appear as either principal or secondary output. Goods that become embodied in the output of the principal or secondary activities are not outputs of ancillary activities.

2.76. More details on principal products, secondary products and ancillary products specific to the construction of the Supply Table are covered in Chapter 5.

Considerations for the compilation of SUTs and IOTs

2.77. In SUTs and IOTs, the industries should be classified according to ISIC Rev. 4. The major advantage of using established international industrial classifications is that the comparability to other types of economic statistics and the National Accounts is not compromised. The choice is therefore not which industrial classifications should be used in the SUTs and IOTs but rather at which level of detail.

2.78. At the working level, it is recommended to use the most detailed level of classification of industry taking into consideration user needs, the availability of data and the level of detail used in the National Accounts. Furthermore, certain compilation aspects also influence the choice of working level such as the distinction between industries which are allowed to deduct Value Added Tax (VAT) and those that are not, the distinction between market and non-market producers, and the explicit identification of certain industry sub-divisions which are relevant for the compilation of the trade and transport margin matrices. In addition, the link between SUTs and the institutional sector accounts should be reflected. These considerations are further elaborated in Chapters 4 to 7. In general, the level of detail in the published/disseminated SUTs differs from that at the working level: SUTs are generally published at a more aggregated level of detail which takes into account users' needs and confidentiality.

3. Classification of products

2.79. The international reference classification of products is the Central Product Classification, Version 2.1 (CPC Ver. 2.1) (United Nations 2015). The primary purpose of the CPC is to classify all goods and services that are the result of production in the economy. The CPC presents categories for all products that can be the object of domestic or international transactions or that can be entered into stocks. It includes products that are an output of economic activity, including transportable goods, non-transportable goods and services. The CPC in general follows the definition of products within the SNA.

2.80. The importance of the industrial origin of goods and services was underscored by the attempt to group into one CPC sub-class mainly the products that are the output of a single ISIC class. Through their linkage to the criterion of industrial origin, the input structure, technology and organization of production characteristics of products are also reflected in the structure of the CPC. The industrial origin of products criterion is one of the classification principles applied by the ISIC.

2.81. The CPC was developed primarily to enhance harmonization among various fields of economic and related statistics and to strengthen the role of National Accounts as an instrument for the coordination of economic statistics. It provides a basis for transforming basic statistics from their original classifications into a standard classification for analytical use. As a general purpose classification, the CPC provides less detail than other specific classification systems in areas or applications for which such systems are available, for example the HS. The HS[4] codes provide building blocks for the part dealing with transportable goods and take into account the basic categories of economic supply and use of products as specified in the SNA such as intermediate consumption, final consumption, capital formation, and imports and exports.

2.82. The CPC is a system of categories that are both exhaustive and mutually exclusive. This means that if a product does not fit into one CPC category, it must automatically fit into another. In CPC Ver. 2.1, in total there are 10 sections, 71 divisions, 329 groups, 1,299 classes and 2,887 sub-classes. Each sub-class in Sections 0 to 4 of the CPC is defined as the equivalent of one heading or sub-heading or the aggregation of several headings or sub-headings of the HS, owing to the fact that the HS is a detailed classification of transportable goods that is widely accepted for use in international trade statistics by virtually all countries. Other classifications of products may be used at country and regional level, however, these classifications are in general broadly consistent with the CPC Ver. 2.1. The Classification of Products by Activity (CPA) is based on NACE – and therefore follows a different aggregation structure than the CPC – and detailed categories that are mostly aligned with the CPC. Exceptions exist for areas where the CPC deviates from the Harmonized System, since the CPA maintains a closer link to the Combined Nomenclature, which is the European version of that classification.

2.83. The CPC and the ISIC are both general purpose classifications with the ISIC representing the activity side. Each sub-class of the CPC consists of goods or services that are predominantly produced in a specific class of the ISIC. However, the relationship between industries and their products is complex and changes over time, and it should be noted that there has been no intention of establishing a one-to-one correspondence between the CPC and ISIC. Such an effort is considered neither practical nor desirable as it might lead to an inadequate description of CPC categories, especially at the higher levels.

2.84. The classification of a product in the service part of the CPC does not automatically imply that the product cannot be a principal output of a goods producing industry. Thus the two CPC Divisions: (87) Maintenance, repair and installation (except construction) services; and (88) Manufacturing services on physical inputs owned by others both appear in the business and production services section of the CPC but the units carrying out these activities on a fee or contract basis are classified in the same ISIC category as units producing the same goods or services for their own account. The correspondence table between CPC Ver. 2.1 and ISIC Rev. 4 (see UNSD classification website at: http://unstats.un.org/unsd/class/default.asp) shows that 125 sub-classes of CPC Division 88 are defined to correspond to 125 manufacturing industry classes of the ISIC. This implies that these manufacturing services are principal output (and not as might have been expected, secondary output) of the corresponding manufacturing activities. In other words, there are no service industries producing these services. This example shows the need to get these kinds of services correctly entered into the domestic output matrix requiring a considerable number of products.

[4] The *Harmonized Commodity Description and Coding System* (HS) is the classification used for international trade statistics.

2.85. Box 2.6 shows other classification of products, such as the HS, the Standard International Trade Classification (SITC), the Classification by Broad Economic Categories (BEC) and the Extended Balance of Payments Services Classification (EBOPS) and how they relate to the CPC. However, the basis for grouping products in the SUTs (and IOTs) is thus most commonly an aggregation of CPC Sections, Divisions, or Groups (2008 SNA, paragraph 14.22).

Box 2.6 Other classifications of products

The **Harmonized Commodity Description and Coding system** generally referred to as "Harmonized System" or simply HS is a multipurpose international product nomenclature developed by the World Customs Organization (WCO). The system is used by more than 200 countries and economies as a basis for their collection of external trade statistics for goods. It is also extensively used by governments, international organizations and the private sector for many other purposes such as internal taxes, trade policies, monitoring of controlled goods, rules of origin, freight tariffs, transport statistics, price monitoring, quota controls, compilation of National Accounts, and economic research and analysis.

As a result of the intensive world-wide use and degree of detail the HS provides, it is a fundamental classification and provides a key link for the definitions of all other classifications of goods (including the goods part of the CPC) as well as for the definition of the classes of the ISIC. The latest version now available is HS 2012.

The HS explanatory notes are a part of a commodity database giving the HS classification of more than 200,000 products actually traded internationally. This high number of "background" products also makes it evident that at the level of external trade statistics (usually 5,000-10,000 products, as most countries apply further sub-divisions of the 5,000 HS-codes), there will be no "homogeneous" products, and of course, even less so at the much higher level of aggregation applied in a SUTs system.

The **Standard International Trade Classification (SITC)** and the **Classification by Broad Economic Categories (BEC)** are both classifications of goods defined in terms of HS, and also primarily used in relation to external trade data. SITC distinguish around 3,000 products at its most detailed level. It is primarily used as an alternative to the HS publication level of external trade statistics, and there will usually be no advantage in applying it in SUTs compared to using the HS directly. With the breakdown of products according to BEC (food, materials, fuel, capital goods, transport equipment, consumer goods), these groupings may be used as a reference when deciding on uses of some products but it is not applicable as the main product classification in the SUTs system. Furthermore, the BEC is not an international standard classification in the same sense as HS or SITC.

The relationship between the CPC and the SITC is similar to that between the CPC and the HS, since SITC also uses the sub-headings of the HS as building blocks to create product groupings that are more suitable for the economic analysis of trade. The BEC is related to the CPC through its close correlation with SITC and is designed to serve as a means for converting external trade data compiled by using SITC into end-use categories that are meaningful within the SNA framework. It is generally possible to rearrange whole CPC sub-classes into BEC categories through the correspondences between CPC and SITC, and between SITC and BEC.

The **Extended Balance of Payments Services Classification 2010 (EBOPS 2010)** (United Nations *et al.*, 2011) is a classification of trade in services that was developed to provide further breakdowns of the BPM 6 classification so as to meet a number of user requirements, including the provision of information required in connection with the General Agreement on Trade in Services (GATS). It builds upon the BPM 6 classification of services. In BPM 6, 12 main service categories are identified and broken down into a list of standard and supplementary components. EBOPS 2010 consists of a further breakdown of these components into more detailed sub-items. EBOPS 2010 also contains several supplementary items for the recording of useful additional information regarding services transactions in various sectors such as, travel/tourism or insurance services. Like the BPM 6 services classification, EBOPS 2010 is primarily a product-based classification. Items of these classifications may be described in terms of the CPC. However, correspondences cannot be established in the areas of travel, construction, and government goods and services, n.i.e., which focus on the mode of consumption of goods and services or the status of the transactor, rather than on the type of product consumed. A detailed correspondence between EBOPS 2010 and CPC, Version 2, can be found online at http://unstats.un.org/unsd/tradeserv/TFSITS/ msits2010/annexes.htm.

Considerations for the compilation of products in the SUTs and IOTs

2.86. Based on the description of the product classifications and their level of detail, it is obvious that "products" in the SUTs, even when a high level of detail is applied such as for example 2,000 products, will nonetheless represent aggregated groups of products when compared to the detail applied in basic statistics, and even more so when compared to the real world variety of products. Therefore, analogies to the notion of homogeneous products, which are often assumed in standard economic theory, will in general be inappropriate, as there can be no homogeneous products or production processes at the SUTs or IOTs level of aggregation. Many economies usually consist of hundreds of thousands of producing units, of which hardly any two are completely identical, and there are millions of different products and even more production processes. Therefore, it is important to realise that National Accounts and SUTs record economic transactions, and not physically identifiable products or related technical production processes, which will in general be outside the sphere of official statistics.

2.87. Even very detailed basic statistics already represent highly aggregated data when compared to the number of real world products. As previously mentioned, the HS contains descriptions of 200,000 products. Statistics on products are collected at a maximum detail of, say, 10,000 products, and only in selected areas such as external trade statistics and output from manufacturing industries. Furthermore, products that are identical in a physical sense may be different in an economic sense when they are sold at different prices to different purchasers. This may, for example, happen because of the way transportation costs are invoiced. The concept of basic prices is defined to specifically include this possibility. Statistics on the breakdown of products for intermediate consumption will often give less detail than production statistics and may sometimes be collected from enterprise units rather than establishment units, and in most cases the statistical coverage of purchases is irregular and/or limited to certain industries, for example, mainly manufacturing industries but even in this case the compilers of SUTs may be confronted with the task of further aggregation.

2.88. For the further understanding of the level of aggregation, it is informative to consider the product definitions required when selecting items and collecting prices for compiling price indices such as consumer price indices and producer price indices. Each item must be defined more precisely than by just referring to even the most detailed product classification. The same is the case when collecting prices for use in the International Comparison Programme. Official statistics have in these cases to make selections from a product universe at a much more detailed level than 10,000 product groups to compile a sound price index. This places the terminology of "homogeneity", often applied in connection with SUTs and IOTs, in perspective. (See 2008 SNA, paragraph 14.144).

2.89. Therefore, the term "homogenous" in the context of the SUTs system usually means "mutually exclusive". As outlined above, international activity and product classifications aim at mutually exclusive classification criteria. Yet within any group of products fulfilling this criterion, there may be considerable "non-homogeneity" depending on the level of aggregation. The classification of products in this sense (mutually exclusive) is statistically possible at any level of aggregation but a product in the SUTs will usually represent a basket of products, and furthermore the contents of the basket will vary from one cell to another along the rows of both the Supply Table and the Use Table. For the classification of producer units into industries the same “mutually exclusive” conditions basically hold, though the situation is somewhat different as the statistically observed input structures will usually represent a mixture of intermediate consumption structures for many individual products, some of which will also be produced in other industries. Therefore, industries producing mutually exclusive products can only be derived on certain assumptions which do not in general form part of the compilation of the SUTs. Redefinitions (see Chapter 5) may be seen as an exception.

4. Other classifications relevant for SUTs and IOTs

2.90. The SUTs system distinguishes a large number of products and industries. However, final uses distinguish often only final consumption, gross capital formation and exports at a very aggregate level. The functional classifications help to support the compilation of SUTs and allow for a wide range of other analyses. It is mainly the disaggregated SUTs which allow us to identify the different purposes of expenditure on a product basis.

2.91. The SNA uses special classifications to analyse consumption and other outlays according to the purpose for which the expenditure is undertaken. Such functional classifications and associated detail - the Classifications of Expenditure According to Purpose (United Nations 1999b) - can be found in 2008 SNA, Chapter 29 on satellite accounts and other extensions. These classifications include in particular: the Classification of the Functions of Government (COFOG); the Classification of Individual Consumption According to Purpose (COICOP), the Classification of the Purposes of Non-Profit Institutions Serving Households (COPNI) and the Classification of the Outlays of Producers According to Purpose (COPP). The main purpose of these classifications is to provide more detailed statistics for a wide variety of analytical uses.

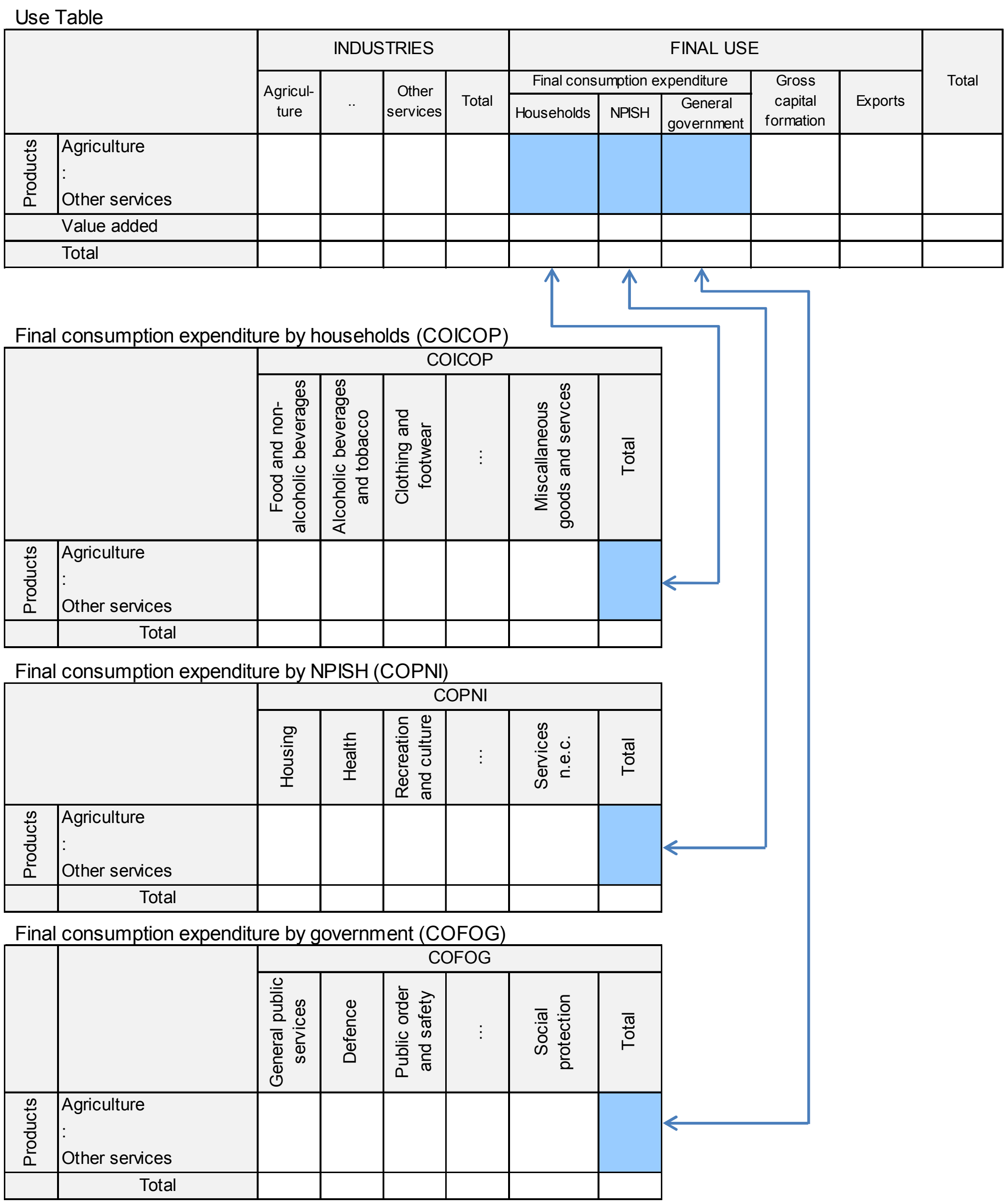
2.92. For the SUTs, the lower level detail is recommended to be produced in the form of disaggregated matrices as sub-systems feeding into the central compilation of SUTs in current prices and in volume terms. Thus a correspondence between categories of these functional classifications and the CPC allows bringing the basic data into the use tables.

2.93. The correspondence table between categories of CPC and COICOP has been established and available on the UNSD classification website at http://unstats.un.org/unsd/class/default.asp. When making decisions on the details of the product classification to be applied in SUTs, the possibility to establish transformation tables to the COICOP at group levels or class levels and to make use of the reverse transformation, from the products surveyed in the household budget surveys to the products of the SUTs should be taken into consideration. These transformation matrices are keys to utilising the consumer price index (CPI) in the volume estimates, as sub-indices of the CPI will usually be based on the COICOP classification. Also, for the purposes of household budget surveys and purchasing power parities (PPP), the COICOP is applied at more detailed level including as many as 300-400 or more sub-classes.

2.94. Table 2.7 shows the types of links and extensions. Some of the key areas are covered in this section but more detail in terms of compilation is covered in Chapter 6.

2.95. The Classification of the Outlays of Producers According to Purpose (COPP) provides detailed information on outlays of producers for current production, infrastructure research and development, environmental protection, marketing and human resource development. It should be noted that the COPP is covered here more for completeness of presentation of the functional classifications. The COPP is not used much and does not fit well in the SUTs framework as outlays include wages and other types of costs in addition to intermediate consumption. In principle, COPP applies to all producers, whether market or non-market or for own final use.

Table 2.7 Links between the Use Table and functional classifications



5. Statistical units

2.96. In general, the same statistical unit is the basis for compiling the Use Table and for compiling the Supply Table. Different choices of statistical units are available for the compiler and it is important to have a clear understanding of the impact of the choice of different statistical units has on the SUTs and on the IOTs.

2.97. Different types of statistical units can be defined (for example, enterprise group, local unit, kind-of-activity unit, etc.). However, for SUTs the focus is on two specific statistical units: enterprises and establishment (local kind-of-activity unit).

2.98. An **enterprise** is defined as the view of an institutional unit as a producer of goods and services (where institutional units are economic entities that have autonomy of decision making and have clear links with the legal units). An **establishment** is an enterprise or part of an enterprise that is situated in a single location and in which only a single productive activity is carried out or in which the principal productive activity accounts for most of the value added.

2.99. Although the impact of globalization and the way multi-national businesses control and operate their activities poses lots of challenges, including the basis of the statistical unit for measurement of national activity versus global activity. However, in line with the recommendations of the 2008 SNA, the establishment is the unit that is more suitable for analysis of production in which the technology of production plays an important role. Thus the establishment is the recommended unit for the compilation of the production part of the National Accounts and therefore the compilation of SUTs. This means, as a rule, that "multi-product" enterprises must be partitioned into smaller and more uniform units with regard to the kind of production, if possible.

2.100. Trying to collect data on sub-establishment production processes as part of the I-O compilation is an approach that has no natural limitation, and will, apart from the costs, almost invariably become biased by the specific knowledge and insight that the compilers happen to possess and lead to non-transparent and uneven compilation processes.

2.101. In practice, the extent of partitioning enterprises into establishments varies across countries depending on whether the creation of establishments is based on a relatively modest breakdown of institutional units or if alternatively the starting point is a register of all local producer units. The latter case follows the formal definitions set out in the 2008 SNA and would lead to a more pure activity classification than the former. Recommendations for partitioning vertical and horizontal integrated enterprises are briefly presented in Box 2.7.

Box 2.7 SNA recommendations on partitioning of vertically/horizontally integrated enterprises

A **horizontally integrated enterprise** is one in which several different kinds of activities that produce different kinds of goods or services for sale on the market are carried out simultaneously using the same factors of production. (2008 SNA, paragraph 5.21).

Horizontal integration occurs when an activity results in end-products with different characteristics. This could theoretically be interpreted as activities carried out simultaneously using the same factors of production. In this case, it will not be possible to separate them statistically into different processes, assign them to different units or generally provide separate data for these activities. Another example would be the production of electricity through a waste incineration process. The activity of waste disposal and the activity of electricity production cannot be separated in this case.

Within the SNA, a separate establishment should be identified for each different kind of activity wherever possible. (2008 SNA, paragraph 5.22)

A **vertically integrated enterprise** is one in which different stages of production, which are usually carried out by different enterprises, are carried out in succession by different parts of the same enterprise. (2008 SNA, paragraph 5.23) Vertical integration of activities occurs wherever the different stages of production are carried out in succession by the same unit and the output of one process serves as the input to the next process. Examples of common vertical integration include tree felling and subsequent on-site sawmilling, mining of metal ores and manufacture of basic iron and steel, a clay pit combined with a brickworks or production of synthetic fibers in a textile mill.

While the procedure for the treatment of vertically integrated activities could be applied to any unit, it should be noted that the SNA recommends that when a vertically integrated enterprise spans two or more sections of ISIC, at least one establishment must be distinguished within each section. With such a treatment, activities of units engaged in vertically integrated activities will not cross section boundaries of ISIC. (2008 SNA, paragraph 5.26). If this has not already been done in basic statistics, the compilers of SUTs will exceptionally have to deal with individual producer units.

6. Valuation in the SUTs

2.102. More than one set of prices may be used to value outputs and inputs depending on how taxes and subsidies on products, and also transport charges and trade margins are recorded. The 2008 SNA distinguishes three main valuation concepts of the flows of goods and services: basic prices, producers' prices and purchasers' prices.

2.103. The valuation of the data for the Use Table (for example, intermediate and final consumption) is different from the valuation of the data for the production side of the Supply Table. In fact, the valuation of Use Table is based on the actual price paid by the users for the goods and services (i.e. purchasers' price) while the valuation of the production data in the Supply Table is based on output at basic prices – this in line with the 2008 SNA.

2.104. In order to balance the SUTs, the same valuation should be used. For this purpose, specific matrices have to be compiled for trade and transport margins and taxes and subsidies on products. The compilation of these valuation matrices is an important component of the compilation of SUTs and IOTs. Chapter 7 provides a detailed description on the compilation steps for the valuation matrices and the compilation issues.

2.105. An overview of the three different valuations – basic prices, producers' prices and purchasers' prices – are looked at in turn below. They differ as a result of the treatment of taxes on products less subsidies on products, and trade and transport margins.

(a) Basic prices

2.106. Basic prices are the preferred method in the 2008 SNA for valuing output in the accounts. This price basis reflects the amount receivable by the producer from the purchaser for a unit of goods or services, minus any taxes payable, and plus any subsidy receivable on that unit as a consequence of production or sale (for instance, the cost of production).

2.107. The value of output at basic prices reflects the sum of intermediate consumption of goods and services at purchasers' prices, compensation of employees, return to capital for market producers' own capital formation, and other taxes less subsidies on production. Other taxes on production include items such as property taxes/business rates, business licences, motor vehicle licenses, mission permits issues by government under cap-and-trade schemes, etc. Basic prices exclude any transport charges invoiced separately by the producer. When a valuation at basic prices is definitely not feasible, then a proxy as close as possible to basic prices should be used.

2.108. The basic price valuation is the preferred valuation to construct IOTs which in turn are used in constructing structural models of the economy or modelling particular features of economic behaviour. When compiling the IOTs, it is therefore necessary to also value the purchases by products at basic prices, and this is further explained in Chapter 7.

(b) Producers' prices

2.109. Producers' prices may be thought of as the prices of goods and services 'at the factory gate'. This valuation includes all taxes on production and taxes on products, for example excise duties. Producers' prices relate to basic prices as follow:

Producers' prices	*equals*	basic prices
	plus	taxes on products (excluding invoiced VAT)
	less	subsidies on products.

2.110. Although the producers' price valuation is valid and noted in the 2008 SNA, it not recommended for use in the 2008 SNA. However, this valuation still forms the basis of some of business survey data. Therefore, if relevant, specific steps are needed to change data based on business survey to basic prices, as appropriate, for use in National Accounts and SUTs.

(c) Purchasers' prices

2.111. Purchasers' prices are those prices payable by the purchaser and include transport costs, trade margins and taxes (unless the taxes are deductible by the purchaser). Purchasers' prices are defined as follow:

Purchasers' prices	*equals*	producers' prices
	plus	any non-deductible VAT or similar tax payable by the purchaser
	plus	transport costs paid separately by the purchaser and not included in the producers' price.
	plus	trade margins.

2.112. In terms of taxes and subsidies on products and other taxes and subsidies on production, below are some short descriptions:

- Taxes on products include, in particular, value added taxes, taxes and duties on imports, and taxes on products such as stamp taxes on the sale of petrol, diesel, alcoholic beverages and tobacco.

- Subsidies on products include import subsidies and other subsidies on products.

- Other taxes on production consist of all taxes that enterprises incur as a result of engaging in production, independently of the quantity or value of the goods and services produced or sold. These may be payable on the land, fixed assets, business/property rates or labour employed in the production process or on certain activities or transactions.

- Other subsidies on production consist of subsidies which resident producer units may receive as a consequence of engaging in production including in particular subsidies on payroll or work force, subsidies to reduce pollution and grants for interest relief.

2.113. In the Use Table transactions are recorded at purchasers' prices. In the Supply Table, domestic production is recorded at basic prices and imports by type of product at cost, insurance and freight (CIF) prices. In the SNA based accounts and the BoP, total imports of goods are valued at free on board (FOB) prices. In Chapter 5, Section D covers these connections and the adjustments required. Therefore, additional columns are included in the Supply Table in order to complete the valuation gap between total use and total supply of products. They include information on trade and transport margins, taxes on products and subsidies on products.

(d) Value added tax

2.114. VAT is a wide-ranging tax usually designed to cover most or all goods and services. In some countries, VAT may replace most other forms of taxes on products but VAT may also be levied in addition to some other taxes on products, such as excise duties on tobacco, alcoholic drink or fuel oils. VAT is a tax on products collected in stages by enterprises. Producers are required to charge certain percentage rates of VAT on the goods or services they sell. The VAT is shown separately on the sellers' invoices so that purchasers know the amounts they have paid. However, producers are not required to pay to the government the full amounts of the VAT invoiced to their customers because they are usually permitted to deduct the VAT that they themselves have paid on goods and services purchased for their own intermediate consumption, resale or gross fixed capital formation.

2.115. Deductible VAT is the VAT payable on purchases of goods or services intended for intermediate consumption, gross fixed capital formation or for resale that a producer is permitted to deduct from his own VAT liability to the government in respect of VAT invoiced to his customers. Non-deductible VAT is VAT payable by a purchaser that is not deductible from his own VAT liability, if any.

2.116. The SNA requires that the net system of recording VAT should be followed. In the net system: (a) Outputs of goods and services are valued excluding invoiced VAT; imports are similarly valued excluding invoiced VAT; and (b) Purchases of goods and services are recorded including non-deductible VAT.

(e) Valuation in SUTs and IOTs

2.117. Box 2.8 presents an overview of the valuation in the compilation of SUTs and IOTs in a simplified numerical example. This overview underlines the different valuation layers: the Supply Table at basic prices including the transformation into purchasers' prices is considered with the Use Table at purchasers' prices (total supply equals the total use). In a second step, valuation matrices are compiled - one for the trade and transport margins and the other for the taxes less subsidies on products, in order to transform the Use Table from purchasers' prices to basic prices. In this way, the Supply Table at basic price can be considered in relation to the Use Table at basic prices (total supply at basic prices equals total use at basic prices). The use table at basic prices is further split between the domestic use table and imports use table at basic prices. The SUTs at basic prices are the starting point for the compilation of IOTs which are compiled at basic prices.

Box 2.8 Overview of the valuation in SUTs and IOTs

BALANCED SUPPLY AND USE SYSTEM

Supply Table at basic prices including a transformation into purchasers' prices

	Industries								
Products	Agricul-ture	Manuf. and Constr.	Services	Output at basic prices	Imports	Supply at basic prices	Trade and transport margins	Taxes *less* subsidies on	Total supply at purchasers' prices
Agriculture	270	30	50	350	20	370	28	20	418
Manufacturing	6	380	87	473	42	515	80	21	616
Construction	4	50	13	67	8	75	22	4	101
Trade, transport and communication	10	15	210	235	7	242	- 130	13	125
Finance and business services	6	17	240	263	11	274		15	289
Other services	4	8	100	112	12	124		7	131
Total	300	500	700	1 500	100	1 600		80	1 680

Use Table at purchasers' prices

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final consumption expenditure	Gross capital formation	Exports	Total use at purchasers' prices
Agriculture	38	65	103	155	24	33	418
Manufacturing	115	123	64	167	85	62	616
Construction	12	16	6	24	39	4	101
Trade, transport and communication	21	2	2	98	1	1	125
Finance and business services	14	54	43	128	32	18	289
Other services	14	35	23	41	10	8	131
GVA	86	205	459				750
Output at basic prices	300	500	700	613	191	126	

COMPILATION OF VALUATION TABLES

Trade and transport margins

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Agriculture	3	5	4	13	2	1	28
Manufacturing	16	14	5	33	10	2	80
Construction	3	4	1	5	8	1	22
Trade, transport and communication	- 22	- 23	- 10	- 51	- 20	- 4	- 130
Finance and business services							
Other services							
Total							

Taxes less subsidies on products

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Agriculture	1	1	6	11	1		20
Manufacturing	2	2	2	12	2	1	21
Construction			1	2	1		4
Trade, transport and communication	1	1	1	9	1		13
Finance and business services		1	1	12	1		15
Other services			1	6			7
Total	4	5	12	52	6	1	80

TRANSFORMATION OF SUPPLY AND USE TABLES TO BASIC PRICES

Supply Table at basic prices

	Industries					
Products	Agricul-ture	Manuf. and Constr.	Services	Output at basic prices	Imports	Supply at basic prices
Agriculture	270	30	50	350	20	370
Manufacturing	6	380	87	473	42	515
Construction	4	50	13	67	8	75
Trade, transport and communication	10	15	210	235	7	242
Finance and business services	6	17	240	263	11	274
Other services	4	8	100	112	12	124
Total	300	500	700	1 500	100	1 600

Use Table at basic prices

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final consumption expenditure	Gross capital formation	Exports	Total
Agriculture	34	59	93	131	21	32	370
Manufacturing	97	107	57	122	73	59	515
Construction	9	12	4	17	30	3	75
Trade, transport and communication	42	24	11	140	20	5	242
Finance and business services	14	53	42	116	31	18	274
Other services	14	35	22	35	10	8	124
Taxes less subsidies on products	4	5	12	52	6	1	80
GVA	86	205	459				750
Total	300	500	700	613	191	126	

COMPILATION OF SEPARATE USE TABLES FOR DOMESTIC OUTPUT AND IMPORTS

Imports Use Table at basic prices

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final cons. exp.	Gross capital form.	Exports	Total
Agriculture	4	9	3	1	1	2	20
Manufacturing	12	17	6	2	3	2	42
Construction	4	2	1	1			8
Trade, transport and communication	2	4	1				7
Finance and business services	4	3	2	1	1		11
Other services	4	5	2			1	12
Total	30	40	15	5	5	5	100

Empty cells by definition

Domestic Use Table for domestic output at basic prices

	Industries			Final use			
Products	Agricul-ture	Manuf. and Constr.	Services	Final consumption expenditure	Gross capital formation	Exports	Total use at basic prices
Agriculture	30	50	90	130	20	30	350
Manufacturing	85	90	51	120	70	57	473
Construction	5	10	3	16	30	3	67
Trade, transport and communication	40	20	10	140	20	5	235
Finance and business services	10	50	40	115	30	18	263
Other services	10	30	20	35	10	7	112
Imports	30	40	15	5	5	5	100
Taxes less subsidies on products	4	5	12	52	6	1	80
GVA	86	205	459				750
Total	300	500	700	613	191	126	

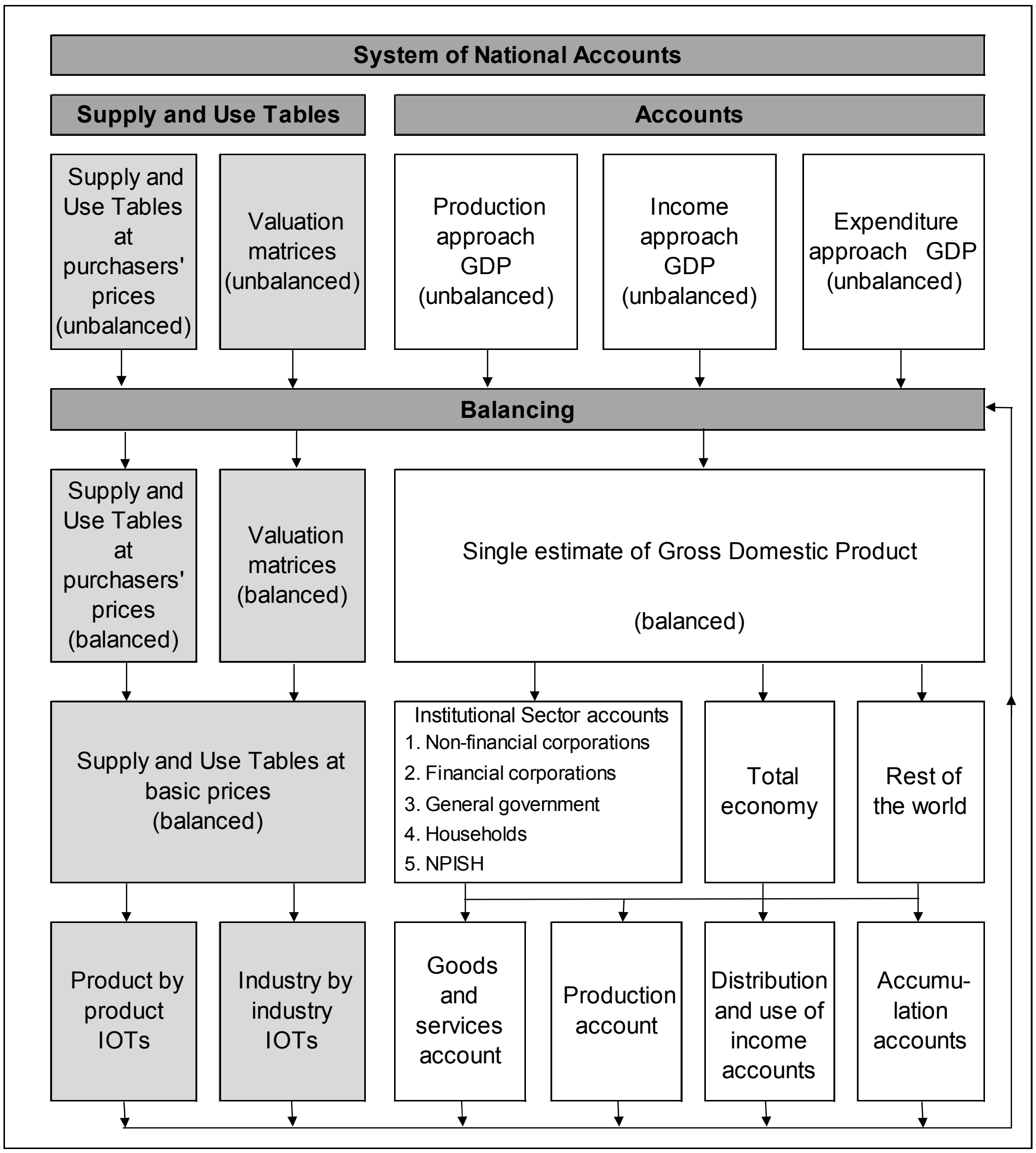
E. Compiling SUTs as an integral part of the National Accounts

2.118. As mentioned before, the compilation of SUTs should be seen as an integral part of the compilation of the National Accounts. Figure 2.4 provides a general overview of how the compilation of SUTs and IOTs fits within the compilation of National Accounts conforming to the same statistical standards (for example, 2008 SNA, BPM 6, SEEA-2012, IMF Government Finance Statistics, etc.), and using the same basic sources generally used for the compilation of National Accounts.

2.119. One important feature of Figure 2.4 is the level at which the traditional annual and quarterly balancing process of the National Accounts and Balance of Payments system takes place. Balanced macroeconomic data can be derived on a more aggregate level by applying the production, income and expenditure approaches.

However, the better quality option and recommendation is to balance the system at the same time for the institutional sector accounts and the SUTs at a lower level disaggregation of products and industries. The annual and quarterly estimates of GDP are obtained from the production, income and expenditure approaches and reconciled using SUTs in many countries. Some countries have a long tradition and much experience in utilising detailed production data based on establishments (local KAU) as the statistical unit for compiling GDP estimates according to the production approach.

Figure 2.4 Overview of SUTs and IOTs as part of the SNA compilation



(a) Different approaches to measuring GDP

2.120. The three approaches to measuring GDP form the basis of estimating GDP both quarterly and annually. Using three different methods which, as far as possible, use independent sources of information avoids sole reliance on one source and allows greater confidence in the overall estimation process. This in turn also underpins not only the quality of the key aggregates but also of the underlying details. The SUTs combine the three approaches together in a consistent manner.

Production approach

2.121. The production approach looks at the contribution of each economic unit by estimating the value of their output less the value of goods and services used up in the production process to produce their output, this is also known as GVA. Using the production approach:

GVA at basic prices	*equals*	output at basic prices
	less	intermediate consumption at purchasers' prices

and then,

GDP	*equals*	GVA at basic prices
	plus	taxes on products
	less	subsidies on products

GDP is also the balancing item of the production account for the whole economy.

2.122. The distinction between market and non-market producers (see 2008 SNA, paragraph 6.133 for the definitions) is important for the determinants of both total output and gross value added which is covered in this section. While the output of market producers is determined from the revenue side, the output of non-market producers is calculated as the costs of all inputs including labour cost and consumption of fixed capital. Box 2.9 provides an overview of the calculation of output for market and non-market producers.

2.123. The estimate of output for producing units in the non-market sector is derived by summing their costs, for example, intermediate consumption, compensation of employees, other taxes (less subsidies) on production and consumption of fixed capital. GVA is the sum of compensation of employees, other taxes (less subsidies) on production and consumption of fixed capital.

2.124. The production approach to measuring GDP, and the estimates of GVA, can be implemented by using an industry dimension or by an institutional sector dimension. GVA is the variable used when producing labour productivity estimates and also output per worker uses GVA as the output measure.

Box 2.9 Calculation of output for market and non-market producers

Market producers and producers for own final use

Total output (at basic prices)	*equals*	total sales of goods and services (as invoiced, excluding VAT)
	plus	changes in inventories of work-in-progress and finished goods
	plus	output produced for own use, for example R&D, computer software and construction (also known as own account capital formation) and household production of agriculture products for own use
	less	purchases of goods or services for resale without further processing (thereby only including the gross margin within output)
	plus	income earned-in-kind
	less	any taxes on products
	plus	any subsidies on products
Total IC[a] (at purchasers' prices)	*equals*	total purchases of goods and services for use as inputs to the production process (excluding employment costs and fixed capital formation)
	less	changes in inventories of materials and fuels
	less	any purchased/bought-in R&D, computer software (treated as capital expenditure, assuming this is included in the purchases in the first place)
	plus	Financial intermediation services indirectly measured (FISIM)

	plus	any imputed insurance premium supplements
	less	any payments to employees such as income earned-in-kind
Gross value added (at basic prices)	*equals*	total output (at basic prices)
	less	total intermediate consumption (at purchasers' prices)
Non-market producers		
Total output (at basic prices)	*equals*	total intermediate consumption (at purchasers' prices)
	plus	compensation of employees (labour costs)
	plus	imputed charge for consumption of fixed capital (sometimes called depreciation)
	plus	other taxes on production and imports
	less	other subsidies on production
Gross value added (at basic prices)	*equals*	compensation of employees (labour costs)
	plus	imputed charge for consumption of fixed capital (depreciation)
	plus	other taxes on production and imports
	less	other subsidies on production
Final consumption expenditure (at purchasers' prices)	*equals*	total intermediate consumption at purchasers' prices
	plus	gross value added at basic prices
	equals	total output at basic prices
	less	market output
	less	payment for non-market output
	less	output produced for own final use
	equals	non-market output

[a] = Intermediate consumption

Income approach

2.125. Using the income approach, GDP is obtained by adding together the income components that make up value added. GDP by income approach covers only the income generated within the domestic economy:

GDP	*equals*	compensation of employees
	p*lus*	gross operating surplus and gross mixed income
	plus	other taxes less subsidies on production
	plus	taxes on products and imports.
	less subsidies on products	

The above income approach provides estimates of GDP market prices.

2.126. As it suggests, the income approach adds up all income earned by resident individuals or corporations in the production of goods and services and is therefore the sum of uses in the generation of income account for the total economy (or alternatively the sum of primary incomes distributed by resident producer units).

2.127. The income approach to measuring GDP can be analysed either by industry, by institutional sector or by type of factor income. The type of factor income approach is often linked to the source data and allows for incorporation of various administrative data sources. For example, generating direct estimates of mixed income (using labour force data and administrative data) and gross trading profits/loss (using company accounts data) as complementary estimates and not as residuals.

2.128. Based on factor incomes, gross operating surplus excludes holding gains on inventories but includes:

- self-employment income (mixed income and quasi-corporations);
- gross trading profits of private financial corporations;

- gross trading profits of private non-financial corporations;
- gross trading surplus of public corporations (financial and non-financial);
- rental income;
- non-market consumption of fixed capital; and
- deduct intermediate consumption of FISIM.

2.129. Producing all three dimensions in a single, integrated SUTs framework provides a natural link between the production account and generation of income account, both by industry and by institutional sector. This approach also ensures a high degree of consistency and coherency across the accounts.

2.130. It should be noted that the income approach to measuring GDP cannot be used to calculate chained linked volume measures directly because it is not possible to separate income components into prices and quantities in the same way as for goods and services. However, a chained linked volume measure of the income based total can be obtained indirectly. The expenditure based GDP deflator at market prices (also known as the index of total home costs) can be used to deflate the current market price income based total estimate to provide a chained linked volume measure of the total income component of GDP for balancing purposes.

Expenditure approach

2.131. In the expenditure approach, GDP is obtained by adding the final expenditures or uses by consumers and producers of goods and services produced within the domestic economy. The total is obtained from the sum of final consumption expenditure on goods and services by households, NPISHs and government, gross capital formation (gross fixed capital formation on tangible and intangible fixed assets, changes in inventories and acquisitions less disposals of valuables) and net exports of goods and services.

2.132. Using the expenditure approach:

GDP	*equals*	Final consumption expenditure (Households, NPISH and government)
	plus	gross fixed capital formation
	plus	change in inventories
	plus	acquisitions less disposals of valuables
	plus	exports
	less	imports.

2.133. The data for these categories are estimated from a wide variety of sources including business surveys, expenditure surveys, the government's internal accounting system, surveys of traders and the administrative documents used in the importing and exporting of goods.

2.134. To avoid double counting in this approach, it is important to classify consumption expenditures as either final or intermediate. Final consumption expenditure involves the consumption of goods purchased by or for the ultimate consumer or user. These expenditures are final because the goods are no longer part of the economic flow or being traded in the market place. Intermediate consumption, on the other hand, is consumption of goods and services that are used or consumed in the production process. Gross capital formation is treated separately from intermediate consumption as the goods (or services) involved are not used up within the production process in an accounting period, except for depreciating over time.

2.135. Exports include all sales to non-residents, and exports of both goods and services have to be regarded as final consumption expenditure, since they are final as far as the domestic economy is concerned. Imports of goods and services are deducted because they are not part of the production of the domestic economy but produced in another economy.

2.136. The expenditure approach to measuring GDP is also used to estimate chained linked volume measures of GDP. The chained linked volume measure shows the change in GDP after the effects of inflation has been removed.

2.137. Box 2.10 shows a numerical example of how a single estimate of GDP can be derived from a balanced SUTs system by extracting the components of the production, income and expenditure approaches to measuring GDP from the Supply Table and Use Table.

Box 2.10 Example of derivation of GDP from balanced SUTs

Supply Table at basic prices, including a transformation into purchasers' prices

Million Euro

			INDUSTRIES									VALUATION						
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Imports	Total supply at basic prices	Wholesale trade margins	Retail trade margins	Transport margins	Taxes on products	Subsidies on products	Total	Total supply at purchasers' prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(15)
Products	Agriculture	(1)	8 782						8 782	3 271	12 052	1 052	873	274	386	- 107	2 479	14 532
Products	Manufacturing	(2)	796	182 982	643	1 808	133	44	186 405	124 590	310 995	29 777	19 061	2 540	21 041	- 49	72 370	383 364
Products	Construction	(3)	83	961	43 060	734	255	179	45 272	563	45 835				1 542		1 542	47 377
Products	Trade	(4)	1	4 773	311	54 204	640	257	60 187	600	60 787	- 31 301	- 21 040		586		- 51 755	9 032
Products	Transport	(5)	13	465	66	25 538	128	125	26 335	8 150	34 485			- 2 800	628	- 448	- 2 620	31 865
Products	Communication	(6)	160	1 781	139	43 912	1 253	982	48 228	6 234	54 463	472	1 021	9	3 592	- 34	5 059	59 522
Products	Finance and business services	(7)	29	8 902	698	7 588	106 909	3 381	127 508	7 061	134 569			- 22	4 865		4 842	139 411
Products	Other services	(8)	3	85	13	1 053	143	74 346	75 643	824	76 467		85		1 777		1 861	78 329
	Total	(9)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	151 293	729 653	0	0	0	34 416	- 638	33 778	763 431
Adjustments	CIF/FOB adjustments on imports	(10)								- 97	- 97							- 97
Adjustments	Direct purchases abroad by residents	(11)								6 675	6 675							6 675
	Total	(12)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	157 871	736 230				34 416	- 638	33 778	770 009
	Total of w hich:																	
	Market output	(13)	9 763	195 916	41 462	127 401	88 330	18 116	480 989		480 989							480 989
	Output for ow n final use	(14)	104	4 029	3 468	2 134	19 890	2 670	32 295		32 295							32 295
	Non-market output	(15)	0	4	0	5 302	1 241	58 528	65 075		65 075							65 075

Use Table at purchasers' prices

Million Euro

			INDUSTRIES							FINAL USE								
										Final consumption expenditure								
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventorie	Exports	Total	Total use at purchasers' prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Products	Agriculture	(1)	2 583	6 570	16	371	34	49	9 623	3 595			180		- 27	1 161	4 909	14 532
Products	Manufacturing	(2)	2 205	107 190	12 441	16 874	6 015	8 797	153 522	71 438		3 180	26 756	2 183	3 034	123 252	229 842	383 364
Products	Construction	(3)	105	2 440	9 528	2 446	3 907	1 604	20 029	1 667			25 155		- 38	563	27 348	47 377
Products	Trade	(4)	33	1 883	119	2 240	259	308	4 842	3 325			67	45		753	4 189	9 032
Products	Transport	(5)	14	4 386	267	8 399	822	321	14 208	5 833		3 370				8 453	17 656	31 865
Products	Communication	(6)	34	2 563	299	9 359	5 919	1 833	20 008	26 444		121	5 976		67	6 905	39 514	59 522
Products	Finance and business services	(7)	457	13 578	4 736	20 359	29 166	9 134	77 430	38 838		1 006	11 170		- 178	11 145	61 981	139 411
Products	Other services	(8)	8	382	59	1 171	415	1 794	3 829	14 923	5 416	53 373	113	107	1	567	74 500	78 329
	Total at purchasers' prices	(9)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
Adjustments	CIF/FOB adjustments on exports	(10)														- 97	- 97	- 97
Adjustments	Direct purchases abroad by residents	(11)								6 675							6 675	6 675
Adjustments	Purchases on the domestic territory by non-residents	(12)								- 12 945						12 945		
	Total at purchasers' prices	(13)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	466 517	770 009
VALUE ADDED	Compensation of employees	(14)	551	30 679	10 239	37 906	22 997	41 971	144 343									
VALUE ADDED	Other taxes less subsidies on production	(15)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
VALUE ADDED	Consumption of fixed capital	(16)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
VALUE ADDED	Net operating surplus	(17)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
VALUE ADDED	Gross operating surplus	(18)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
VALUE ADDED	GVA	(19)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Total input at basic prices	(20)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

Austria 2011

The box below shows how a single estimate of GDP at market prices can be derived from the above balanced SUTs system by extracting the components of the production, income and expenditure approaches to measuring GDP from either the Supply Table and/or the Use Table.

					Million Euro
Production approach		**Income approach**		**Expenditure approach**	
Total output at basic prices	578 360	Compensation of employees	144 343	Final consumption expenditure by Househods	159 792
- Intermedate consumption at purchasers' prices	- 303 492	+ Other taxes less subsidies on productio	4 858	+ Final consumption expenditure by NPISH	5 416
		+ Consumption of fixed capital	53 469	+ Final consumption expenditure by General government	61 050
		+ Net operating surplus	72 198	+ Gross fixed capital formation	69 418
= GVA	274 868	= GVA	274 868	+ Changes in valuables	2 335
				+ Changes in inventories	2 859
+ Taxes less subsidies on products	33 778	+ Taxes less subsidies on products	33 778	+ Exports	165 648
				- Imports	- 157 871
= GDP	308 647	= GDP	308 647	= GDP	308 647

Austria 2011

(b) SUTs links to the institutional sector accounts

2.138. It is important to link the SUTs to the institutional sector accounts in order to have a complete, consistent and integrated set of accounts as highlighted in Figure 1.1. The SNA uses two types of units and two ways to sub-divide the economy. Both are quite different and serve different analytical purposes. In order to describe production, income, expenditure and financial flows, and balance sheets, the SNA uses institutional units which, on the basis of their principal functions, behaviour and objectives, are grouped into institutional sectors like non-financial corporations and financial corporations. For the institutional units, the full set of accounts is covered in the system.

2.139. A simplified version of a table covering the main institutional sectors is shown in Table 2.8. More details are covered in Chapter 10 (Linking the Institutional Sector Accounts to the Supply and Use Tables).

Table 2.8 A simplified table linking the SUTs to the institutional sector accounts

INSTITUTIONAL SECTORS	INDUSTRIES				Total
	1	2	…	n	
1. Non-financial corporations					
Total output					
Market output					
Output for own final use					
Non-market output					
Intermediate consumption					
GVA at basic prices					
Compensation of employees					
Other net taxes on production and imports					
Consumption of fixed capital					
Operating surplus, net					
Gross fixed capital formation					
2. Financial corporations					
Total output					
:					
Gross fixed capital formation					
3. General government					
Total output					
:					
Gross fixed capital formation					
4. Households					
Total output					
:					
Gross fixed capital formation					
5. Non-profit institutions serving households					
Total output					
:					
Gross fixed capital formation					
6. Total					
Total output					
:					
Gross fixed capital formation					

2.140. When describing the processes of production (and I-O analyses), the system uses the establishment as the basis of their main type of activity when grouping into industries. For the establishment, only a limited set of accounts is feasible, namely those accounts of the SUTs framework.

2.141. In order to show the relationships between the accounts of the production processes and the accounts of the institutional units, a link table can be compiled as an integrated part of the system. In this link table, a cross-classification of output, intermediate consumption, components of GVA (and possible other variables of industries) between the industries and the institutional sectors is shown. This link table should help to ensure consistency of data compiled on the basis of establishment and on the basis of institutional units. As both units are classified differently, the link table also provides a picture of the relationships between output, intermediate consumption, GVA, etc., originating in the different industries and institutional sectors.

(c) Benefits of compiling SUTs as an integral part of the National Accounts

2.142. There are a number of advantages of producing SUTs as an integral part of the National Accounts and therefore recommended in this Handbook.

2.143. From a methodological point of view, the following advantages for compiling SUTs as an integral part of the National Accounts can be emphasised:

- SUTs provide the ideal framework for integrating the components to the three approaches to measuring GDP both in current prices and in volume terms.
- When statistical discrepancies exist amongst the macroeconomic aggregates, it is less clear where adjustments could be applied. However, through the detailed examination of the supply and use of products, the SUTs provide a powerful approach to identify which areas could be adjusted.
- SUTs allow for the data confrontation of different primary sources by bringing them together into a single framework, and aid the prioritization of where resources could be allocated to seek quality improvements.
- Where statistical information is incomplete or contradictory, as it may happen with gross fixed capital formation or household final consumption expenditure, alternative estimates can be made in a transparent way using the SUTs framework ensuring consistency and coherency.
- SUTs provide the full framework for establishing the connection between the various valuation concepts in National Accounts, from basic prices through to purchasers' prices.
- SUTs form the ideal framework for estimating GVA through "double deflation" and GDP in volume terms as well as ensuring coherency of deflation across the different areas.

2.144. In terms of practical benefits:

- SUTs offer new options to incorporate all existing information, including from primary sources, on a consistent basis. This is also true for information that is only periodically available as well as a framework for making reliable estimates, including plausible restrictions and identities.
- When SUTs are produced as an integral part of the National Accounts, it is relatively easy to compile IOTs. These IOTs derived from SUTs will be fully compatible and consistent with all figures from the National Accounts, adding to the credibility and analytical usefulness of both products.
- SUTs that are consistent with the National Accounts are normally produced in connection with benchmarked macroeconomic data around 2-3 years after first preliminary results of the National Accounts are published. However, SUTs can also play a vital role in the production of preliminary annual or even quarterly accounts.

2.145. Once the SUTs system is in place on an annual basis, the benefits are significant and can take various forms:

- Updating SUTs from the last year with information available for the preliminary year in order to have a complete set of SUTs (albeit at a more aggregated level) available that are consistent with the preliminary figures. This procedure is a good method for revealing inconsistencies in the aggregated preliminary figures at an early stage.
- Using of SUTs to incorporate new information; for example, when new detailed information on total supply and exports is available earlier, then the structure of SUTs of the previous year could be used to project SUTs for domestic output and imports.

Chapter 3. Business Processes and Stages of Production

A. Introduction

3.1. The compilation of monetary and physical SUTs and thus IOTs is viewed as part of a statistical production process which starts from the identification of the objectives and users' needs to the dissemination of the tabulations and the evaluation of the production process. The various stages of compilation of SUTs (and IOTs) presented in this Handbook follow the stages of the Generic Statistical Business Production Model (GSBPM) (United Nations Economic Commission for Europe, 2013). The GSBPM explicitly identifies and organizes the compilation steps and the inter-dependencies between them in a generic statistical business process. Thus, it provides a useful flexible framework to describe the compilation for SUTs and IOTs.

3.2. It should be mentioned that country practices in the compilation of SUTs and IOTs vary considerably since they are specific to the particular context in which they take place. For example, they depend on the specific institutional arrangements of the statistical system, the statistical legal framework, the legal, political, regional and taxations type arrangements, the statistical units, the business registers, the range of processes, publication schedules, revision policies, resources, data availability, confidentiality, and, also, the final outputs produced. Despite the great variability in country practices, there are common steps in the compilation of SUTs and IOTs. The compilation stages of the GSBPM described in this Handbook describe these common steps that are flexible and applicable to all countries.

3.3. There is an over-arching framework within which the statistical production process takes place and should be taken into consideration in the design of the compilation process as well in the actual compilation of SUTs and IOTs. This includes the statistical institutional arrangement in the country and the data and metadata quality framework.

3.4. The objective of this chapter is to provide an overview of the compilation steps for SUTs and IOTs. This chapter starts in Section B with an overview of the different institutional set-ups that exist in countries. Section C provides an overview of the GSBPM compilation stages that relate to SUTs (and IOTs), and finally, Section D provides a schematic summary of the compilation steps and their links with the relevant chapters of the Handbook and a summary of the main recommendations, principles and guidelines for the compilation of SUTs, IOTs and PSUTs/EE-IOTs that are contained in this Handbook. Annex A to Chapter 3 provides examples of institutional arrangements for the compilation of economic statistics in countries.

B. Institutional arrangements

3.5. The institutional arrangements are generally understood as a set of agreements between the involved agencies on the division of the responsibilities in the collection, processing, compilation and dissemination of data. They are fundamental for an effective statistical system and essential for the management of an integrated economic statistics programme. In fact, the functions and responsibilities of the lead statistical agency in the country can be carried out more efficiently if it is supported in its role by institutional arrangements such as advisory committees, relationship meetings, memorandums of understanding, service-level agreements, technical cooperation and a legal framework that protects the confidentiality and integrity of the data while allowing for the sharing of data between partner statistical agencies. (United Nations, 2013, paragraph 3.23)

3.6. Institutional arrangements depend, among other factors like the legal framework etc., on what kind of national statistical system exists in a given country, namely centralized and decentralized statistical systems.

- A national statistical service is referred to as centralized if the management and operations of the statistical programmes are predominantly the responsibility of a single autonomous government agency.
- A national statistical service is commonly referred to as decentralized if the statistical programmes are managed and operated under the authority of several government departments. Under this arrangement, a particular agency is usually charged with the responsibility of coordinating the statistical activities of the various departments.

3.7. In economic statistics, countries have different institutional arrangements with different roles and responsibilities between, for example, the National Statistical Office (NSO) and the National Central Bank (NCB). Countries often follow a decentralized approach splitting economic statistics across different institutions within the country where, for example: the National Accounts (non-financial accounts) are compiled by the NSO, the Balance of Payments and financial accounts are compiled by the NCB, and the Government Finance Statistics covering the Public Sector are compiled by the Finance Ministry.

3.8. When countries are considering either building or redesigning their systems or changing the roles and responsibilities of the various institutions involved, the plans should be viewed with the aim of producing integrated economic accounts throughout whole of the statistical production process. The motivation for integrated economic statistics comes from the benefits such data sets provide for coordinated national and global policy initiatives in an increasingly interconnected world. The integration of economic statistics is about the use of common concepts, definitions, estimation methods and data sources for statistical reconciliation which will help to improve coherency and consistency of a wide-range of economic statistics as well as reducing the respondent burden and overall costs. The integration therefore is neither specific to the type of national statistical system (centralized versus decentralized statistical system) nor the level of development of the statistical system. It is an approach that requires the:

- adoption of the conceptual framework of the SNA and the SEEA as the umbrella framework for organizing economic statistics;
- alignment of the inter-dependencies of the components of the statistical production process (statistical units, classifications, etc.); and
- establishment of enabling institutional arrangements for statistical integration. (United Nations, 2013, paragraph 2.5)

3.9. Examples of institutional arrangements different countries are presented in the Annex to Chapter 3. In general, it could be said that, beyond the coherency and consistency of official economic statistics, a centralised arrangement may provide more comparability and harmonization inside the national statistical system and with other national statistical system. Although moving towards an integrated system may incur large investments costs, it would generate great benefits in terms of improved quality and reduced costs in the short-term and long-term.

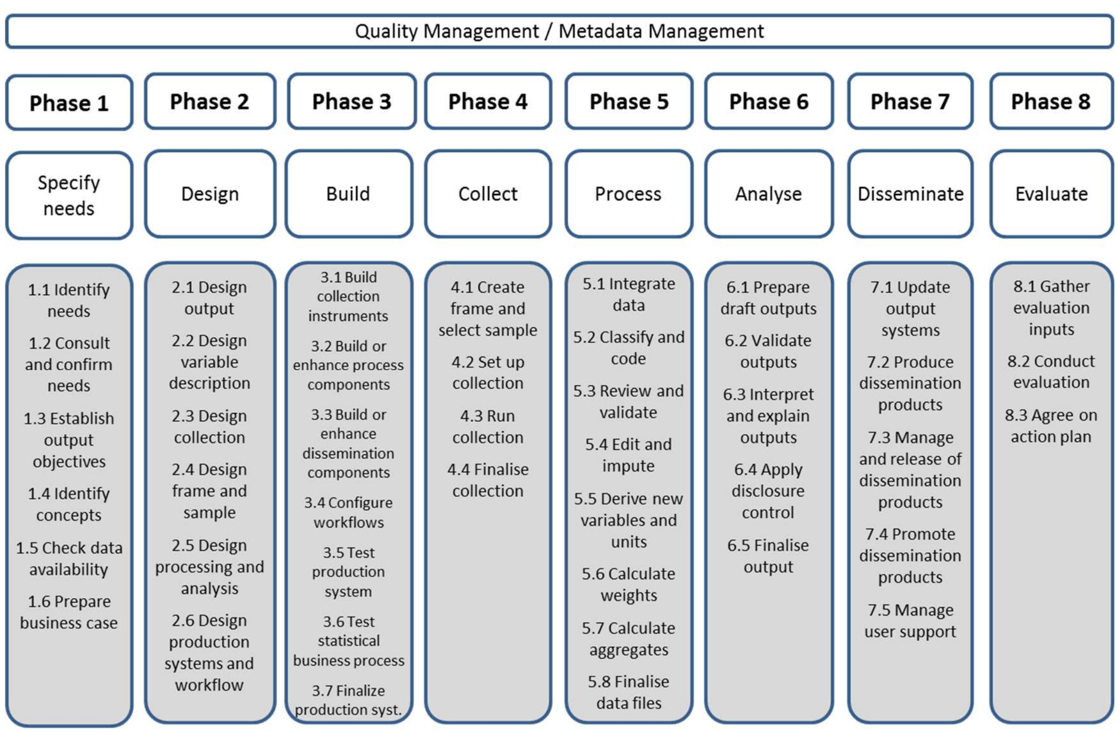
3.10. The roles and responsibilities of the various institutions in countries evolve over time and some of the historical evolution of these arrangements is reflected in the country examples covered in this chapter. A recent example is that of Finland where, in 2014, the compilation of the Balance of Payments was transferred from the NCB to the NSO. Finland now follows the same practice of other countries such as Denmark, Ireland, Luxembourg, Malta, Norway and the UK, where the Balance of Payments is compiled alongside the National Accounts within the NSO and not in the NCB.

C. Overview of GSBPM

3.11. The GSBPM describes, and defines, the set of business processes needed to produce official statistics. It provides a standard framework and harmonised terminology to help statistical organizations to modernise their statistical production processes, as well as to share methods and components. The GSBPM can also be used for integrating data and metadata standards, as a template for process documentation, for harmonizing statistical computing infrastructures, and to provide a framework for process quality assessment and improvement. The GSBPM is a reference model that can be used in a flexible manner to describe, document, organize, and communicate the statistical production process in question.

3.12. The GSBPM consists of a sequence of eight phases: (1) Specify needs; (2) Design; (3) Build; (4) Collect; (5) Process; (6) Analyse; (7) Disseminate; and (8) Evaluate. Figure 3.1 provides an overview of the phases together with the sub-elements of each phase.

Figure 3.1 Phases of the Generic Statistical Business Process Model



3.13. The GSBPM is not a rigid framework in which all steps must be followed in a strict order; rather, it helps to identify the possible steps in the statistical business process, and the inter-dependencies between them. Although presentation of the GSBPM follows the logical sequence of steps in most statistical business processes (for example, business surveys), the elements of the model may occur in different orders in different circumstances. Also, in compiling SUTs and IOTs, some sub-processes will be revisited a number of times forming iterative loops, particularly within “process” and “analyse” phases.

3.14. This section focuses on the business processes in National Accounts, in particular, compilation of SUTs, PSUTs and IOTs. The business process and stages of production covered in this chapter reflect therefore the application of the underlying GSBPM. As a result, Figure 3.2 provides an overview of a “simplified” business processing model specific for the compilation of SUTs, PSUTs and IOTs.

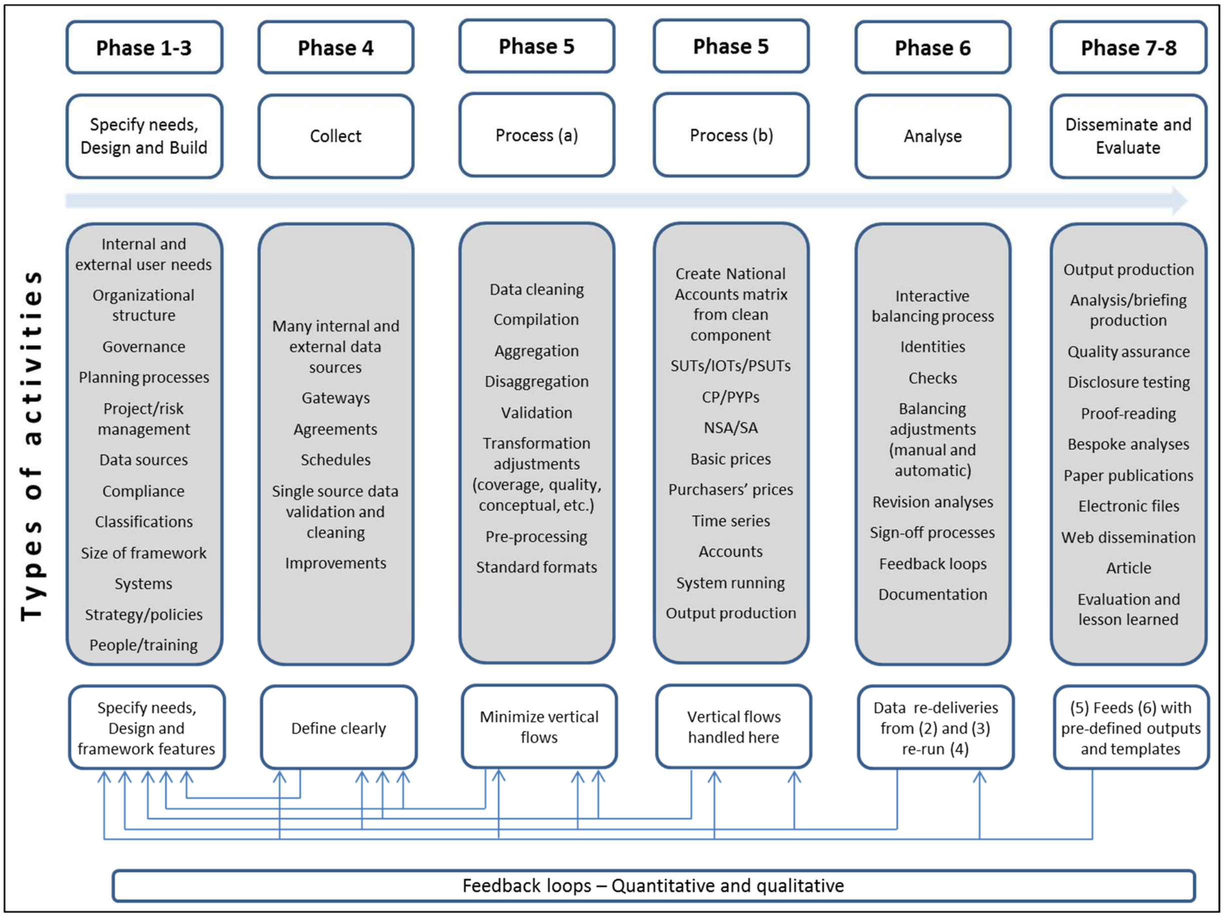
3.15. In the compilation of SUTs and IOTs, the sequential stages of compilation of the GSBPM can be simplified as presented in Figure 3.2 as follows:

- Phases 1-3: Specify needs, design and build. This stage contains tasks related to the Phases: “Specify needs” (1), “Design” (2) and “Build” (3) of the GSBPM of Figure 3.1. It contains all the pre-collection activities of setting up the system including identifying users’ needs, designing the system, determining the size of the SUTs and IOTs etc.
- Phase 4: Collect. This relates to the activities of data gathering from various sources. In general, the compilers of SUTs (and IOTs) rely on data already collected for the purposes of National Accounts which are often already adjusted to fit into the national accounting framework.
- Phase 5: Process. This stage corresponds to a number of activities related to the data cleaning, adjustments and transformation that are needed in order to start putting the data into an unbalanced SUT. This stage is very important in the compilation of SUTs and IOTs and is therefore separated into two steps in Figure 3.2. The first corresponds to all the activities necessary to put the data in the initial unbalance SUTs. This involves data cleaning, pre-processing, aggregation/disaggregation of the basic data and any other adjustment to the basic data to fit into the national accounts concepts of the SUTs. The second step in this phase corresponds to all the activities of putting an initial (unbalanced) set of SUTs at purchasers’ and basic prices and in current prices and volume terms.
- Phase 6: Analyse. This phase corresponds mainly to the activities of balancing (manual and automated) SUTs and IOTs and the feedback loop to the source data to resolve inconsistencies. Thus there is a continuous loop between this phase and the previous in order to arrive at balanced SUTs and IOTs. In this stage, the final output of the compilation process is prepared, validated and finalized.
- Phase 7-8: Disseminate and Evaluate. This stage refers to the activities related to the dissemination of the output tables which include the preparation of printed publications, press releases and web sites, the promotion of dissemination products etc. as well as the activities related to the evaluation of the production process as well as of the output as a result of internal or external feedback.

3.16. The grey boxes for each stage in Figure 3.2 contain examples of the types of functions undertaken. They are listed in no particular order of importance and have links between each other.

3.17. The broad thrust is to move and process data from left to right, with minimal loops backwards, even though effective feedback loops are critical at each phase, and the incorporation of new, or improved, data deliveries are unavoidable. Good data version control at each stage is needed, enabling the generation of a wide-range of outputs, articles and analyses such as revision analysis.

Figure 3.2 Simplified business processing model for compiling SUTs, IOTs, and PSUTs



3.18. Each phase should be viewed as cumulative even when allowing for the iterative nature of the balancing process. The incorporation of balancing adjustments should be viewed as a cumulative step and not as creating a loop.

3.19. It is important to have proper documentation throughout the various compilation stages and in particular during the stage of balancing and adjustment. The steps and links between the source data through to the balanced data should be recorded and documented separately and reviewed in subsequent balancing exercises to investigate source data incoherence, bias, etc. For example, moving from the original source data (covering for example, business survey data, administrative based data, company accounts based data, etc.) to the validated 2008 SNA data, a number of adjustments may need to be made such as:

- coverage (including exhaustiveness) adjustments;
- conceptual adjustments;
- quality adjustments; and
- balancing/coherency adjustments.

3.20. In general, for all the stages of the compilation process, it is important also to have in place the following:

- Data version control - for example, data storage, conventions, allowing easy access and revision analyses as well as pre and post automated balancing analyses;
- Clear controls and disciplines - for example, read and write access for each stage, setting out operational standards, change controls and testing, etc.;
- Appropriate staffing - for example, ensuring all staff are trained and skilled to undertake the different functions as well as ensuring sufficient staff are in place for each phase; and
- Clear organizational structure of the staff involved - for example, clear roles and responsibilities of staff, as staff can have more than one role in more than one phase.

D. Overall strategy for the compilation of SUTs and IOTS

3.21. Within the stages of the overall production process presented in the previous section, Process and Analyse (phases 5-6) have a particular structure in the compilation of SUTs and IOTs. This section provides an overview of the steps that are generally undertaken to construct SUTs and IOTs after the data have been gathered. In addition, since the compilation of SUTs and IOTs is not seen as a one-time exercise but as part of a continuous programme, this chapter also provides the strategy for compiling SUTs and IOTs in current prices and in previous years' prices for the first year of compilation and the subsequent years.

3.22. The first step in compiling SUTs and IOTS is to construct the various separate parts of the Supply Table and Use Table (as shown in Figure 3.3) with the available data. This leads to the construction of unbalanced SUTs which then goes through a balancing process to reconcile all the entries.

3.23. The steps that are generally used by countries to construct an unbalanced version of the SUTs are presented below:

Step 1 - Construction of the Supply Table. This consists of filling the available data into an initial unbalanced Supply Table which cover domestic output by product (Part 1 in Figure 3.3) and the imports of goods and services and the valuation matrices comprising information on taxes less subsidies on products, trade margins and transport margins (Part 2 in Figure 3.3). These valuation matrices allow the transformation of total supply of products at basic prices (formed by summing the domestic output and the imports) to total supply of products at purchasers' prices. The construction of this initial unbalanced Supply Table is presented in Chapter 5 of this Handbook.

Step 2 - Construction of the Use Table. Similarly to Step 1, this step consists of filling the Use Table with the available data, which covers: the intermediate consumption at purchasers' prices (showing the input requirements of goods and services for the production of the domestic output of each industry shown in the Supply Table) (Part 3 in Figure 3.3); final uses at purchasers' prices and for each category - such as final consumption and gross fixed capital formation, separate compilation steps will be needed (Part 4 in Figure 3.3); and production-based GVA at basic prices shown by industry (Part 5 in Figure 3.3). This compilation step is covered in Chapter 6 of this Handbook.

Step 3 - Compilation of the valuation matrices. These matrices are essential to arrive to SUTs at basic prices. These matrices expand the valuation columns in Part 2 of the Supply Table in Figure 3.3 into corresponding matrices for intermediate consumption and final consumption of the Use Table. This step of the compilation is described in Chapter 7 of this Handbook.

Step 4 - Compilation of the Imports Use Table and Domestic Use Table at basic prices. This step is essential to increase the analytical uses of SUTs by distinguishing the use of imported and domestic products. This compilation step is presented in Chapter 8 of this Handbook.

Step 5 - Compilation of the SUTs in volume terms (previous years' prices). When balanced both in current prices and in volume terms, the SUTs ensure coherent and consistent deflation of the components of the production and expenditure approaches to measuring GDP as well as coherent and consistent estimates of price and volume indices. This requires that SUTs are compiled in volume term at this stage of the compilation process. The compilation of SUTs in volume terms is described in Chapter 9 of this Handbook.

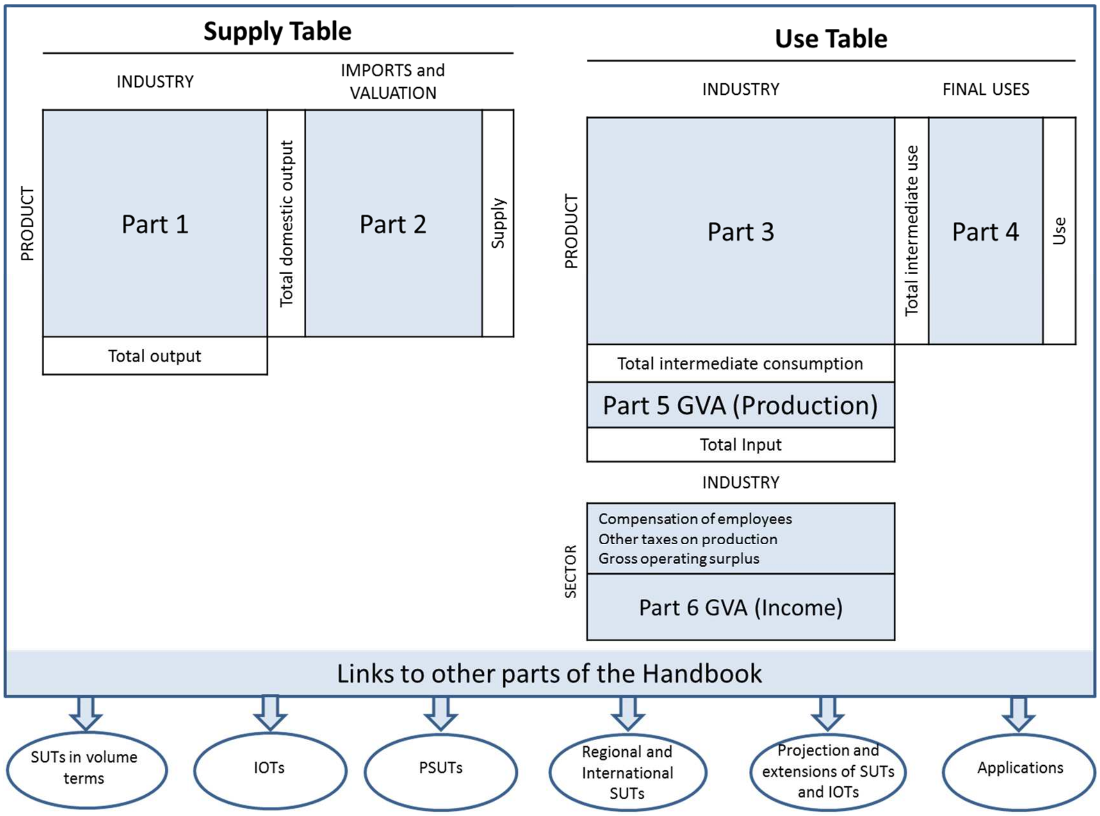
Step 6 - Linking SUTs with the institutional sector accounts. Linking SUTs and the institutional sector accounts is an important step in the compilation of SUTs which ensure the full integration and consistency of SUTs with the National Accounts. This link is provided by compiling a linking table between the sectors and industries (Part 6 in Figure 3.3). The compilation of the linking tables is presented in Chapter 10 of this Handbook.

3.24. These six steps above are generally followed in that order; however, there is a significant amount of inter-dependency in the compilation process. For example, trade and transport margins and taxes less subsidies on products are necessary for the transformation of the Use Table from purchasers' prices to basic prices as well as to convert the supply of products at basic prices to purchasers' prices in the Supply Table, to enable the balancing of products at purchasers' prices. This information may partly be derived from estimates based on the Use Tables and linked to estimates from the Supply Table at basic prices.

3.25. On the other hand, estimates of certain final uses may require basic supply side information if, for example, the product flow[5] method is being applied. Nevertheless, allowing for inter-dependencies in the compilation of these tables, it is vital that these tables are viewed and accepted as primary estimates.

[5] Note following the terminology 2008 SNA (paragraph 14.2), in this Handbook the expressions "product balance" and "product flow" methods are used in preference to "commodity balance" and "commodity flow method" as reflecting more recent usage of the word product in place of commodity. However, the change in terminology does not indicate a change in methodology.

Figure 3.3 Structure of the SUTs and the links covered in this Handbook



Balancing

3.26. Once these six steps are completed, the result is unbalanced SUTs at purchasers' prices and basic prices. This represents the start of a balancing procedure which is an iterative procedure integrating the following aspects:

- balancing of SUTs at purchasers' prices;
- compilation of valuation matrices;
- transformation of SUTs into basic prices;
- compilation of separate Use Tables for use of domestic output and use of imports of goods and services;
- balancing of SUTs at purchasers' prices and at basic prices; and
- balancing the production based GVA and income based GVA, providing the link to the institutional sector accounts.

All of the above should be balanced with time series in mind to ensure consistent movements of levels and growth rates.

3.27. One of the key reasons why the SUTs are balanced first at purchasers' prices is to reflect as closely as possible the basis of the survey data collected feeding into the Use Table. The intermediate uses and final uses, for example, are collected close to the economic reality of the prices paid by purchasers, that is, purchasers' prices. In addition, no valuation issues exist with variables like compensation of employees and other taxes less subsidies on production.

3.28. However, these aspects need to be viewed alongside the domestic output part of the Supply Table reflecting data collected from producers whereby the output is valued at basic prices. Thus a balance between the two is needed.

3.29. For the SUTs balanced at purchasers' prices, the two key identities are:

- total supply of products at purchasers' prices equals total uses of products at purchasers' prices, and
- total output of industries at basic prices equals total input of industries at basic prices.

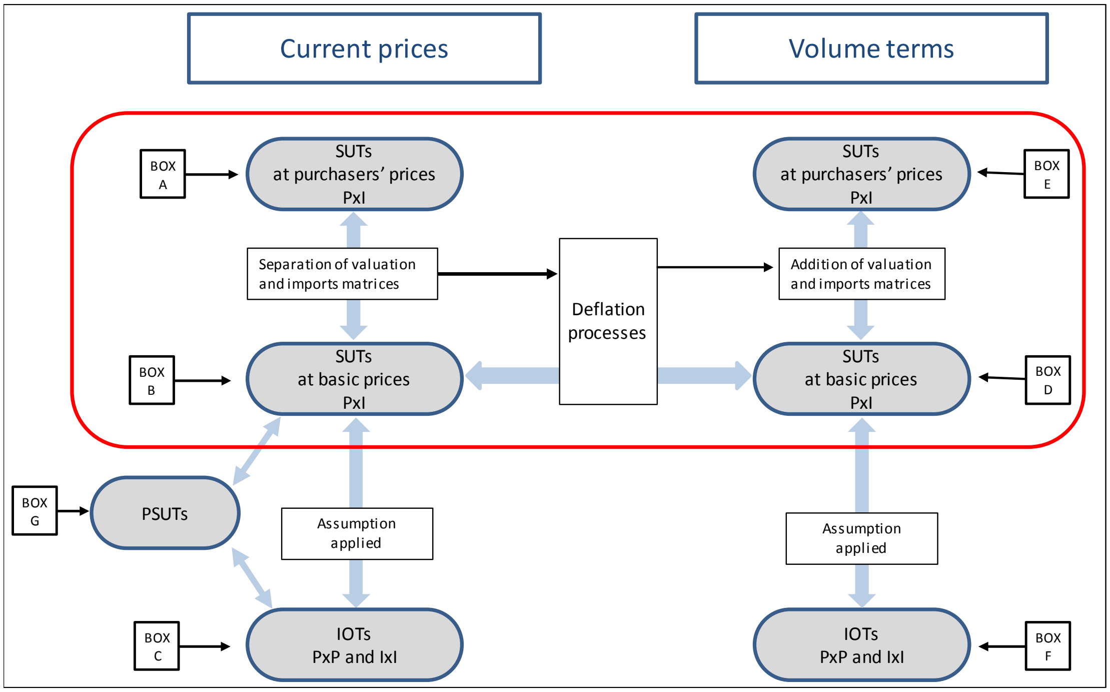
3.30. Balancing is not just necessary in order to achieve the above identities but also allows us to trace inconsistencies of basic data and estimation methods. Ideally, the balancing of the SUTs system should be done both in current prices and in volume terms simultaneously. In fact, balancing in this manner implies it is not complete until the transformation into basic prices and the separation of the use of domestically produced products from the use of imported goods and services has been achieved, as they are key steps to produce the SUTs in volume terms. These steps are in practice interrelated and provide a powerful feedback loop in terms of quality and validity of the various component estimates.

1. Compilation of SUTs in current prices and volume terms

3.31. The SUTs framework in Figure 3.3 when treated in summary form can be combined with the "H-Approach" to show a simplified version of the compilation schematic when the SUTs are compiled in current prices and in volume terms. Figure 3.4 illustrates the sequence of steps involved in the compilation of SUTs, PSUTs, and IOTs. The red line box focuses on the compilation of SUTs. Thus countries that intend to compile only monetary SUTs can focus on the steps within the red line box and follow the sequence of compilation indicated by the arrows in the figure. The order of compilation of PSUTs and IOTs in the figure does not imply a sequence of compilation of these tabulations. The compilation of these tables reflects the country's priority.

3.32. The simplified illustration of compiling SUTs, PSUTs and IOTs in Figure 3.4 can be seen in relation, on the one hand, to phase 4 "Process" when it comes to compiling unbalanced SUTs and PSUTs and, on the another hand, to phase 5 "Analyse" when it comes to compiling balanced SUTs, PSUTs, and IOTs.

Figure 3.4 Compilation of SUTs and IOTs in current prices and in volume terms



3.33. In order to compile the seven boxes, in the sequence from Box A to Box G, there is a further evolution dimension to reflect. In Year One of the compilation process, Box A, B and C representing current prices are produced in that sequence covering the economy for year (T) for SUTs and IOTs, and Box G covering PSUTs which are linked to the outputs of Box B and Box C.

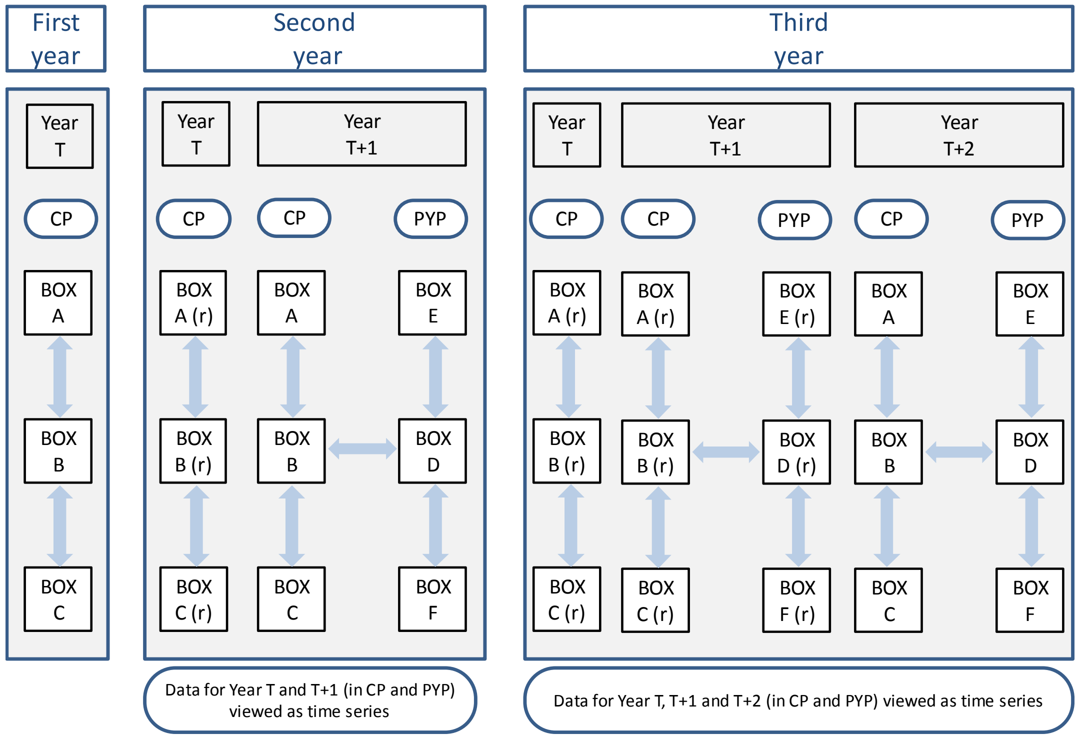
3.34. As mentioned in Chapter 2, SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators. However, the preferred approach contains a time-series dimension and Box D, Box E and Box F representing the previous years' prices should not be compiled in Year One as there are no SUTs in current prices for the previous year (T-1).

3.35. Thus it is essential to have two consecutive years of SUTs in current prices to enable the production of the first year of SUTs in previous years' prices. If the SUTs are produced less frequently, say every five years, it is much more difficult to produce SUTs in volume terms.

3.36. In Year Two, Box A, B and C are produced covering the economy for year (T+1) together with any revisions to the data for Box A, B and C for the year (T). In addition, the first set of SUTs in previous years' prices can be compiled for year (T+1). In each year thereafter, the process will extend the availability of SUTs by an extra year in current prices and previous years' prices as well as incorporating any revisions to SUTs for earlier periods to ensure consistent time series.

3.37. Figure 3.5 provides a summary of the evolution dimension for the first three years. As time goes by, different challenges will evolve such as retaining an ever-increasing number of years of SUTs on a consistent basis, need for a revisions policy, data version/vintage control, managing the production of consistent levels and/or growth rates, organizational arrangement of resources which may not increase each year, etc. It is thus important to plan and manage this process from the start.

Figure 3.5 Evolution of compiling SUTs and IOTs in the first three years



Note: CP: Current prices; PYP: previous years' prices; (r) revised tables.

3.38. Based on the overall strategy for the compilation of SUTs and IOTs, it is possible to provide a step-by-step guidance. This guidance is provided for the first year of compilation, as well as subsequent years of compilation, as there are some additional steps that need to be considered in order to ensure a fully consistent time series of SUTs in current prices and in previous years' prices.

(a) Step-by-step summary for the first year of compilation

3.39. Figure 3.6 provides a description of the various phases in the compilation of SUTs and IOTs for Year One of the compilation together with the reference to the relevant chapters of the Handbook. The figure also contains references to Boxes A to G of Figure 3.4 and the compilation stages of Figure 3.2. Although Boxes A, B and C form key outputs, there are various intermediate stages and intermediate outputs as denoted in the separate stages in Figure 3.6.

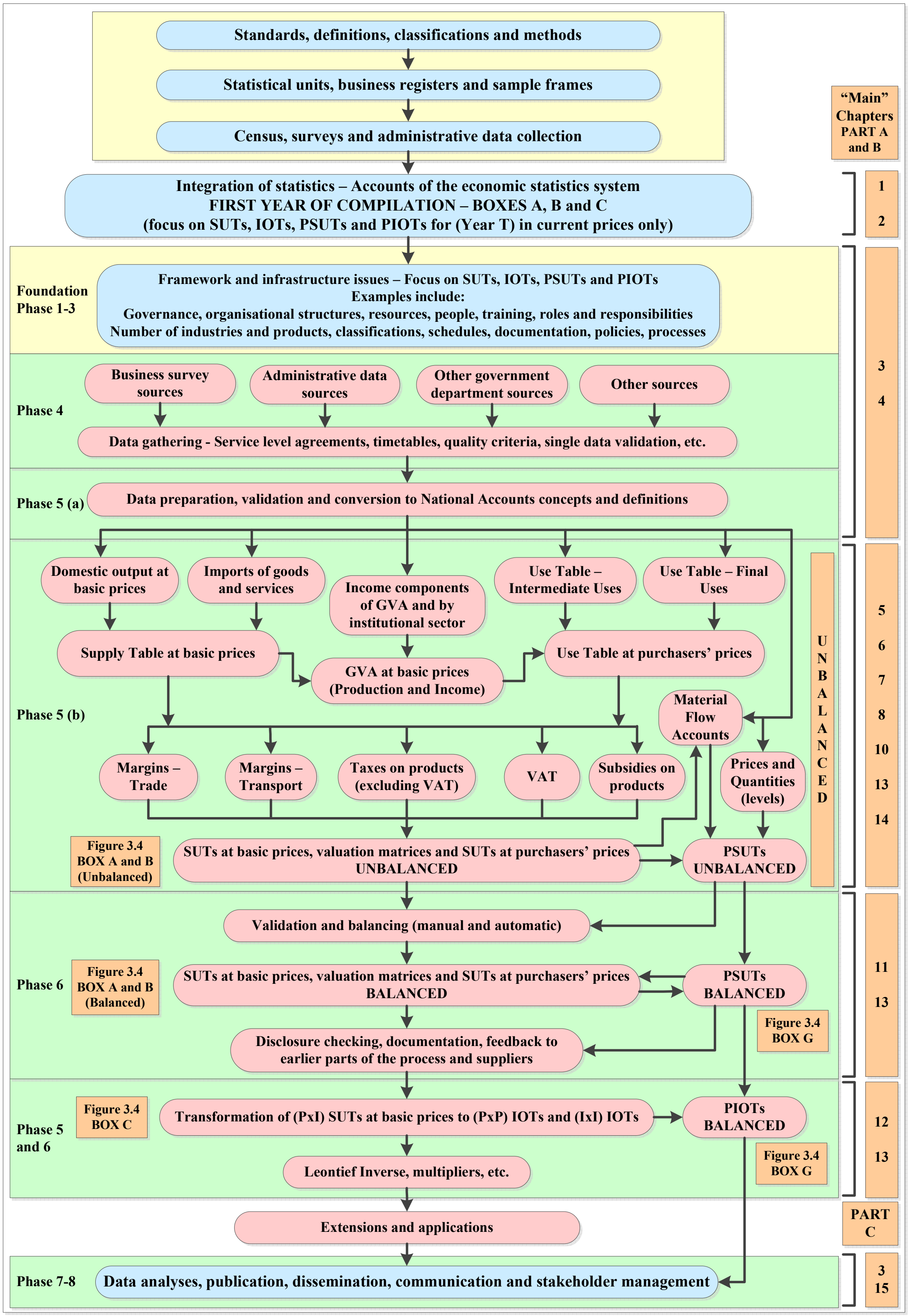
3.40. Before starting the first year of compilation, as illustrated in Figure 3.6, compilers should ensure that the overall framework is well in place: standards, definitions, classifications and methods, statistical units, business registers and sample frames, census, survey and administrative data collection.

3.41. Figure 3.6 brings together and reflects various aspects and key features to note:

- It is consistent with Figure 3.5 and covers the simplified business process model for compiling SUTs and IOTs. Each block of work in Figure 3.6 is split according to the type of work as indicated in the six different stages in Figure 3.2.
- It follows the underlying principles and features of the GSBPM.

- The flow of work is kept as logical and sequential as possible and follows the "H-Approach" as covered earlier. However, as mentioned earlier in this chapter, the compilation of SUTs and IOTs has several inter-related processes and dependencies which have to be reflected and retained. Furthermore, in some cases, there is more than one approach available, for compiling trade margins using a supply-side approach or use-side approach or both.
- The flows in Figure 3.6 do not present loops backwards, though effective feedback loops are critical at each phase and improve the process. For example, the compilation and balancing of PSUTs provides an important feedback loop to the compilation of monetary SUTs, thus enhancing the quality of physical and monetary SUTs.
- Integrated links bringing the PSUTs together with input data like the prices and quantities (levels) and material flow accounts alongside the SUTs and IOTs.
- Each phase of work is also linked to the main chapters in Part A, and Part B of the Handbook, providing much more detail on the compilation – these links provide the key chapters but not all references.
- The same approach has not been applied to Part C (Extensions and applications) of the Handbook as there are many variations and options.

Figure 3.6 First Year of Compilation



(b) Step-by-step summary for the subsequent years of compilation

3.42. Having completed the Year One results, Figure 3.7 provides a detailed stage of production for Year Two with the focus on the SUTs in previous years' prices, which as mentioned, can only be compiled when SUTs have been compiled for the current year and the previous year.

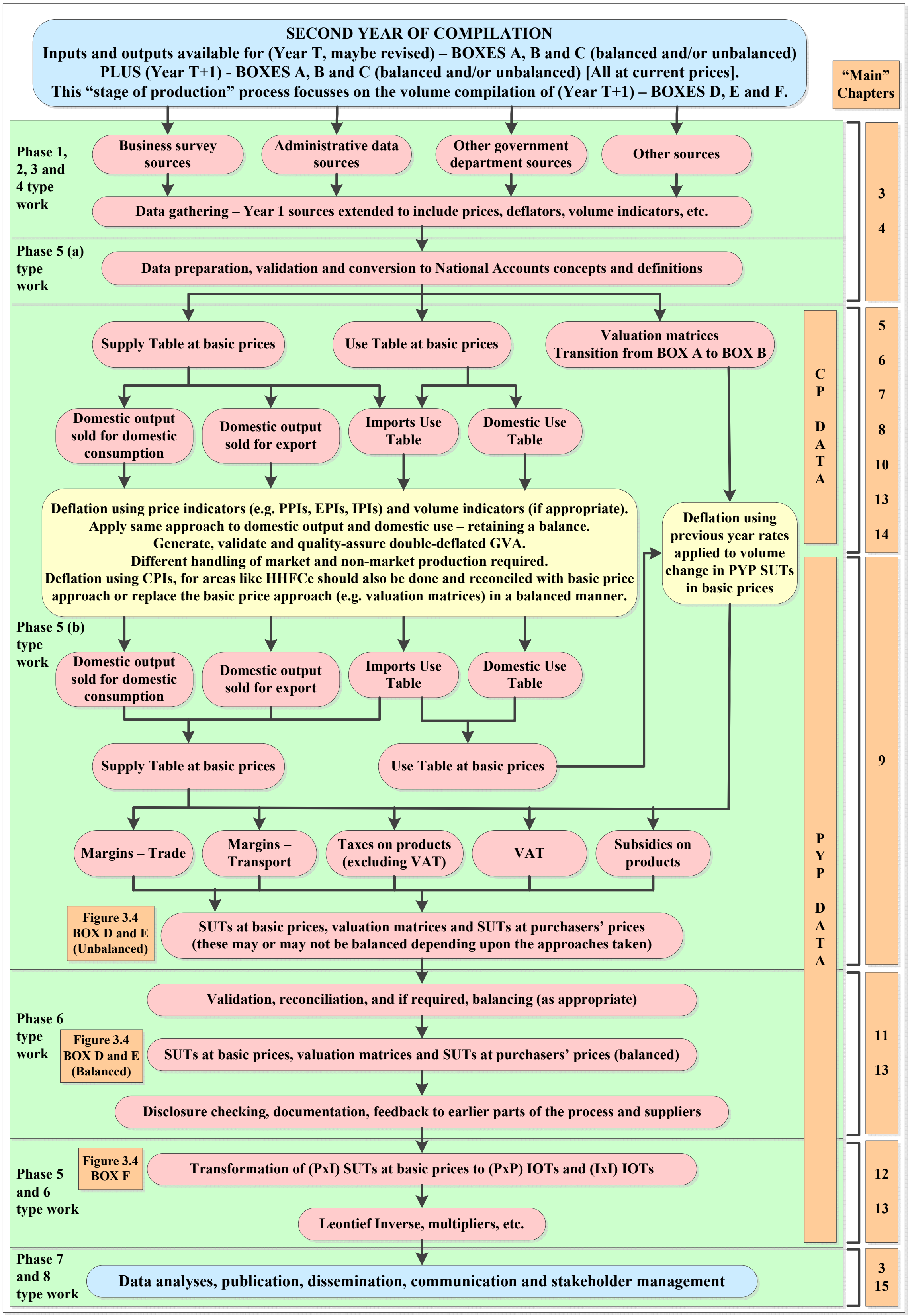
3.43. In compiling SUTs in previous years' prices for the first time, there may be several years of SUTs in current prices already available. If so, then the compilation is just an extended version of the process indicated in Figure 3.7, and it is better in terms of quality and consistency as there is a time series dimension in place immediately.

3.44. Other features to note in Figure 3.7 are the following:

- The focus of the steps in Figure 3.7 is the right-hand side of the "H-Approach" of Figure 3.4 and builds on the detail available from the left-hand side – assuming the left-hand side products are available.
- Deflation approach follows the underlying "H-Approach" and is covered in Chapter 9 (Compiling Supply and Use Tables in volume terms).
- Other approaches are available but this is the recommended approach.
- Compilation of IOTs in volume terms is not essential but is not resource intensive if all the other parts are available.

3.45. An additional feature is also achieved whereby GVA in volume terms is achieved using the SNA recommended approach, i.e. "double deflation". However, the results from this approach need additional quality assurance against other indicators. This is to ensure the quality of the GVA estimate in volume terms (and in turn GDP) is not reduced due to the errors in either the current price estimates of output and intermediate consumption or inappropriate deflation of these two variables.

Figure 3.7 Second Year of Compilation



2. Summary of the main recommendations, principles and guidelines of the Handbook

3.46. Box 3.1 provides a list of the main recommendations, principles and guidelines relevant for the compilation of SUTs, IOTs, PSUTs (and EE-IOTs) and related products presented in this Handbook, covering various aspects such as the organizational/institutional environment, compilation, data strategy and requirements, and balancing.

3.47. The recommendations and guidelines presented in Box 3.1 may be viewed as aspirational as they provide the model scenario for the compilation and dissemination of SUTs, IOTs and related products. Countries can implement gradually the recommendations and guidelines in accordance with their specific situation in terms of data availability, resource constraints, legal framework, etc. and in line with their priorities.

Box 3.1 Examples of the main recommendations, principles and guidelines provided in this Handbook

(A) Organizational/institutional environment

(1) The organization of the economic statistics system to follow an integrated economic statistics approach. The use of the GSBPM to organize the statistical production process would facilitate the compilation of SUTs, IOTs and related products.

(2) National Accounts should have very close links with all its suppliers, in particular, the business register, business surveys and administrative sources.

(3) The compilation of the various components of the SNA framework to be coordinated and integrated in terms of production processes, e.g. production schedules, feedback loops, coherency, etc.:

- National Accounts (including Balance of Payments and Monetary Financial Statistics, Government Finance Statistics);
- SUTs and IOTs together with PSUTs and EE-IOTs;
- Environmental-economic accounts to link in closely with the compilation of SUTs;
- Regional accounts;
- Prices; and
- Labour market statistics.

(4) The compilation of SUTs and IOTs to be done as part of the regular compilation of the National Accounts and within the “core” National Accounts”. This:

- Leads to better quality, coherency and consistency of National Accounts, Balance of Payments and related statistics; and
- Creates effective and powerful data quality and coherence feedback loops, which in turn help to address structural issues, biases and prioritize resources to targeted improvements.

(5) The final estimates of the National Accounts aggregates should be derived from the balanced SUTs framework and not the other way around. For example, the SUTs based estimates should be not constrained to pre-determined estimates or already published estimates.

(6) The compilation of SUTs and IOTs to reflect stakeholder interests by organizing regular meetings with data suppliers and users together with other regular stakeholders.

(7) Appropriate “internal” governance to ensure accountability and guidance supported with programme, project and process management, including risk management, framework reflecting:

- Schedules, timetables and customer/supplier service level agreements to be in place to ensure a regular supply of source data, briefings and evaluation reviews.
- Various standards and policies, such as revision policy, confidentiality and disclosure controls, etc.

- Staff recruitment, retention and skill development.

(8) Skill development needs to take into consideration the following types of training requirements:

- National Accounts - Technical skill focus covering National Accounts concepts, methods, processes and guidance, etc. as well as functions such as developments, compilation, coordination, balancing, analyses and dissemination.
- Systems - IT systems, programming, data management (standards and principles), data dissemination including web-site management, etc. including the role of dedicated IT professionals supporting economic statistics.
- Management - Staff management, effective leadership, communication, etc.

(9) For effective and sustainable production of SUTs and IOTs, it is important to have sufficient computing capacity in place that includes:

- Robust, reliant, structured, quick and well-documented systems.
- Database software and hardware, speed, structure, flexibility, statistical functionality, data management and links to web-dissemination.

(10) It is important that the statistical production process is well documented and kept up to date, reflecting:

- Operational, methodological, system, metadata and recording specific issues, adjustments, etc. for each quarterly/annual exercise.

(11) The compilation of SUTs and IOTs to be done taking into consideration costs and resources available as well as other criteria such as data availability, data quality and time.

(B) Compilation

(1) SUTs (and IOTs) to be compiled annually, and, if possible on a quarterly basis, following the "H-Approach" for producing SUTs/IOTs in current prices and in previous years' prices (including valuation and imports matrices). The application of the “H-Approach” allows for the volume of GVA to be estimated using a “double deflation” method as well as greater coherence linking SUTs to various other parts of the SNA framework.

(2) Produce SUTs first, then derive IOTs from the SUTs using additional information and assumptions.

(3) Compiling rectangular SUTs with more products than industries provides for:

- Greater detail, better the quality - although more detail will impact on the burden on business, systems and resources, it can improve the quality of balancing.
- Improved matching between prices and values, thereby better quality of the data in volume terms.
- Compilation (and balancing) should be undertaken at the greatest level of detail available - time, quality and resources permitting. However, due to confidentiality type criteria, the level of publication may, or will, be aggregated to a higher level.

(4) Use standard international statistical classifications (for example, ISIC, CPC, COICOP, etc.) at appropriate detailed levels to ensure international comparability. Within these classifications, greater granularity may be desired for specific economies.

(5) Use of consistent statistical unit(s) through the process from the business register and business surveys through to the SUTs.

(6) Ideally SUTs and PSUTs (EE-IOTs, as appropriate) are based on sound and complete data sources reflecting:

- Common concepts, definitions and classifications.
- Comprehensive and up-to-date statistical business register.
- Wide-range of (preferably annual) regular business surveys (including structural detail), household surveys, administrative data, prices, etc.
- Benchmarking/reconciliation - preferably, annually, reflecting rapidly changing economies (use of fixed factor or stability assumptions minimized).
- Incorporation of labour and capital information ensuring improved coherence for productivity estimates.
- Appropriate choice of index number formulae and base year.

(7) Record all the data building blocks separately, namely source data, coverage adjustments (including exhaustiveness), conceptual adjustments, quality adjustments, balancing adjustments, etc.

(8) Compile a table linking the SUTs and the institutional sector accounts:

- Goods and services.
- Production accounts by industry and by institutional sector.
- Generation of income accounts by industry and by institutional sector.
- Parts of the Use of disposable income account (such as Household final consumption expenditure) and parts of the Capital account - by industry and by institutional sector (such as gross capital formation and its components).

(9) It is preferred to use the bottom up approach in the compilation of regional SUTs which should be reconciled with National SUTs.

(10) The most frequently used methods to derive IOTs are:

- Model A (Product by Product) IOTs using the product technology assumption.
- Model D (Industry by Industry) IOTs using the fixed product sales structure assumption.
- Hybrid – Mix of technologies usually chosen to avoid having any negatives.

(11) Comprehensive documentation on operational methods and methodology including appropriate metadata and revision analysis.

(12) Keep up to date with, and contribute to, internationally evolving/agreed changes to concepts, methods and systems developments.

(C) Data strategy and requirements

(1) SUTs are data hungry and a range of timely, comprehensive, consistent and coherent data sources are needed. The data strategy should reflect a range of aspects.

(2) Data handling aspects such as:

- Data collection (for example, questionnaire design, electronic data capture, receipt of all the data a company can provide, etc.).
- Data processing, data editing, metadata and data warehousing.
- Data quality frameworks.
- Data dissemination and use of SDMX standards.

(3) Structural and data collection issues:

- Comprehensive and up-to-date statistical business register used as the sampling frame for all business surveys.
- Use of as many data sources as possible, censuses, business and household surveys, administrative data, company accounts, regulatory accounts, company websites, etc.
- An international business unit handling all aspects of multinational enterprise (MNE) groups from profiling the business structure(s) to data collection to data reconciliation and feeding coherent data through to the various statistical domains. In addition, developing links and sharing data with other NSOs / NCBs for statistical purposes only.
- Frequency of information – monthly, quarterly, annually or five-yearly. More regular, the better reflecting rapidly changing industry structures of sales and inputs, changing patterns of household consumption, impact of globalization on trade flows, etc.
- Sufficient, appropriate and relevant, price indices matching the current price values for deflation and/or use of suitable volume only indicators where price information may be unavailable.
- Strategy for handling, and reviewing, areas where data may be missing.

(4) More generally:

- Need to minimize the burden on business.

- Need to have confidentiality and disclosure testing processes.

(D) Balancing

(1) Balanced SUTs in current prices and in volume terms leads to:

- A single estimate of GDP incorporating the components of production, income and expenditure approaches to measuring GDP;
- Volume estimates of GVA through “double deflation”; and
- Balance between supply of products and use of products and between industry inputs and industry outputs.

(2) The balancing process to encompass simultaneously:

- SUTs at basic prices and at purchasers' prices;
- SUTs in current prices and in volume terms (preferably, previous years' prices);
- SUTs links to IOTs, PSUTs and EE-IOTs (as appropriate); and
- Link with the institutional sector accounts.

(3) Balancing presents powerful integration theme:

- Goods and services, Production account, Generation of income account, parts of the Capital account and Use of disposable income account.
- Incorporation of PSUTs and EE-IOTs (as appropriate).
- Productivity estimates (labour, capital and multi-factor).

(4) Simultaneous balancing is preferred over sequential balancing. If this is not possible, an alternative is sequential balancing (first in current prices, then in volume terms) with quick and effective feedback loops.

(5) The organization of the “balancing” function can be set-up in different ways across teams, however, a centralized balancing approach is preferred over the de-centralized balancing arrangement whereby the balancing of the various elements related to SUTs and IOTs (e.g. current and constant prices for a single year and for a time series, links with productivity, regional accounts, etc.) is carried out at the same time and within the same unit in order to ensure the full consistency of all SUTs-related products.

(6) The production and balancing of SUTs should enable the identification of source data incoherence. Mechanism should be developed to provide feedback to data suppliers and help prioritize areas for improvement and allocation of resources.

(7) Carry out annual review and evaluation of the balancing adjustments to identify and address any evolving biases.

Annex A to Chapter 3: Examples of institutional arrangements in countries

A3.1 This Annex presents examples of institutional arrangements in selected countries. The examples cover the cases of centralized and decentralized statistical systems.

A. Example of centralised production of economic statistics - Canada

A3.2 As a centralised NSO, a federal act (the Statistics Act) provides Statistics Canada the legal mandate to collect and disseminate a broad range of statistics. Provisions in the Act also serve to protect data confidentiality and assure political neutrality and an arms-length relationship with policy-makers.

A3.3 Users are regularly consulted, and the NSO, through various channels, ensures that priority requirements are established and met. These channels include national advisory committees, federal-provincial consultations and regular bilateral meetings with key policy partners such as the federal finance department and the Central Bank.

A3.4 Statistics Canada produces a full suite of macroeconomic accounts, including:

- National Accounts (including financial and wealth accounts);
- Balance of Payments;
- Government Finance Statistics;
- Productivity Measures;
- Environmental Accounts (natural resource stocks as well as physical flows of energy use, greenhouse gas emissions and water use); and
- Selected satellite accounts covering tourism, culture and pensions.

A3.5 The compilation processes are integrated to assure data coherence across components of the Canadian macroeconomic accounts, and Regional SUTs serve as the integrating mechanism for the production dimensions. The integration is achieved via annual benchmarking and reconciliation processes with current price measures of GDP income and expenditure, real GDP by industry and labour and multifactor productivity. Data coherence is a requirement for key policy applications, for example, input to fiscal formulas for the sharing of sales tax revenues among the federal government and provincial jurisdictions or to formulas for equalising fiscal capacity among Canadian provinces.

A3.6 Economic surveys, along with labour market data, price statistics and international trade statistics are produced within Statistics Canada, ensuring alignment of priority-setting for feeder programs to the macroeconomic accounts.

A3.7 All business surveys are linked to a central business register maintained via regular updates from administrative files. The survey content is harmonized as are approaches to collection, processing and estimation within an Integrated Business Statistics Program framework. The use of administrative data is optimised throughout all stages of the process, and continuous access to required files is assured through formalised arrangements with data providers, such as the Canada Revenue Agency and national and provincial regulatory authorities.

A3.8 In recent years, Statistics Canada has made significant progress towards implementing consistent classification standards across all feeder programs, facilitating the compilation of SUTs. North American Industry Classification System (NAICS) serves as the basis of industry statistics and North American Product Classification (NAPCS) the basis of statistics on products. On-going efforts are made to ensure compliance and to coordinate input from the macroeconomic accounts and feeder program areas into the development of updated standards.

B. Example of centralised production of economic statistics - Norway

A3.9 Statistics Norway has overall responsibility for official statistics in Norway as well as for carrying-out extensive research and analysis activities. Statistics Norway reports to the Ministry of Finance supported by the Statistics Act of 1989. Statistics Norway is a professional, autonomous organization with the mandate to determine what it publishes as well as when, and how, the publishing takes place.

A3.10 Statistics Norway is responsible for the production and maintenance of the Business Register as well as the Business Surveys using samples drawn from this register.

A3.11 The Department of National Accounts and Industry Statistics is responsible for the following nine divisions:

- National Accounts;
- Primary industry statistics;
- Manufacturing and R&D statistics;
- Construction and service statistics;
- Transport, tourism and ICT statistics;
- Energy statistics;
- Natural resources and environmental statistics;
- Accounting statistics; and
- Business Register.

A3.12 The Division for National Accounts is responsible for:

- Quarterly and annual National Accounts (including SUTs, IOTs and regional accounts);
- Quarterly and annual non-financial accounts; and
- Quarterly Balance of Payments.

The Balance of Payments has been an integral part of the National Accounts since the 1950s. Satellite accounts are also prepared by the National Accounts Division but not on a regular basis.

A3.13 The Department of prices, financial and external trade statistics is responsible for the following six divisions:

- Financial market statistics (including financial accounts);
- Public finance statistics;
- Financial corporations;
- External trade statistics (in liaison with Customs Department);
- Price statistics; and
- Development cooperation.

Banking statistics were originally within Statistics Norway and then moved to Bank of Norway before being moved back to Statistics Norway.

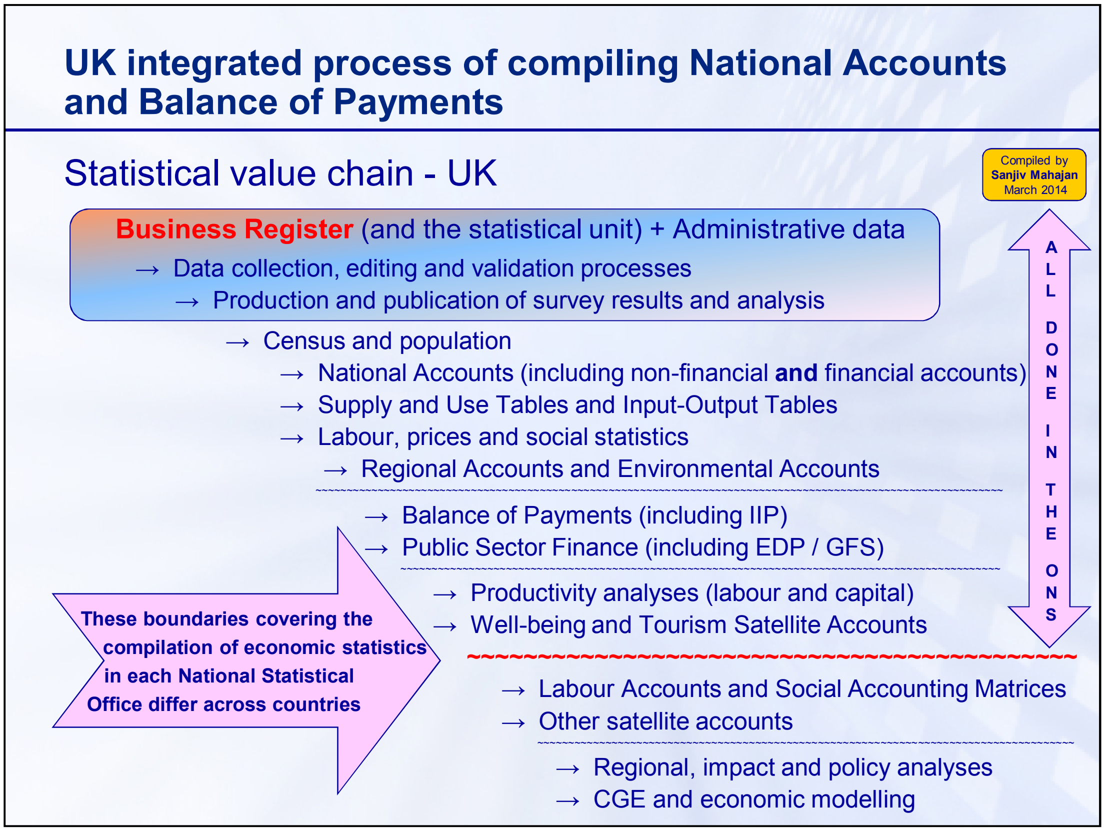
C. Example of centralised production of economic statistics - UK

A3.14 The structure of the United Kingdom (UK) statistical system has evolved over many decades, helped by several reorganizations of statistical departments and changes in legislation, bringing together the responsibility for almost all economic statistics under the UK Office for National Statistics (ONS) and the UK Government Statistical Service. The UK system continues to evolve, for example developing better links and access to administrative data.

A3.15 Presently, the UK has in place resources, systems and processes for producing detailed, integrated and timely quarterly and annual economic accounts. The ONS, as an independent statistical body with a central role, is wholly responsible for the compilation of the National Accounts, Balance of Payments, Public Sector Finance statistics, Labour Market statistics and Price statistics. The compilation of SUTs is central to the annual National Accounts system. The ONS also produces Regional Accounts, Environmental Accounts and IOTs. (Mahajan 2016)

A3.16 The ONS is an example, one of a few NSOs, with such centralised responsibility and coverage of economic statistics – this has only been the case since the late 1980s. Furthermore, since 2011, all of the above economic statistics are all being produced on the same site location.

A3.17 The independent status of ONS is supported by national legislation, whereby the ONS reports to the UK Statistics Authority. The UK Statistics Authority was established on 1 April 2008 under the Statistics and Registration Service Act 2007. The UK Statistics Authority is a non-ministerial Department overseen by Parliament and not by a Government Minister.



D. Example of de-centralised production of economic statistics – Chile

A3.18 Economic statistics in Chile are mainly produced by three institutions:

- The Central Bank of Chile (CBC) is responsible for the compilation of most of the macroeconomics statistics, namely National Accounts (non-financial and financial accounts), Balance of Payments and International Investment Position.
- The Finance Ministry produces the Government Finance Statistics.
- The NSO undertakes the data collection covering economic and business surveys, compilation of price indicators as well as labour market indicators and socio-demographic data.

A3.19 The organizational structure described above allows the CBC to achieve a high level of consistency between external statistics and National Accounts both in statistical terms and methodological terms.

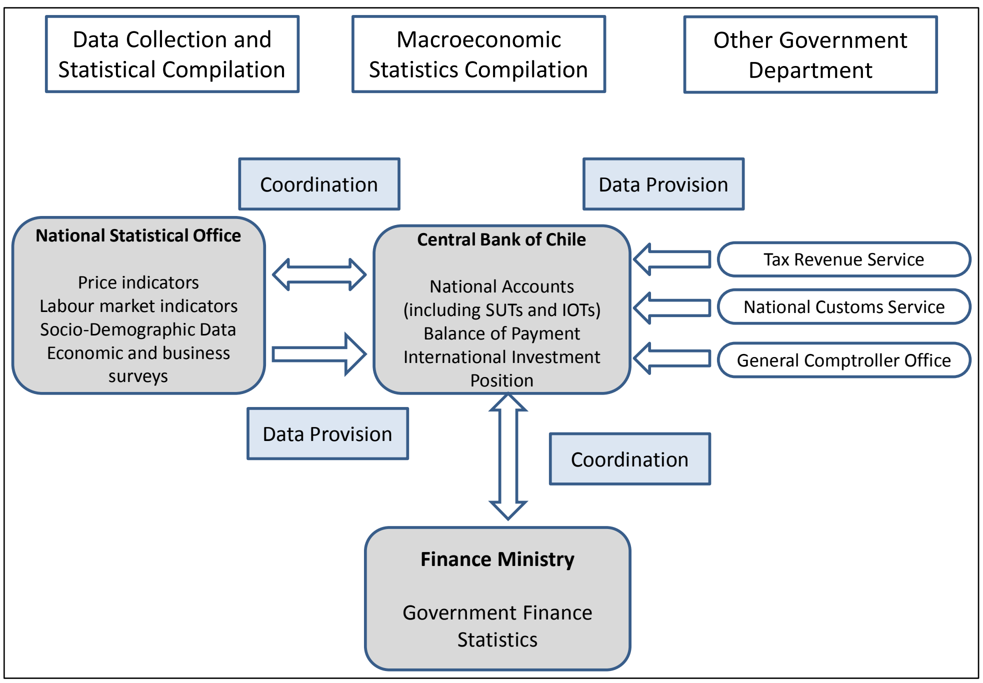
A3.20 In the production of macroeconomics statistics, the CBC uses a significant amount of data, provided mainly by Tax Revenue Service, National Customs Service, the General Comptroller Office and the NSO, the latter being the main provider of statistics for National Accounts compilation. The dependency on the statistics from the NSO requires a high degree of coordination between both institutions. To this end, a framework agreement is in place to ensure the requirements and conditions for the provision of statistical products are met. In addition, a committee with members from both institutions regularly meets to coordinate issues related to data collection and the specific needs of National Accounts.

A3.21 There are strong links between the CBC and NSO supported with a continuous programme to improve the cooperation and the quality of the links and the data flows between the customer and supplier.

A3.22 Other points to note:

- The SUTs and IOTs are compiled within the National Accounts in the CBC.
- In terms of Balance of Payments, the CBC collects the data on international trade in services to supplement the international trade in goods data collected, and provided, by the National Customs Service.
- The CBC also produces Regional GDP on an annual basis.
- The NSO produces a Business Register, which in turn, the CBC utilizes after implementing improvements and modifications.
- Although the Environmental Accounts are not produced for Chile, various efforts are in motion by the Minister of the Environment to produce a range of environmental indicators.

A3.23 The diagram below shows the components of the statistical system in Chile.



E. Example of de-centralised production of economic statistics – United States of America

A3.24 The United States of America (USA) has a highly decentralised statistical system with responsibility for producing a substantial portion of official federal economic statistics divided among 13 agencies that have statistical work as their principal mission.

A3.25 There are also numerous other entities that are considered part of the statistical system in the USA but statistical work is not their principal mission. Most of the USA primary economic indicators are produced by one of three main federal statistical agencies, while the US Census Bureau conduct economic censuses and surveys.

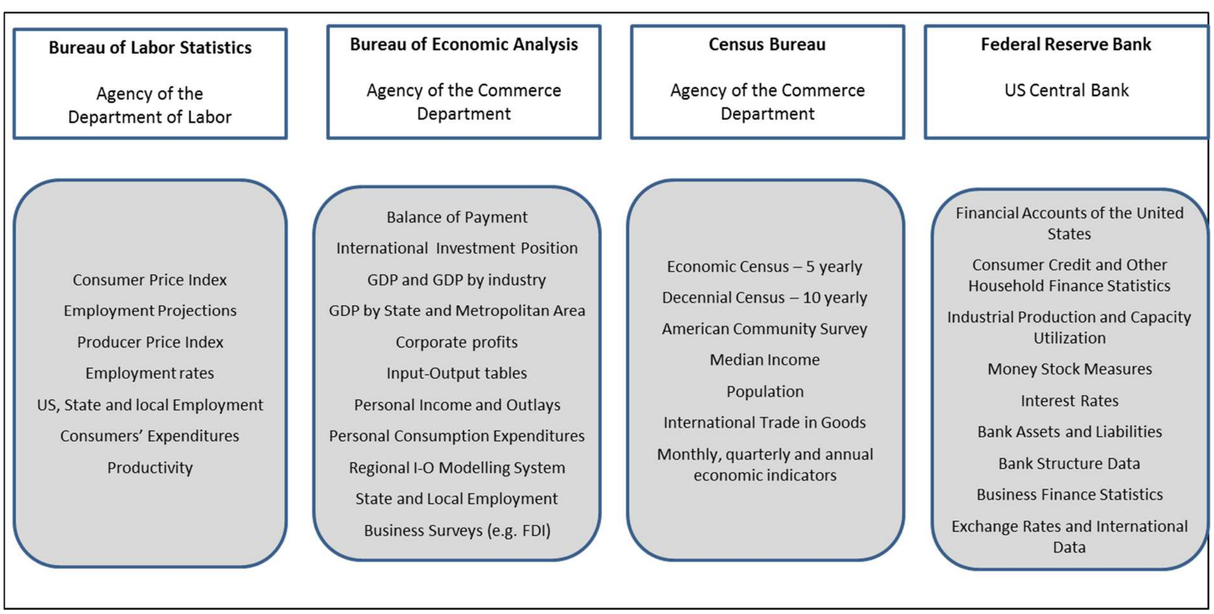
- The US Bureau of Economic Analysis (BEA) relies primarily on data generated by other agencies to compile the National Accounts (non-financial accounts) and the Balance of Payments.
- The Federal Reserve Board (the US Central Bank) compiles the Financial Accounts and Government Finance Statistics.
- The Labor Market Statistics and Price Statistics are prepared by the US Bureau of Labor Statistics (BLS).

A3.26 The BEA also undertakes a number of business surveys. However, most of the statistics used by BEA in preparing GDP and I-O accounts come from non-BEA sources, including other statistical offices. The Census Bureau provides most of the other expenditure components of GDP and output and intermediate purchases within the I-O framework. For the period 1997 to 2017, the BEA produces SUTs at basic prices with a transformation to purchasers' prices, Make/Use Tables at purchasers' prices for benchmark years and at producers' prices annually as well as IOTs. Annual Make/Use Tables at producers' prices at a more aggregate level of detail are also available for the period 1947-1996.

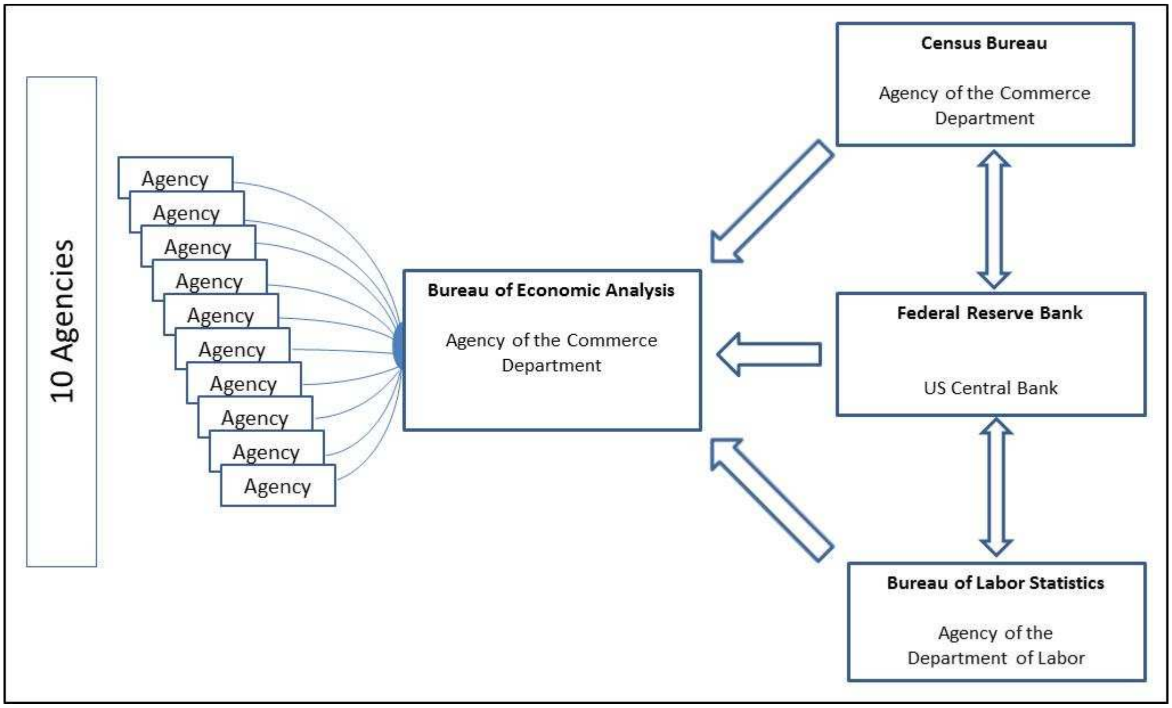
A3.27 The agencies each produce and maintain their own business register often created using different sources:

- Census Bureau's business establishment list is compiled mainly from federal tax forms and used as the primary sampling frame for the 5-year economic censuses and many of the economic surveys.
- BLS business establishment list is based on information collected in connection with the joint federal/state unemployment insurance program and used by BLS establishment surveys, including the PPI survey.

Overview of the products produced by the main agencies



Overview of the statistical system structure



A3.28 Data sharing between agencies, like in the USA, may improve significantly data harmonization and lead eventually to savings. The BEA in recent year has set up some Memorandum of Understanding with other agencies/ministries to facilitate the exchange of data including confidential data.

A3.29 Although differences in concepts and coverage between different agencies on common statistics may occur (for example, the productivity statistics are published in the USA by BLS and used by BEA in their measurement of National Accounts), the confrontation of data itself or data processing steps achieves another level of validation of the data and raise the quality of statistics

Chapter 4. Specify needs, design, build and collect phase

A. Introduction

4.1. The objective of this chapter is to describe the activities specific to the compilation of SUTs and IOTs, which take place during the stages of the Generic Statistical Business Process Model (GSBPM) that relate to "specify needs", "design", "build" and "Collect", and to elaborate on specific elements that need to be considered when compiling SUTs and IOTs. These phases of the GSBPM are particularly important in the compilation process as they affect the remaining phases of the compilation process. They are obviously routinely reviewed as to make adjustments to the process.

4.2. Section B of this chapter focuses on the "specify needs", "design" and "build" phases for SUTs and IOTs. Considerations on the level of detail of the industry and products in the tables are to be carefully evaluated at the beginning of the compilation process together with other elements such as the schedule of compilation, the revision policy etc. Section C moves onto the collect phase and describes the main data sources used for SUTs and IOTs.

B. Specify needs, Design and Build phase

1. Specify needs

4.3. The identification of user's needs is a fundamental step in the compilation of any statistics, as it aims to identify what statistics need to be compiled in which format, when and for what purpose. All these elements affect the planning of the compilation process of SUTs and IOTs since they impact, for example, the choice of the level of industry and product detail of the SUTs. Thus an assessment of the objectives of these tabulations has to take place during the phase 'specify needs' of the statistical production process and it needs to be regularly reviewed based on the feedback from users to ensure the relevance of the compiled SUTs and IOTs. During this phase consultation with relevant stakeholders, through for example, meetings, workshops and surveys form key elements.

4.4. Other elements of this phase include the identification of the statistical outputs that are required to meet the user needs and checking the data availability to see if existing data sources can meet the user requirements, if there are alternative data sources that would be more suitable for the specific statistics, and if there are data gaps to fill.

4.5. There are many different users (for example, policy makers, analysts, researchers, etc.) and uses (for example, planning, modelling, monitoring, etc.) of SUTs and IOTs. It is therefore important to maintain the link with the users to ensure that their needs are met through one efficient compilation process. For example, with the increasing concerns about the environment, if a specific environmental topic (for example, water, energy, fish, forest, etc.) is considered as a key user need to address, it is important to develop and design a compilation process which include these elements from the beginning rather than adjusting ex-post the statistical output through modelling based on various assumptions.

4.6. The compilation of any statistical output depends to a large extent on the availability of appropriate infrastructure for information technology (IT) and human resources. The technology has changed enormously in the last 50 years. Statistics which were once compiled with calculators are now processed in seconds by modern computers, laptops or even smart phones. This fast development has facilitated the work of statisticians and improved the timeliness of the statistical outputs. When compiling SUTs and IOTs, different software, databases, and custom-designed platforms are available and can be adapted to the specific compilation process in the country.

4.7. It is therefore important to have a clear understanding of the IT requirements necessary for all the phases of the compilation process. In practice, more than one software package is often required and each one is used to best meet the various, separate functional requirements of the specific phase and need to be able to communicate with each in an easy, effective and efficient manner. If the links between the software packages are cumbersome or time consuming, alternatives should be sought. Many NSOs have built in-house tailored software to best meet their needs – this has various advantages but may provide a greater overhead maintenance and training requirements.

4.8. Box 4.1 and Box 4.2 provide examples of custom-made software produced and maintained in the first case by Statistics Netherlands and in the second by INSEE and Eurostat.

Box 4.1 Example of in-house built software - Statistics Netherlands

Statistics Netherlands (CBS) has a long-standing tradition of compiling SUTs both in current prices and in volume terms as well as IOTs, and therefore has long experience in addressing the range of challenges of using computer systems to produce and maintain long-run series of SUTs and IOTs.

CBS has published SUTs since 1990 (relating to the benchmark revision for the year 1987) and IOTs since the 1950s (with the first year being 1948).

The CBS has always used in-house built software for the compilation of the balanced SUTs and IOTs. There are two separate tools which are both updated continuously an SQL database. These are combined with a graphical user interface in Visual Basic for Applications (VBA) allowing data to be accessed and adjusted by the national accounts staff. Both systems can handle quarterly and annual data.

The first application contains tools used for the transformation of source data to national accounts definitions and standards, both in current prices and in volume terms.

The second application contains tools for simultaneous balancing of the SUTs in current prices and in volume terms, for compiling the valuation matrices and for transforming the SUTs to Industry by Industry IOTs.

The present systems are based on a major overhaul in 1995 and have been continuously updated. A key re-build took place in 2004/2005 reflecting a new programming language as well as the inclusion of new features.

Box 4.2 ERETES

ERETES - the French acronym for Equilibre Ressources-Emplois et Tableau Entrées-Sorties (Supply-Use Balances and Input-Output Tables) - is a computer system designed to assist national accountants to compile the SUTs and Integrated Economic Accounts (including sector accounts) and complies with the principles and guidelines set out by the SNA. ERETES was developed by the French NSO (INSEE) and Eurostat. In 2014, it was being used by several countries in Africa and Latin America and the Caribbean.

Further countries are expected to adopt the system. The ERETES system is available in French, Spanish and English.

Although the objective of ERETES is to generate SUTs and the integrated economic accounts, it can also be used by countries that have limited data resources. The minimum data requirements are an enterprise and a household budget survey, foreign trade statistics, government accounts, balance of payments and banking statistics. With these data, ERETES can aid countries to generate estimates of GDP in current prices. If sufficient price and volume indices are available, then estimates of GDP in volume terms can also be generated. The compilation of SUTs would also require information on intermediate consumption and trade and transport margins.

One key advantage of ERETES over other computer systems is that it is supported by a permanent secretariat that can call on a group of multi-lingual national accountants and IT experts who are very experienced in applying the system in several developing countries. ERETES is regularly updated and improved. ERETES is available at: http://www.eretes.net/EN/index.htm

4.9. Another successful example of custom-built software produced by one NSO, and then provided for effective use by other countries under specific terms and conditions was the Norwegian software (SNA-NT), where Statistics Norway provided the software as well as the associated human resource for training in the use of the applications, by for example, Malawi, the Czech Republic and Slovakia.

4.10. When choosing the software and hardware to support the compilation of SUTs and IOTs as part of the National Accounts, one should consider various criteria such as the database environment, in particular its flexibility and structure, its statistical functionality and diagnostic tools required, the necessary availability of mathematical functions such as matrices calculations, the resources and costs, the training program, the compatibility with data suppliers, the data management, the data dissemination platform envisaged.

4.11. Across countries various products are used such as Oracle, JAVA programming, MATLAB, SPSS, SQL, SAS, Excel and custom-made software built to meet specific requirements. For example, using Excel or input systems such as an Oracle database could provide an effective solution in the “Collect” phase and in the “Process” phase for preparing and validating the data, while SAS could be used for further processing of SUTs and IOTs. Tools such as Excel, an output system and web-tools for dissemination may be the solution regarding the validation and balancing as well as the analyses and dissemination of the data.

4.12. Skilled and trained human resources are also a fundamental pillar for the compilation of SUTs and IOTs. It is thus important to recruit and retain skilled and effective staff and develop and utilise internal and external training opportunities on the theoretical and practical aspects of the compilation of economic statistics.

4.13. An important step in this phase is the preparation of a document summarizing the findings of all the activities mentioned above (i.e. identifying needs, establish output objectives, check data availability, checking IT requirements, etc.) in the form of a business case to get approval to implement the new or modified statistical business process. Such a business case would need to conform to the requirements of the approval body but would typically include elements such as: a description of the "As-Is" business process (if it already exists), with information on how the current statistics are produced, highlighting any inefficiencies and issues to be addressed; the proposed "To-Be" solution (with clear improvements and benefits); detailing how the statistical business process will be developed to produce the new or revised statistics; an assessment of costs and benefits, as well as any external constraints.

2. Design and Build phase

4.14. The design phase describes all the activities undertaken to define the statistical output and the concepts, methods, collection instruments and operational processes necessary. Therefore, this phase includes all the design elements needed to define or refine the statistical output identified in the previous phase, all relevant metadata, ready for use later in the statistical business process, as well as quality assurance procedures.

4.15. These activities make substantial use of international and national standards, in order to reduce the length and cost of the design process and enhance comparability and usability of outputs. Organizations are also encouraged to reuse or adapt design elements from existing processes. Additionally, outputs of design processes may form the basis for future standards at the national and international levels.

4.16. The design of the statistical output for SUTs and IOTS refers to the size and layout of the tables; the breakdown of industries and products; disclosure control methods; processes governing access to any confidential information; and the identification of the statistical variables needed, which is then linked to the data collection phase.

4.17. In the build phase, the production solution is put together and tested to the point where it is ready for use in the "live" environment. This phase is broken down into several activities, which include: a review of data sources; the configuration of the workflow from data collection through to dissemination; and testing of the statistical business process. For statistical outputs produced on a regular basis, the 'design and build' phase usually occurs for the first iteration, and following a review or a change in methodology or technology, rather than for every iteration.

4.18. During the design and build phase a number of specific issues in the compilation of SUTs and IOTs should be considered. They include, for example, the choice of the level of detail of industries and products of SUTs and IOTs at working level and at the dissemination stage; how to handle confidentiality throughout the compilation process; the schedule of compilation and dissemination of SUTs and IOTs; the revision policy and analysis; the required resources to sustain the compilation on a sustainable basis; the benchmarking; and the choice of the index formula and the base year. In addition, it is important to create and maintain documentation for all the stages of the compilation process to serve as a quality control measure of the process. All these activities in the design and build phase are further elaborated in the following sections.

(a) Level of industry and product detail and size of SUTs and IOTs

4.19. The level of industry and product detail of the published/disseminated SUTs (and IOTs) greatly depends on the objectives of the tabulations and its uses. The industries and products explicitly identified in the disseminated tables reflect to a great extent the users' needs and the specific policy concern of interest. For example, if a specific environmental domain is of interest, for example energy, specific industries and products are likely to be explicitly identified in the disseminated tables in order to address the specific domain. The ultimate level of aggregation of the disseminated SUTs and IOTS has an impact on - and at the same time is affected by - the data collection/availability, compilation and balancing procedures.

4.20. The number of products in the SUTs is usually higher than the number of industries, thus showing for each industry not only one primary product, in which case SUTs are rectangular. Their size and shape will have appropriate implications for IOTs, the physical tables and other related products analyses (for example, productivity).

4.21. The level of detail of industries and products at the working level is generally very disaggregated and the recommendation is to work with the most detailed level of aggregation taking into consideration the constraints posed by the available data, resources, and burden on business. Various aspects need to be considered including the user needs, the availability of data, as well as the level of detail used in National Accounts. For example, compilation aspects that influence the level of detail (since they facilitate the compilation and validation of the data at the working level) include:

- Distinction between industries which are allowed to deduct VAT and those that are not allowed to deduct VAT, and different VAT rates per product and categories exempt from VAT to facilitate the compilation of the valuation matrices in particular for taxes and subsidies;
- Distinction between market and non-market activities to facilitate the understanding of the input structure of GVA;
- Sub-divisions of industries according to institutional sectors which impact the linking table between SUTs and the institutional sector accounts;
- Separately identify certain industry and product sub-divisions to facilitate the compilation of the trade and transport margin matrices such as Section G and its Divisions of the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4;
- Links to international industry, product and functional classifications;
- Links between output structures, input structures, price indices and values for deflation as well as the availability of price statistics to generate estimates in volume terms;
- Links between domestic supply and exports as well as intermediate consumption and imports to study the input structure of the industries;
- Links to the environmental accounts;
- Enterprises that trade internationally and have links to Global Value Chains (GVCs) (see extended SUTs and the OECD Trade by enterprise characteristics data (TEC) indicators);
- Availability and quality of source data;
- Size and value of output and value added of the industry: if the industry is too large and heterogeneous then it should be further broken down. The same can apply to products;
- Benchmarking (annual as opposed to 5-yearly) using comprehensive sources/censuses since the level of detail in benchmarking years is much larger than that during regular annual compilation of SUTs and IOTs;
- Annual chain-linking the volume estimates; and
- Staff resources, time schedules for production and publication, confidentiality and system infrastructure.

4.22. An appropriate choice of the level of industry and product detail in the SUTs at working level facilitates the compilation and the search for causes of inconsistencies. For many products, by their nature, it is possible to identify in which industry they are used. For example, fertiliser is mainly used in agriculture, crude oil in oil refineries, concrete in construction, etc. For some products, it may also be possible to identify whether they are used as intermediate consumption or final consumption. Haircut services, for example, can be assumed to be mainly consumed by Households and thus recorded in Household Final Consumption Expenditure. The more detailed classification of products used in SUTs, the easier it is to use expert knowledge to supplement surveys in allocating products to different uses.

4.23. Linking and matching products to elements concerning valuation (taxes, subsidies, trade and transport margins) make the compositions of transactions more transparent, clear-cut and makes analysing much easier.

4.24. More detailed products also imply that the number of users of a certain product is greatly reduced. Where there is only one producer and one user of a product, the search for the cause of inconsistencies would only require investigating two source statistics. When a product has 20 users, for example, the search becomes more complicated.

4.25. Questions of the SUTs table layout also arise for the final use part of the SUTs. It is worthwhile to integrate the functional classifications in the final consumption data, showing final consumption by products and by consumption purpose. On the other hand, it may be better to keep such detail and transformation separate but this is still needed in whichever form in the integration of compiling SUTs and the other accounts of the system.

4.26. At the dissemination stage, the size and industry/product breakdown shown in the SUTs (and thus in the IOTs) mainly reflect the user's needs and the objective of the tabulations taking into account confidentiality considerations. Other presentational considerations include, for example, the size and relative value of output and value added for the industries and the size and value of supply for the products. Industries or products that are not economically significant or relevant for a particular economy may be aggregated together, while a more detail breakdown may be shown for economic activities that contribute substantially to GDP, in order to better analyse the cost structures and the inter-dependencies with other economic activities.

4.27. It should be mentioned that when compiling consistent annual, or quarterly, SUTs, the stability of the level of detail of the applied classifications is also important as many ratios and proportions will usually be taken as a starting point in the estimates for the following year.

4.28. A higher degree of product detail also supports the use of certain estimation methods, for example the product flow method of compiling National Accounts (i.e. balancing supply and use of products) by taking into account the relevant differentiation concerning product tax rates, margin rates and homogeneity in prices. Moreover, it is much easier to distribute disaggregated products and services across industries and final use categories with the product flow method than at a higher aggregate level. Detailed product accounts also help in the balancing procedure, as it is easier to explore and detect the causes of imbalances if the basis is determined by homogeneous single products rather than aggregate groups of products. The work on a detailed product level certainly increases the data quality but has resource and systems implications. At higher levels of aggregation, problems of imbalances might not even be seen at all and therefore not addressed.

4.29. Table 4.1 provides an example of the size of SUTs and IOTs compiled by selected countries. It is worth noting that the internal working level of the industries/products detail used for compilation and balancing is much larger than what is published. For example, in the USA, the working level in producing the SUTs is over 800 industries, whereas in Denmark, there are around 2,350 products at the working level but the SUTs are published only at the 64 product by 64 industry level.

4.30. It is important to distinguish between the detail required for the compilation and balancing work at the working level as opposed to the information required for the publication. The in-house operating detail should be the same or, as in most cases, be in greater detail in terms of number of industries and products than what the level for publication allows for disclosure. For example, many countries distinguish hundreds or even thousands of products but do not publish at these levels as these reflect a lot of confidential information. However it should be noted, that countries do often allow people outside the NSO to have access to more detailed data, albeit confidential and under signed agreements, for analytical purposes.

Table 4.1 Examples of the size of "published" and "internal working level" SUTs and IOTs

Country[(1),(2)]	National Supply and Use Tables					National Input-Output Tables			
	Current prices				Volume terms or PYPs	Current prices			
	Internal working / compilation levels		Published levels		Do you produce such tables: Y (yes) N (no) or P (plan to)	Internal working / compilation levels		Published levels	
	Number of products	Number of industries	Number of products	Number of industries		Number of industries / products		Number of industries / products	
						P x P Tables	I x I Tables	P x P Tables	I x I Tables
Argentina[(3)]	271	162	271	162	N	n/a	124	n/a	124
Australia[(4)]	301	67	n/a	n/a	Y	n/a	114	n/a	114
Austria	573	135	74	74	P	74	n/a	74	n/a
Belgium[(5)]	355	135	64	64	P	135	n/a	64	n/a
Brunei Darussalam[(6)]	324	74	74	74	N	74	74	74	74
Canada	490	230	490	230	P	n/a	230	n/a	230
Chile	275	160	180	111	Y	n/a	111	n/a	111
Columbia	369	61	61	61	Y	61	61	61	61
Costa Rica	183	146	183	138	Y	183	136	183	128
Czech Republic	252	120	88	88	Y	184	184	82	82
Denmark[(7)]	2,350	117	117	117	Y	n/a	117	n/a	117
Estonia	247	98	64	64	Y	64	n/a	64	n/a
Finland	776	179	64	64	Y	n/a	179	n/a	64
Germany	86	63	85	63	P	73	n/a	72	n/a
Greenland	680	33	23	29	Y	n/a	30	n/a	30
Hungary[(8)]	820	242	64	64	Y	88	88	64	64
Iceland[(9)]	561	142	n/a	n/a	P	n/a	n/a	n/a	n/a
India[(10)]	142	126	140	66	N	130	n/a	130	n/a
Indonesia[(11)]	244	81	n/a	n/a	P	251	n/a	185	n/a
Ireland[(12)]	82	82	58	58	Y	82	n/a	58	n/a
Korea	1,851	328	384	328	N	1,851	n/a	384	n/a
Kuwait[(13)]	43	43	n/a	n/a	N	43	43	n/a	n/a
Mexico[(14)]	819	814	262	262	P	814	262	814	262
Netherlands	614	128	85	76	Y	n/a	128	n/a	76
New Zealand[(15)]	299	118	201	106	P	n/a	106	n/a	106
Norway	860	156	64	64	P	n/a	156	n/a	64
Saudi Arabia[(16)]	59	59	18	18	N	59	59	n/a	n/a
Serbia	216	88	n/a	n/a	N	n/a	n/a	n/a	n/a
Singapore	71	71	71	71	N	n/a	71	n/a	71
Slovakia	290	88	64	64	Y	88	n/a	64	n/a
Slovenia[(17)]	350	230	64	64	Y	64	n/a	64	n/a
South Africa	104	293	104	62	N	n/a	50	n/a	50
Sweden[(18)]	403	97	62	64	P	62	n/a	62	n/a
Tanzania[(19)]	250	59	250	59	P	n/a	n/a	n/a	n/a
United Kingdom[(20)]	112	112	112	112	P	112	n/a	112	n/a
United States of America[(21)]	4,988	819	73	71	P	73	71	n/a	n/a
Submissions to European Commission reflect EU Member States[(22)]	64	64	64	64	P	64	64	64	64

Note (1) The above detail has been compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) at the time of preparation of this Handbook. The numbers are indicative for tables as available for the reference year 2014 (as at December 2016) unless denoted otherwise.

Note (2) Other differences will exist in terms of comparability such as the tables are compiled on a different basis, for example, the frequency of the tables, classifications used, the SNA version, latest reference year, latest benchmark year, valuation of SUTs (basic prices or producers' prices or purchasers' prices), assumptions used underpinning the IOTs, etc.

Note (3) Argentina - the SUTs reference year is 2004 and the IOTs reference year is 1997.

Note (4) Australia - the IOTs working level operates at 1268 products and 114 industries.

Note (5) Belgium - the IOTs reference year is 2010.

Note (6) Brunei Darussalam - the reference year for SUTs and IOTs is 2005.

Note (7) Denmark - the number of products can vary from year to year. Detailed data can be made available outside Statistics Denmark for analytical purposes.

Note (8) Hungary - the IOTs reference year is 2010 (compiled five-yearly).

Note (9) Iceland - the SUTs are produced but not yet published. The plans are to publish 64 products x 64 industries.

Note (10) India - the SUTs reference year is 2012/13 and the IOTs reference year is 2007/8. Industry outputs published in full whereas industry uses aggregated to higher levels.

Note (11) Indonesia - the SUTs and IOTs reference year is 2010.

Note (12) Ireland - the SUTs reference year is 2013 and the IOTs reference year is 2011.

Note (13) Kuwait - the SUTs and IOTs reference year is 2010.

Note (14) Mexico - the reference is year 2008. PxP IOTs reference year is 2008 (814 products), updated version for 2012 (259 products). IxI IOTs reference year is 2012.

Note (15) New Zealand - the production of SUTs in volume terms are being planned but no plans for publication.

Note (16) Saudi Arabia - the SUTs and IOTs internal working levels reference year is 2011 and published SUTs reference year is 2013.

Note (17) Slovenia - the SUTs reference year is 2013 and the IOTs reference year is 2010. SUTs and IOTs will be published in 2017 both with a reference year of 2014.

Note (18) Sweden - the SUTs in PYPs are produced but not yet published. However, a version is submitted to the Commission (Eurostat) and plan is to publish at some stage.

Note (19) Tanzania - the SUTs reference year is 2007. IOTs for the reference year 2007 is being finalized.

Note (20) United Kingdom - the IOTs PxP Tables use the "hybrid" assumption approach.

Note (21) USA - In benchmark years, the SUTs are published at the 389 product and 389 industry level of detail. While IOTs themselves are not currently published, the IxI. Leontief Inverse tables calculated from IOTs are published at the 71 industry level of detail as well as PxP tables at the 73 product level of detail.

Note (22) All EU Member States are expected to provide:

Annual SUTs both in current prices and PYPs as well as five-yearly IOTs under the ESA 2010 Transmission Programme after the expiry of any National Derogations.

The SUTs and IOTs are to be supplied using 64 products and 64 industries.

4.31. Confidentiality is a fundamental principle of official statistics (see United Nations 2013b). It ensures that individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons are to be strictly confidential and used exclusively for statistical purposes. It is important therefore that procedures are put in place to ensure the confidentiality of the information disseminated.

4.32. Countries may apply different criteria to decide whether specific data may be disclosed or not. This is likely to be driven by the legislation in place underpinning the collection of data from businesses. Usually, the number of enterprises observed in an industry takes influence on this decision or whether disclosure can be determined by deduction. One solution would be to choose a higher aggregation level with a sufficient number of enterprises in an industry to overcome any disclosure problems. There may not always be an easy solution for some industries or products to which they should be allocated. The price is a loss of information due to aggregation resulting in a larger heterogeneity of the SUTs system. Other methods might therefore be explored or combined such as creating or redefining products.

4.33. Cases where there is one or two dominant producers in an industry, like say mining, extraction of crude oil, sugar, pharmaceuticals, etc., pose a different challenge. In these cases, it is recommended, when necessary, that specific permission is sought from the business when their data are publicly available from other public sources, for example published company annual report and accounts. If permission is not granted, then suppression of the relevant cells in the SUTs should be considered. Aggregation of industries/products with non-disclosive industries/products should, however, be avoided as this loses useful details for non-disclosive industries/products.

(c) Schedule of the work programme

4.34. Aligning the monthly, quarterly and annual timetables covering data collection processes, compilation processes, data supply, validation, balancing and publication for all the accounts, and outputs, is a key step in ensuring coherency and consistency. This should include the compilation of SUTs, and other I-O related products, as appropriate.

4.35. The overall process needs therefore to be split into well-defined blocks of work with clearly defined processes and linkages between the processes and all fitting within realistic schedules (including contingency planning and risk management) with clear roles and responsibilities for the staff and management involved. The governance of the programme should be clear with regular monitoring and meetings scheduled at key junctures, for example, linked to key milestones in the process. The project management of the process should ensure dedicated resource is attributable to this support function.

4.36. The schedule needs to incorporate deadlines of both data providers and data users as well as various internal intermediate deadlines. For annual business surveys, the time lag from changing the questionnaire to incorporating the new results and publication in SUTs/National Accounts could be around three years, thus it is important to retain schedules, which are regularly reviewed and reflect the incorporation of continual data improvements.

4.37. In general, it is useful to put in place service level type agreements with data providers as well as with data users. Agreements with data providers would cover what types of data to be provided, quality criteria, briefings, schedules and the format in which the data will be delivered. Important elements to consider in such service level type agreements include:

- Clear ownership – senior representatives from both the supplier side and the customer side.
- Reasons for data requirement.
- Publication of results including disclosure requirements.
- Process of data delivery by data provider (for example, format).
- What data are required (need to be specific of the variables needed).
- Timing of data deliveries.
- Briefing required accompanying the data.
- Handling of customer queries.
- Quality (covering criteria like consistency, credibility, revisions, precision and communication).
- Methodological notes supporting the data (for example, sources, methods, coverage, etc.).
- Development, improvements and consultation.
- Arrangements for review of the process, etc.

4.38. Service level type agreements with data users, on the other side, would cover, for example, users' deadlines (for example, those linked to policy agendas, research schedules, etc.) to be reflected in the statistical production schedule. For example, the finance ministry and/or the Central Bank may require structural updates on the economy to fit with their policy review, and these may be part of regular annual schedules, thus requirements of the producers of SUTs, etc.

4.39. In general, there should be a regular review, for example, on an annual basis, of all aspects of the process (including timetables, data quality, implementation future changes, etc.) with both data providers and data users in order to continually improve and change as necessary.

4.40. The schedule for the compilation of SUTs depends of course on the periodicity/frequency of SUTs/IOTs. In general, it is recommended the annual compilation of SUTs, in line with the United Nations Statistical Commission recommendations on the scope of the implementation of the 2008 System of National Accounts[6]. While it is recommended to compile every five years a benchmark system of SUTs based on specific survey results, rapid changes in the economy, external impact from globalization, the increasing rate of change of technology and its impact, new products, new industries, impact of digitization and digitalization, etc. may impact the production process of SUTs and the periodicity of benchmarked tables, whereby an annual benchmark process may be preferred.

4.41. Schedules in terms of frequency of SUTs compilation may be assessed against the revision policy and the uses of infra-annual sources (such as quarterly and monthly short-term indicators) to incorporate if necessary the revision guidelines and indicators policy.

(d) Revision policy and analysis

4.42. Revisions to time series data are an important part of the production process. Changes to published data can occur for many different reasons. For example, forecast data may be replaced by survey data, reclassification of industries, methodological changes to the way in which data are estimated or just correcting errors. Changes due to the correction of errors should be identified as corrections and distinguished from revisions that are more commonly associated with improving estimates as more information is gathered over time (Mahajan, 2015). There is a conflict between releasing timely estimates and releasing accurate estimates. If NSOs/NCBs waited to publish the most accurate data possible, due to the nature of data collection there would be a large time lag between the date to which the data refer and the date of publication.

4.43. Bringing together data for the purposes of compiling SUTs, and other I-O related products, integrated within the National Accounts implies aligning production timetables (quarterly and/or annual) and schedules but also revision policies. Ideally, a highly effective revision policy to ensure revisions are implemented in a coordinated and coherent fashion across the accounts should cover the National Accounts, Balance of Payments and Government Finance Statistics, and this in turn should include the SUTs and IOTs as well as extending to primary source data and other domains such as Regional Accounts and Environmental Accounts.

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[6] See the recommended data set in the Report of the Intersecretariat Working Group on National Accounts (E/CN.3/2011/6) available at: http://unstats.un.org/unsd/statcom/doc11/2011-6-NationalAccounts-E.pdf

4.44. The revision policy should reflect appropriate criteria to assess each revision, including when best to implement the changes, for example, in a quarterly exercise (for example, for short-term revisions) or in an annual exercise (for example, for long period revisions). This will impact on how to compile SUTs and IOTs and the revision guidelines should be operated flexibly reflecting issues like economic significance and practical aspects such as impact on resources and systems.

4.45. The usual guidelines applied to all the accounts cover:

- Revisions to the latest quarters for an incomplete year (these can impact annual SUTs).
- Revisions to past recent quarters since the last full benchmark year.
- Revisions made through the annual process to recent years, say 3-5 completed years.
- Revisions to a longer period, sometimes viewed as a major revision. Many earlier years may be revised dependent upon meeting certain criteria like methodological improvements, correction of errors and economic significance.

4.46. Any changes to back data will also have an impact on the monthly and/or quarterly seasonally adjusted estimates.

4.47. In some countries, occasional or major revisions of National Accounts are usually carried out every five years and require more resources if the revision is implemented on the basis of a large SUTs system. A revision at a more aggregated level is always easier and less demanding.

4.48. The various revision practices have different pros and cons:

- Regular revisions to SUTs and National Accounts, thereby preserving good quality levels and/or growth rates. However, some users do not welcome regular revisions, whereas other users do not welcome “big bang” approach to revisions.
- Five-yearly revision exercises may imply more significant changes for a number of years until the next revision window.
- Revisions only at the aggregated level may provide problems with the detail and provide discontinuities in the long time series of annual SUTs
- Revisions also at the level of IOTs ensures that SUTs and IOTs remain consistent.

4.49. Revisions applied only to part of the accounts and not all the relevant outputs would generate incoherence across different outputs and not help users, for example, in some countries, SUTs may be revised but the IOTs are not revised, thus the links between the two products are out of line. This situation should be avoided.

4.50. Analysis of revisions can provide information about the reliability of estimates and how they change between the first estimate and final estimate as well as a source for the identification of any biases, (Mahajan 2004b). Note that revision analysis does not give information on the accuracy of an estimate, for example, the final estimate may not be accurate in terms of sampling error or non-sampling error.

4.51. The knowledge of the source and the reason(s) for the revisions is key and helps producers, and users, to better understand the data. Sometimes with major revisions going back in time, understanding the changes can be quite complicated like changes in definitions, classifications and data. For analytical users of SUTs and

IOTs, it is important to understand the reasons and impact, especially when there is a mix of revisions, for example, with the introduction of 2008 SNA, SUTs and/or IOTs may be revised going back 30-40 years or more. The forthcoming Handbook on Backcasting Methodology (United Nations, forthcoming) provides more information on this topic.

(e) Resources

4.52. When discussing the resources and human requirements for a full integration of SUTs and IOTs (as well as PSUTs) in the compilation of National Accounts and Balance of Payments, it is essential to distinguish between the first compilation of the SUTs, the recurrent production of SUTs and the process around major backward revisions.

4.53. A substantial amount of resources is required to build up an integrated SUTs framework for the first time. This work involves establishing all the planning, conceptual and methodological work, data collection needs, requirements of all the individual industry and product balances, the development of appropriate techniques for incorporating the primary sources and new software for handling the SUTs system as well as training and investment in staff and systems. The investment may lead to considerable changes in the working procedures towards a better integration of activities from data collection through to publication following an integrated statistics approach.

4.54. The resources needed for establishing an integrated SUTs framework should, however, be seen in connection with the way the development will evolve, for example, the level of integration and the organisation of roles and responsibilities across the statistical domains. The implementation of the recommendations and guidelines provided in this Handbook can be done in a gradual manner taking into account countries' specific situation in terms of resource available and national priorities. Countries practices can vary considerably, for example:

- Only annual SUTs in current prices.
- Annual SUTs in both current prices and in volume terms.
- Annual SUTs complemented with a quarterly SUTs system.
- Annual and quarterly SUTs in current prices and in volume terms.
- SUTs at basic prices and/or at purchasers' prices.
- Benchmarking annually, or say, at least every five years.
- Links between SUTs and IOTs:
    - SUTs only.
    - SUTs and IOTs, both in current prices (maybe in volume terms too).
    - Only IOTs and no SUTs – this clearly the least favoured but has a historical legacy in some countries.

4.55. Developing a new SUTs and National Accounts System poses different challenges to changing existing production systems whilst maintaining business-as-usual activities.

4.56. Regarding the periodicity, at least every five years a benchmark system of SUTs should be compiled which is based on more exhaustive specific survey and administrative data results. However, as described earlier in this Chapter when considering schedules for SUTs (and IOTs), with rapidly changing and developing economies, impact of globalization and digitalization, etc., it is recommended that the development of new SUTs systems should reflect an annual benchmarking/reconciliation process. This also helps to avoid storing significant revisions and distortions to levels. Together with annual chain-linking, this will imply better quality of the measurement of the growth rates of GDP in volume terms, especially for the more recent periods. Appropriate techniques have been developed and the trends of structural change (for example, composition of outputs and intermediate consumption) during the previous years can be used to take forward the structures in SUTs, if no new structural information is available, for example, beyond benchmark years.

4.57. The experience from countries which have integrated the SUTs framework into the compilation of National Accounts suggests that the resources needed are similar as the resources for those countries following a more traditional approach with a separate SUTs compilation. It is therefore recommended that SUTs are compiled as an integrated process and a regular part of the compilation of the National Accounts. Reflecting that IOTs are produced with relatively few additional resources if a SUTs system is in place, the resource question turns in favour of an integrated and regular approach for the compilation of IOTs.

(f) Benchmarking, extrapolation using indicators, price and volume information

4.58. Planning a new system of SUTs is generally linked to a benchmark year for which the most important areas of the economy are covered by censuses and surveys. This is especially important when policy decisions are based on the levels of the figures, for example, the level of Gross National Income (GNI). Some detailed data sources are collected at more or less regular intervals and will not all be available for the benchmark year. Hence, figures that do not relate to the actual year will need to be corrected for the changes that have taken place between the reference period of the data and the period for which they are being used. This can be done using indicators for value or volume and price indicators.

4.59. When a balanced benchmark SUT exists, the compilation of SUTs for following (or previous) years will usually be considerably easier. It is possible to utilise information on the structures of the benchmark table to fill the gaps between those cells for which no new source data are available or to extrapolate as appropriate. For example, input structures will change over time and information on new input structures can then be utilised as they become available, replacing the extrapolated information. Taking into account that the other estimated structures are subject to uncertainty, it may be sufficient to review them with intervals of a few years, one at a time. Even when such structures are reused from the previous year, they will change over time as a result of balancing the SUTs. This could happen even more rapidly with the impact of globalization and the development of new products.

(g) Features of GDP in volume terms

4.60. When looking at the change in the economy over time, the main concern is often whether more goods and services are actually being produced now than at some time in the past. With productivity, however, the point of interest is whether this output is increasing relative to the inputs.

4.61. Over time, changes in current price GDP show changes in the monetary value of the components of GDP. These changes in value can reflect changes in both price and volume changes making it difficult to establish how much of an increase in the series is due either to increased activity in the economy (volume change) or to an increase in the price level. For productivity measures only volume changes are used. It is therefore useful to measure GDP in volume terms (preferably in previous years' prices), meaning excluding price effects, as well as in current prices. In most cases, the revaluation of current price data to remove price effects (known as deflation) is carried out by using price indices such as component series of the retail prices index or producer price index, to deflate current price series at a detailed level of disaggregation.

4.62. Internationally, constant price estimates and chain-linked volume measures are two common measures for volume change of GDP. Under the constant price method, a certain year is selected as the base year; constant price volume estimates of GDP for subsequent years are the aggregation of its components computed by multiplying the price of each component in the base year by its volume in the current year, and the real growth is derived from the comparison of constant price volume estimates at different years.

4.63. Under the chain-linked volume measures method, the annually re-weighted chain linking approach is adopted to compile the volume measures of GDP and its components. Firstly, the volume estimates of major components of GDP in current year are re-valued at preceding year prices, which in practice are calculated by "deflating" the current price values of sub-components by the relevant price indices. Secondly, the short term volume indices for different years, calculated by dividing the volume estimate of GDP from the initial step by the current price GDP in the previous year, are chain linked to a selected reference year in order to obtain a continuous time series of the chain volume indices of GDP and its components. The chain volume index series can be converted into the chained monetary series by multiplying the chain volume index by the current price value in the reference year

4.64. For some series, price indices for particular goods and services are used to deflate the current price series, such as components of the:

- consumer price index (CPI)
- retail prices index (RPI)
- producer price index (PPI)
- corporate services price index (CSPI)
- import prices
- export prices

4.65. "Double deflation" is the preferred method to estimate GVA in volume terms. This is achieved by deflating the value of output and the value of intermediate inputs separately to get corresponding volume measures, and then subtracting the latter from the former. This "double deflation" approach means that an industry's total output is deflated by the price of its primary and secondary output, while each intermediate input is deflated by its own price index.

4.66. This is in contrast to the single deflation method whereby GVA in current prices is deflated directly using an output based deflator to arrive at GVA estimates in volume terms. The "single indicator" volume estimates can also be derived in other ways, for example, deflating output with output price indices, assuming a constant GVA to total output ratios from the base year, or using volume indicators directly. This direct price deflation of GVA is not recommended by the SNA when using a single indicator method.

4.67. The SUTs provide a major advantage and a natural framework that allows for “double deflation” to be applied in a coherent and consistent manner across the National Accounts.

4.68. Chain-linked volume measure series are expressed as index numbers in which the series are simply scaled proportionately to a value of 100 in the reference year. These index numbers are volume indices of the ‘base weighted’ or ‘Laspeyres’ form.

4.69. Aggregate price indices are of the ‘Paasche’ or ‘current-weighted’ form. They are generally calculated indirectly by dividing the current price value by the corresponding chained volume measure and multiplying by 100. Examples are the GDP deflator and the households’ consumption deflator.

4.70. Value indices are calculated by scaling current price values proportionately to a value of 100 in the reference year. By definition such a value index, if divided by the corresponding volume index and multiplied by 100, will give the corresponding price index.

4.71. From the point of view of production, GDP at market prices is at best estimated with reference to annually compiled SUTs both in current prices and in previous years’ prices. The SUTs are compiled in previous years’ prices in order to achieve an accurate breakdown of value changes in subsequent years according to volume and price changes.

4.72. The base-year table provides the specific weights for each industry and product, used in the index formulae by which the price data are aggregated.

4.73. The great statistical benefit of a system based on previous years’ prices is the fact that the weights in the index formulae are always up-to-date, thus reflecting the structure of the recent past, and in turn, optimising the quality of the GDP growth rates in volume terms for more recent periods.

Choice of index number formulae

4.74. In order to calculate price and volume measures, a number of methodological choices have to be made, for example:

- which index number formulae will be applied; and
- whether a fixed base year or an annually changing base year will be applied.

4.75. Different index formulae can be applied using different weighting schemes. It is beyond the scope of this manual to discuss in depth the theoretical and practical considerations with respect to this choice. Chapter 15 of the 2008 SNA and the Eurostat (2016) provide much more details on the choice of index formulae.

4.76. Economic theory suggests that an index formula that assigns equal weights to the current year and the base year is to be preferred. This is one of the reasons why the SNA prefers, albeit not strongly, the so-called superlative indices, like Tornqvist and Fisher.

4.77. Although the superlative indices have a number of attractions, it should be noted they also have notable disadvantages:

- superlative indices are demanding in their data requirements and will increase the work burden significantly;

- superlative indices are less intuitive than Laspeyres and Paasche indices;
- superlative indices are not additively consistent, which is a serious constraint when applied in an accounting framework; and
- values change do not always equal volume change times price change.

4.78. From a practical point of view, a number of requirements can be imposed on the index numbers:

- The applied index formulae should be a good approximation of the changes obtained by the superlative indices;
- A change in value must be divided into a price change and a volume change without a residual;
- Values in volume terms for aggregates should equal the sum of values in volume terms of constituent parts, applying the same index formulae; and
- Additionally, it is sensible for the index formulae to be relatively straightforward and easy to interpret for users.

4.79. The last three requirements can only be met with the application of the Laspeyres volume index formula and the Paasche price index formula. The formulae underpinning these indices are shown below:

Laspeyres volume index

$$L_q = \frac{\sum p_0 q_t}{\sum p_0 q_0} = \frac{\sum p_0 q_0 \frac{q_t}{q_0}}{\sum p_0 q_0}$$

Paasche price index

$$P_p = \frac{\sum p_t q_t}{\sum p_0 q_t} = \frac{\sum p_t q_t}{\sum p_t q_t / \frac{p_t}{p_0}}$$

where p is the price and q is the quantity.

4.80. The characteristic for the Laspeyres volume index is that the volume changes of individual goods are weighted with the value of the concerning transaction in the base year.

4.81. The characteristic for the Paasche price index is that the price changes of individual goods are weighted with their value of the concerning transaction in the current year. The deflated values derived with this index formula combination can easily be explained as "values in prices of the base year".

4.82. It can be easily shown that the decomposition of value changes, in terms of volume and price changes, do not have a residual.

$$P_v = \frac{\sum p_t q_t}{\sum p_0 q_0} = L_q \times P_p$$

4.83. The deflation of values in current prices by using a Paasche price index gives:

$$P_v / P_p = \sum p_t q_t \Big/ \frac{\sum p_t q_t}{\sum p_0 q_t} = \sum p_0 q_t$$

4.84. This illustrates that the deflated aggregate equals the sum of deflated components, which means that additivity in the SUTs for volume estimates is assured. The use of Laspeyres volume indices and Paasche price indices ensures that the current price identities also hold in volume terms. This also means that after balancing:

4.85. For every product, the total supply equals total use, and for every industry, the total output equals total intermediate consumption plus gross value added and in volume terms, this is:

Total supply in volume terms	*equals*	Total use in volume terms
Total output in volume terms	*equals*	Total intermediate consumption in volume terms
	plus	Total value added in volume terms

Choice of the base year

4.86. By applying the Laspeyres volume index number formula, the volume changes are weighted with the values of the concerning transaction in a "base year". The question arises which year should be chosen as the base year. Generally speaking, there is a choice between a fixed base year and a changing base year.

4.87. With the method of fixed weights for a series of years, the weights are derived from a single year in the past. An advantage of this method is that with long time series of values at prices of the base year, the deflated components of aggregates exactly add up to the deflated aggregate. However, a very serious disadvantage is that volume changes of aggregates are calculated with outdated weights. This disadvantage is especially severe when relative prices change rapidly, and as a result, economic growth can be significantly misrepresented. In addition, the disappearance of products (for example, vinyl records, cathode ray tube televisions, etc.) or the appearance of new products (for example, mobile telephony, pharmaceutical tablets, iPads, etc.) can lead to notable distortion in the estimates of economic growth. Even with a fixed base year, you have to change it every five years, and then all previously published real growth rates will be revised – this change is often not welcome by users.

4.88. Applying a changing base year means that the weights are updated every year and are usually derived from the previous year. Since those weights are more up-to-date, a better approximation of the volume changes is obtained compared to the method of using fixed weights. The time series can be obtained by multiplying separately estimated year-to-year volume indices - this is called "chaining".

4.89. An important advantage of the chaining method is that the above mentioned misrepresentation of growth rates is avoided. In fact, chain-linked volume measures provide a more reliable measure of volume growth, provided individual prices and quantities tend to increase or decrease steadily over time. However, there is also a key disadvantage, in that when the time series are in prices of a fixed reference year, the deflated components of an aggregate then no longer add up exactly to the deflated aggregate. As a result "mathematical discrepancies" will appear that cannot be removed without distorting the underlying "actual" volume and price movements.

(h) Documentation

4.90. As the compilation of SUTs is a complex process, a thorough documentation of the basic data and the methods used, the problems encountered, solutions applied, and the results achieved is highly recommended. Such an annual (and/or quarterly, if appropriate) inventory is not only worthwhile for purposes of publication but also for internal use in the compilation process itself and future exercises. When SUTs have to be balanced, in particular information on the sources and methods of estimation for each single supply and use element is needed to evaluate and analyse industry and product imbalances. The documentation helps to evaluate the data quality and outline the strategy for balancing. Of course, the balancing steps should also be documented in order to avoid repeating changes and destruction of already balanced data.

4.91. Documentation of the various compilation steps can also point to missing data issues and problems of basic data quality. It is important that such findings are utilised as feedbacks to primary statistics and provide priorities to improving the compilation methodology. A documentation system for the SUTs should be seen in the frame of the overall documentation for the System of National Accounts data.

4.92. Producing a balanced set of SUTs for several years is like solving a puzzle. At first, all macroeconomic data, survey results, census results and other valid economic data on supply and use of products in the economy have to be collected. In a second step, missing data has to be estimated on the basis of harmonised methodologies and documented procedures. In the third and final stage, the balancing of the SUTs system is generating a consistent set of macroeconomic variables in current prices and in previous years' prices. Thus the documentation of all stages of the compilation of 'hard' data in terms of sources and 'soft' data in terms of estimates and adjustments, ideally for each cell of the SUTs system is key. In turn, a quality assessment using clear criteria for each cell can also be developed over time.

4.93. Links between survey data and final National Accounts data should be maintained in the system, in particular separately recording documentation on the survey data, coverage adjustments, conceptual and valuation adjustments, quality adjustments and balancing and coherence adjustments. Analyses of these types of adjustments over time and over successive exercises can also help to highlight any biases, incoherence in data sources, etc. and in turn, help to develop priorities and strategies for further improvements and investment.

C. Collect phase

4.94. The collect phase of the GSBPM (see Figure 3.2) consists of all the activities concerning the collection and gathering of all necessary information (data and metadata), using different collection modes (including extractions from statistical, administrative and other non-statistical registers and databases), and store them in an appropriate structured environment for further processing. Whilst it can include the validation of dataset formats, it does not include any transformations of the data themselves, as these are all done in the "Process" phase. For statistical outputs produced regularly, then this phase occurs in each iteration.

4.95. Generally, the compilation of SUTs and IOTs relies on the data sources used for calculating GDP according to the production, income and expenditure approaches. An overview of the range of data sources generally used is provided in Box 4.3.

4.96. It should be noted that this situation is reversed in some countries, such as Chile and Japan, which first clearly define the requirements of SUTs (and/or IOTs) and then undertake the surveys (regular and ad-hoc) to collect data to meet these requirements. Of course, this may be ideal for SUTs (and IOTs) but may also be more costly.

4.97. The compilation of SUTs is data demanding and in principle could be done based on many source(s) that could help to populate the SUTs. However, it is strongly recommended to have more regularly available data sources in terms of timeliness, which are also based on official statistics, preferably using the same business register sampling frame. It is also worth noting, many sources can provide data feeding into both the Supply Table and the Use Table for the respective industries/products as appropriate. For example, annual structural surveys provide details on both sales and purchases.

Box 4.3 Data sources generally used

Monthly, quarterly, annual, regular and ad hoc business surveys based on the business register sampling frame:

- Monthly business surveys covering production, distribution, construction and service industries and financial information like employment and turnover.
- Monthly surveys collecting price related details such as producer (input and output) prices covering all industries (for example, manufacturing and services), retail and consumer price indices, import prices, export prices, and earnings/wage prices.
- Quarterly business surveys covering areas like capital expenditure, inventories and profits.
- Annual business surveys covering structural business statistics for each industry:
  - Detailed information covering variables like turnover, employment, purchases, capital expenditure, inventories, holding gains, taxes and subsidies, etc.
  - Detailed sales by type of product.
  - Detailed purchases data by type of product covering intermediate-type products and capital-type product separately.
- Range of quarterly and annual surveys covering financial services, in particular financial assets and liabilities, international trade in services and foreign and direct investment.
- Economic censuses every 3 to 5 years.

Household based surveys:

- Living costs and food surveys – collecting details on expenditure by households.
- International passenger surveys – expenditure by residents abroad and non-residents expenditure in the domestic economy.
- Labour force surveys – collecting details on employment including hours worked.

Administrative data:

- Census – population estimates for grossing purposes for use in household based surveys.
- Pay and profits data relating to tax and employment records from collecting government departments as well as data covering self-employed incomes.
- VAT payments data and turnover subject to VAT by industry (and by product where differential rates exist) from the tax collecting departments.
- Imports and exports of goods data collected by customs.

Other government departments:

- Agriculture industry data from the Agricultural Ministry.
- Banking industry data from the Central Bank.
- Data on government incomes and expenditures from the Finance Ministry – expenditures will need to be split between the individual consumption and collective consumption categories. This source can also provide the full range of taxes receivable and subsidies payable.

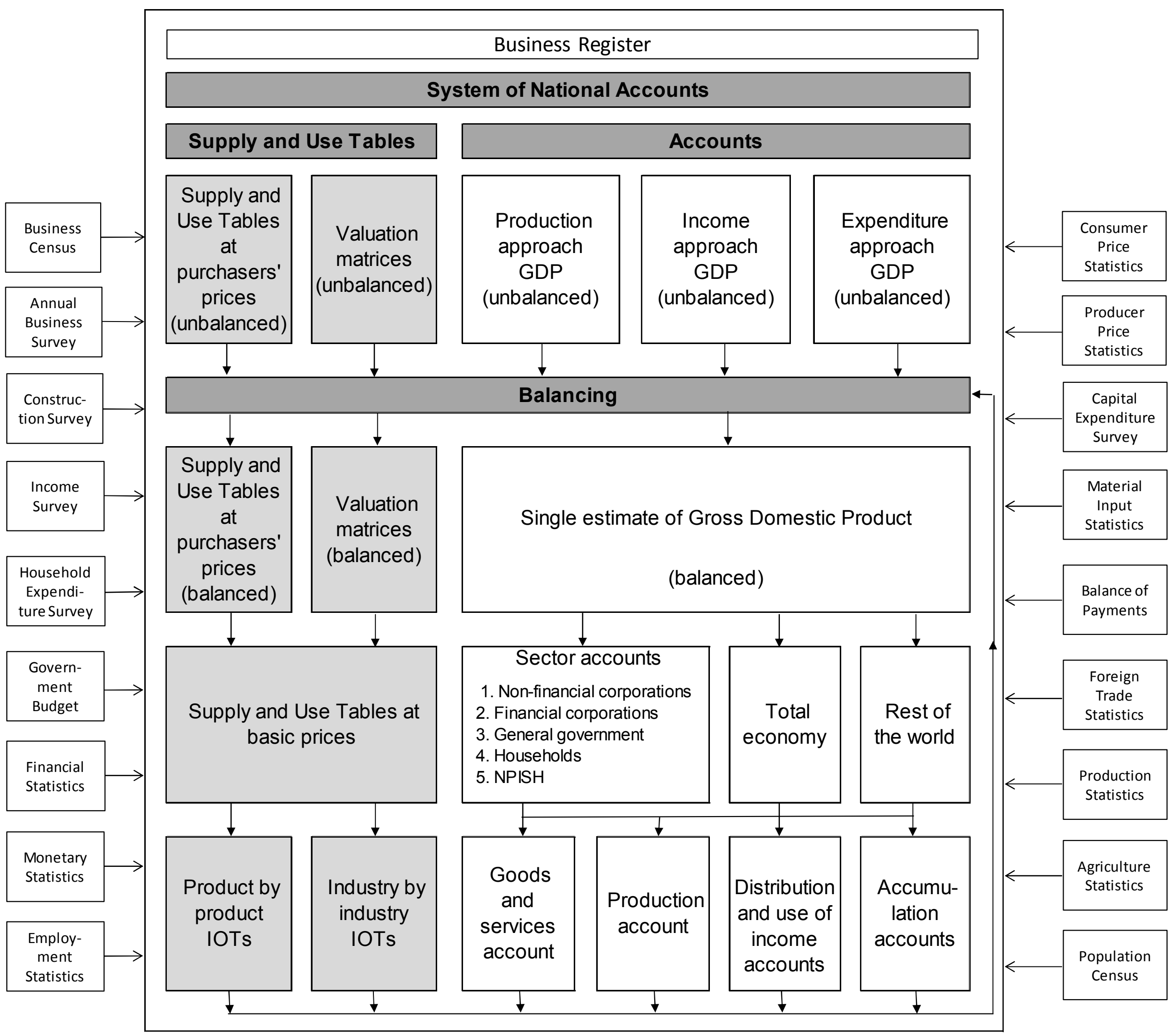
Other sources:

- Company annual report and accounts (in general, the direct use is limited, however these are often used for public supply companies like electricity, gas, water, postal services, telecommunications, etc. in many countries).
- Regulatory bodies' accounts.
- Insurance data from the insurance industry regulators.
- Airline data from the airline industry regulators.
- Financial detail from company websites which supplements the company annual report and accounts.

4.98. The compilation of SUTs whether done as an integral part of the compilation of National Accounts (as recommended in this Handbook) or done as a separate compilation from that of the National Accounts, is based to a large extent on the same data sources as those used for the National Accounts. Figure 4.1 expands on Figure 2.3 in Chapter 2 to shows the typical data sources used for the compilation of National Accounts which also feed in the compilation of SUTs and IOTs. Often the same source can provide data feeding into more than one of the approaches to measuring GDP. For example, the agriculture data from agricultural departments often feeds into all three approaches to measuring GDP, thereby ensuring natural consistency and coherency of the data used in SUTs.

4.99. In general, there is a strong correlation with the level of detail used within the SUTs and the quality of the product balances and the aggregates. The more disaggregated the level of industries/products ensures a higher degree of matching of individual products in terms of allocation of uses, prices, etc. and hence improving the quality. If the product level is too aggregated, the individual products may be too broad and heterogeneous, thereby of lesser quality.

Figure 4.1 Overview of SUTs and IOTs as part of the SNA compilation



1. Typical data sources

(a) Structural surveys

4.100. Many countries rely on annual structural type surveys which fit in naturally to the needs of the SUTs framework. One of the advantages of such a set-up is that it allows the collection of a range of variables from a single source - the statistical unit - thereby ensuring consistency and coherency of each variable and across variables. For example, the employment data will be consistent with the turnover data and, in turn, with the derived GVA data.

4.101. Where annual structural surveys exist, data for a number of key variables are collected with more detail supplemented from other surveys (for example, detailed purchases data). These variables can include:

- Sales of goods and services (and an appropriate product breakdown);
- Purchases of goods and services (and an appropriate product breakdown);
- Purchases and sales of goods for resale without any further processing (this helps to produce the trade margins by type of product);
- Changes in inventories (split between materials and fuels, work-in-progress and finished goods not sold is required as the first category affects intermediate consumption and the latter two categories affect output);
- Capital expenditure (and an appropriate product breakdown);
- Employment costs (and an appropriate breakdown);
- Taxes on products and production (covering business rates, excise duties, etc.);
- Subsidies on products and production (covering agriculture, transport, etc.); and
- Areas like research and development, and international trade in services, which link to other related surveys.

4.102. Often data compiled to respond to statistical regulations are used in the compilation of SUTs. For example, in the EU, various statistical regulations for EU Member States cover various business statistics derived from monthly, quarterly and annual surveys providing short-term indictors and structural business statistics. Data from many of these sources also feed into the compilation of SUTs. The Handbook on the Design and Implementation of Business Surveys, Eurostat (1998), provides a lot of detail on conducting such surveys.

(b) Administrative data

4.103. Administrative data forms a key data source for both the compilation of quarterly and annual national accounts and in some countries administrative data may be the main data source. The use of administrative data is growing due to several factors, such as good coverage, less resource impact on NSOs and lessening of the response burden.

4.104. Administrative data have statistical strengths and weaknesses vis-à-vis sample surveys. Apart from the low cost of obtaining administrative data, their major strength is that they commonly have complete, or nearly complete, coverage of whatever they relate to. So, there are no sampling errors and some non-sampling errors, such as those arising from an out-of-date business register and inadequate new business provisions, are either non-existent or minor.

4.105. The weaknesses of administrative data arise from the fact that they are by-products of administrative systems, which are not generally designed to meet the needs of the National Accounts. Examples of these weaknesses include the following:

- the available data do not meet national accounting definitions (for example, wages rather than compensation of employees, or a measure of depreciation that differs from the national accounting concept of consumption of fixed capital);
- purchases registered in the VAT system will usually include both purchases for intermediate consumption and for gross capital formation;
- the data are not recorded on an accrual basis (for example, exports and imports from customs are recorded as they cross the customs frontier and not when they change ownership);
- the data are incomplete (for example, movement of oil rigs in and out of territorial waters are excluded from customs data);
- the data may not be disaggregated in a desirable way (for example, government expenditures may not distinguish between wages and intermediate consumption or new motor vehicle registrations may not distinguish between household and business use);
- administrative data may be untimely (for example, company tax data); and
- administrative data can undergo change as a result of a change in policy.

(c) Business/company accounts based statistics

4.106. The values of outputs, inputs, gross capital formation, etc. have their counterparts in business accounts or government accounts but the concepts used in business accounting often do not completely follow National Accounts definitions. For more detail, see United Nations (2000) and Mahajan (2013). A few examples are listed below:

- Differences between concepts: Financial Intermediation Services Indirectly Measured (FISIM), insurance services, etc.
- Change in inventories: different valuations, correction for holding gains and losses, etc.
- Distinction between intermediate consumption and capital formation: acquisitions of machinery and equipment included in current expenses, etc.
- Distinction between intermediate consumption and compensation of employees: fringe benefits, links to own account production, etc.
- Business accounts do not always follow the calendar year. Often accounts that are closest to the calendar year can be used as an approximation for the annual values but it may be appropriate to correct figures

for some big enterprises that have accounts that cover other periods or may have large seasonal patterns, for example, the gas supply industry.

- Government accounts may use fiscal year that differs from the calendar year. It can be misleading to use the information for the nearest fiscal year as if it were identical to calendar year data. Annual data can be calculated by weighting together data for the two fiscal years that overlap the actual year. A better method is, however, to use quarterly or monthly information to split the data from each fiscal year into the shares belonging to different calendar years where such information exists.

(d) VAT based statistics

4.107. The VAT system usually provides statistics on those units that are covered by the business register, which will also use the VAT-registered businesses as a source. The business register generally includes the units that collect VAT on all or a part of their turnover and those that can deduct VAT on all or part of their purchases (capital or current).

4.108. The VAT based statistics may exist in published form but even when not published, it can usually be made available from the authorities that are responsible for collection of VAT with appropriate service level and confidentiality agreements in place. Typically, this source will contain information on VAT liable, zero-rated and VAT exempt turnover as well as deductible and non-deductible purchases with a classification by industries.

4.109. The VAT based statistics tend to be available on a quarterly as well as an annual basis, and it is usually available shortly after the reference period. A correction based on the final dates of payment may be necessary if the statistics show payments instead of accruals.

4.110. There are pitfalls to consider when using VAT based statistics for National Accounts purposes:

- The concepts used in VAT based statistics are different from those used in National Accounts. As VAT based turnover covers sales of products from own production, sales of traded goods as well as sales of used capital equipment, the VAT purchases cover purchases of goods and services for use as inputs, goods intended for resale as well as purchases of capital equipment. Before these figures can be used in National Accounts, the VAT purchases must be split into the different shares based on details payments.
- VAT based statistics do not show figures for units with activities that are not VAT liable and they may not include units with turnover below certain thresholds. Such thresholds differ from country to country but will often exclude a significant share of the smaller enterprises. The informal economy can – by nature – be assumed not to be included in the VAT based register sources.
- The industry classification of the VAT based units may not be the same as the classification used in national accounts.
- For practical reasons, the units accepted in VAT based statistics may be enterprises, KAUs, establishments, or even conglomerates of enterprises which are allowed a joint registration for payment of VAT.

4.111. Despite such caveats, the VAT based statistics may still be the most reliable data source for the size of some industries that are poorly covered by other sources. The figures from VAT based statistics should, however, be seen as the minimal size of the industries in question. It can be necessary to add values for units below the threshold values and VAT exempt units including those operating in the informal and hidden economy.

(e) Missing data

4.112. If certain data are not available in the official statistical system, the first option would be to check whether such data are available outside official statistics. An example is, for instance, when intermediate data on advertising costs are not available as a separate item in the business surveys. In this case, one possible source could be data from relevant trade associations observing the advertising market. Despite the fact that the data are often not comprehensive enough, or the classifications are different from the official ones so that data does not fully conform to the required concepts, these data certainly give a good indication of the advertising market over the various industries.

4.113. There may be a full set of data observations for a period, and then again for a later period. Various modelling techniques exist for generating estimates for the intervening periods to populate the SUTs, for example basic Holt-Winters approach (Holt, 1957; Winters, 1960). However, when balancing SUTs, these estimates should be treated as much lower quality compared to the more reliable and up to data estimates.

4.114. Furthermore, if no specific data are available, the expert advice of chambers of commerce, trade associations, research institutes or other similar organizations could be useful.

4.115. In certain industries, one or a few companies are the big players in that market. They could also be specifically contacted for expertise or requesting some of their internal data on a confidential basis. For example, telecommunication companies may provide their revenue data by type of customer, supermarket chains may be asked to provide data on their sales by products, major railway companies to provide data on the goods transported, and so on.

4.116. Annual company reports and accounts, publications of regulatory bodies and trade associations, and internet company web-sites are very useful sources of financial data for businesses and households.

4.117. Certain estimates can be based on the identities and coherence of the SUTs framework. This holds true for the application of the product flow method, where detailed supply data are used to estimate certain use data. The product flow method basically applies fixed allocations which will need to be reviewed each year. The method should be applied with great caution to populate SUTs and will depend on the level of product detail. The collection of primary data from various sources with data confrontation provides the best approach to populate SUTs and to achieve quality results.

(f) Exhaustiveness - methods of grossing up

4.118. Statistical sources usually exclude units with employment or turnover below certain thresholds while National Accounts data should include estimations for these missing units. The methods used for grossing up will typically be based on an estimate of employment in the excluded units, and assumptions on output, input, capital formation, etc. by employee. These assumptions should as far as possible reflect the conditions in comparable units but when the small units are not covered by source data, the grossing up procedure will necessarily add to the uncertainty of the estimated totals. It can also be expected that the structures of outputs and inputs of small units are somewhat different from those found in the units covered by collected data.

4.119. There is considerable interest in the phenomenon of the non-observed economy. This term is used to describe activities that, for one reason or another, are not captured in regular statistical enquiries, because they are underground, illegal, informal, household production for own final use, or just because of deficiencies in the basic data collection system. Guidance on the measurement of the non-observed economy is provided in OECD *at al.* (2002) and on the informal sector in ILO, 2013.

4.120. In countries where a significant share of total output and input is found in the informal economy, it can be appropriate to conduct specific surveys of this activity. To confront data on the supply and use of labour, useful information on this subject may actually be found in population censuses, household budget surveys or labour force surveys. In this respect, the SUTs framework, in which available source data are combined and balanced, provides the greatest potential to arrive at exhaustive estimates of economic activity.

Part B

Chapter 5. Compiling the Supply Table

A. Introduction

5.1. The first step in the compilation of SUTs and IOTs is the construction of an initial and unbalanced version of the Supply Table. The values entered into the tables should reflect, as far as possible, all available knowledge and data on the product structure of each column, although many values may need to be changed when the SUTs system is balanced. This applies to estimated totals as well as the values of supply of specific products.

5.2. Before balancing takes place, the estimates for domestic supply, imports of goods and services should be checked for credibility, and if necessary adjusted as appropriate. These will then form the starting point for the balancing process.

5.3. This Chapter focuses on the steps and data sources needed to compile this initial, unbalanced version of the Supply Table. Section B provides a more in-depth overview of the structure of the Supply Table. Section C focuses on the compilation of the domestic output table and the necessary compilation steps and Section D focuses on the compilation of the imports of goods and services. Annex A to Chapter 5 provides an example of a questionnaire collecting sales of goods and services, inventories of goods and trade related data.

B. Structure of the Supply Table

5.4. The Supply Table shows the supply of goods and services by type of product of an economy for a given period of time and distinguishes between the output of domestic industries and imports by type of product. The Supply Table is generally compiled first at basic prices reflecting the valuation of the data sources. As illustrated in Table 5.1, the Supply Table at basic prices contains two main parts: domestic output and imports of goods and services.

5.5. The domestic output matrix contains information on the supply of products by the different industries. The column for the imports of goods and services contain information on the total imports by products. The matrices for domestic output and imports of goods and services have the same row structure defined by categories of products. This structure allows the horizontal aggregation of all elements and the transition from total supply of products at basic prices to total supply at purchasers' prices.

Table 5.1 Numerical example of a Supply Table at basic prices

			INDUSTRIES								
			Agriculture (1)	Manufacturing (2)	Construction (3)	Trade, transport and communication (4)	Finance and business services (5)	Other services (6)	Output at basic prices (7)	Imports (8)	Total supply at basic prices (9)
PRODUCTS	Agriculture	(1)	8 782						8 782	3 271	12 052
	Manufacturing	(2)	796	182 982	643	1 808	133	44	186 405	124 590	310 995
	Construction	(3)	83	961	43 060	734	255	179	45 272	563	45 835
	Trade	(4)	1	4 773	311	54 204	640	257	60 187	600	60 787
	Transport	(5)	13	465	66	25 538	128	125	26 335	8 150	34 485
	Communication	(6)	160	1 781	139	43 912	1 253	982	48 228	6 234	54 463
	Finance and business services	(7)	29	8 902	698	7 588	106 909	3 381	127 508	7 061	134 569
	Other services	(8)	3	85	13	1 053	143	74 346	75 643	824	76 467
	Total	(9)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	151 293	729 653
Adjustments	CIF/FOB adjustments on imports	(10)								- 97	- 97
	Direct purchases abroad by residents	(11)								6 675	6 675
	Total	(12)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	157 871	736 230
	Total of w hich:										
	Market output	(13)	9 763	195 916	41 462	127 401	88 330	18 116	480 989		
	Output for ow n final use	(14)	104	4 029	3 468	2 134	19 890	2 670	32 295		
	Non-market output	(15)	0	4	0	5 302	1 241	58 528	65 075		

Austria 2011

5.6. The Supply Table at basic prices is then transformed to the Supply Table at purchasers' prices, through the addition of valuation adjustments represented by valuation matrices containing trade margins, transport margins, taxes on products and subsidies on products. Table 5.2 shows the valuation adjustments which are added to the columns of the Supply Table at basic prices to arrive to a total supply of each product at purchasers' prices.

5.7. The first step in the compilation of an initial version of the Supply Table involves therefore the compilation of data for total domestic output at basic prices and imports valued at CIF prices aggregated to total supply at basic prices. The second step involves the compilation of trade and transport margins, taxes on products less subsidies on products which are used to convert total supply of products at basic prices to total supply of products at purchasers' prices.

5.8. The data in the domestic output matrix are valued at basic prices which is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable by the producer as a consequence of its production or sale. The value of output of goods excludes any transport charges invoiced separately by the producer.

5.9. Data on imports by product from foreign trade statistics are usually valued at CIF prices. However, in the 2008 SNA and BPM 6, total imports of goods are valued FOB, an extra row for the CIF/FOB adjustments on imports has to be added in order to reconcile the different valuations. These adjustments are shown in row (10) of Table 5.1 and explained in detail in Section D. In addition, a further adjustment is added in the Supply Table to account for the direct purchases abroad by residents, this is shown in row (11) in Table 5.1.

5.10. These adjustment in the Supply Table (row (10) and (11) in Table 5.1 and Table 5.2) have corresponding entries in the Use Table (row (10) and row (11) in Table 6.1) under the columns for Exports and Final consumption expenditures by households. It should be noted that some countries do not show these estimates in the separate rows but consolidate the values across the product groups in the respective columns providing a different product balance.

Table 5.2 Supply Table at basic prices, including a transformation into purchasers' prices

			INDUSTRIES						Output at basic prices	Imports	Total supply at basic prices
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services			
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PRODUCTS	Agriculture	(1)	8 782	0	0	0	0	0	8 782	3 271	12 052
	Manufacturing	(2)	796	182 982	643	1 808	133	44	186 405	124 590	310 995
	Construction	(3)	83	961	43 060	734	255	179	45 272	563	45 835
	Trade	(4)	1	4 773	311	54 204	640	257	60 187	600	60 787
	Transport	(5)	13	465	66	25 538	128	125	26 335	8 150	34 485
	Communication	(6)	160	1 781	139	43 912	1 253	982	48 228	6 234	54 463
	Finance and business services	(7)	29	8 902	698	7 588	106 909	3 381	127 508	7 061	134 569
	Other services	(8)	3	85	13	1 053	143	74 346	75 643	824	76 467
	Total	(9)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	151 293	729 653
Adjustments	CIF/FOB adjustments on imports	(10)								- 97	- 97
	Direct purchases abroad by residents	(11)								6 675	6 675
	Total	(12)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	157 871	736 230
	Total of which:										
	Market output	(13)	9 763	195 916	41 462	127 401	88 330	18 116	480 989		
	Output for own final use	(14)	104	4 029	3 468	2 134	19 890	2 670	32 295		
	Non-market output	(15)	0	4	0	5 302	1 241	58 528	65 075		

			Total supply at basic prices	VALUATION MATRICES						Total supply at purchasers' prices
				Trade margins	Transport margins	VAT	Taxes on products	Subsidies on products	Total	
			(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	12 052	1 926	274	329	57	- 107	2 479	14 532
	Manufacturing	(2)	310 995	48 838	2 540	13 175	7 866	- 49	72 370	383 364
	Construction	(3)	45 835	0	0	1 529	13	0	1 542	47 377
	Trade	(4)	60 787	- 52 341	0	575	11	0	- 51 755	9 032
	Transport	(5)	34 485	0	- 2 800	558	71	- 448	- 2 620	31 865
	Communication	(6)	54 463	1 493	9	3 375	217	- 34	5 059	59 522
	Finance and business services	(7)	134 569	0	- 22	2 706	2 159	0	4 842	139 411
	Other services	(8)	76 467	85	0	1 201	576	0	1 861	78 329
	Total	(9)	729 653	0	0	23 447	10 969	- 638	33 778	763 431
Adjustments	CIF/FOB adjustments on imports	(10)	- 97						- 97	- 97
	Direct purchases abroad by residents	(11)	6 675						6 675	6 675
	Total	(12)	736 230	0	0	23 447	10 969	- 638	40 356	770 009
	Total of which:									
	Market output	(13)								
	Output for own final use	(14)								
	Non-market output	(15)								

Austria 2011

5.11. A distinction may be made in the SUTs between the three types of production: market output; output for own final use; and non-market output. However, in the domestic output matrix, these three categories of production are usually grouped together in the relevant industries and shown in three supplementary rows for each industry. Thus government services are distributed in the system to the various activities in which the government is engaged, for example, public administration services, education services, health services, recreation services, social welfare services, etc. but are shown together with the corresponding market producers. For example, health services provided by market and non-market producers (within the same industry) are shown as a total. Furthermore, the supplementary rows are for some industries useful for the link with the institutional sector accounts.

5.12. Although the supplementary rows make it possible to split output by industry to the three categories of output, there is no product dimension. Ideally, each industry could be shown separately (also reflecting different structures and links between the output and the inputs) or additional analyses produced for the user.

5.13. Imports of goods and services are classified by type of product. Since this table is designed to show the total supply by type of products, the valuation of imports of goods should be compatible with the valuation of the domestic production of goods. Imports by type of product are therefore valued at CIF prices which are comparable with the domestic output at basic prices.

5.14. Adding both components, production and imports, gives the total supply of products at basic prices.

5.15. The Supply Table at purchasers' prices is obtained by adding to total supply at basic prices, various valuation matrices (earned on both domestic output and imports) that allow moving from one valuation to another. The valuation matrices include:

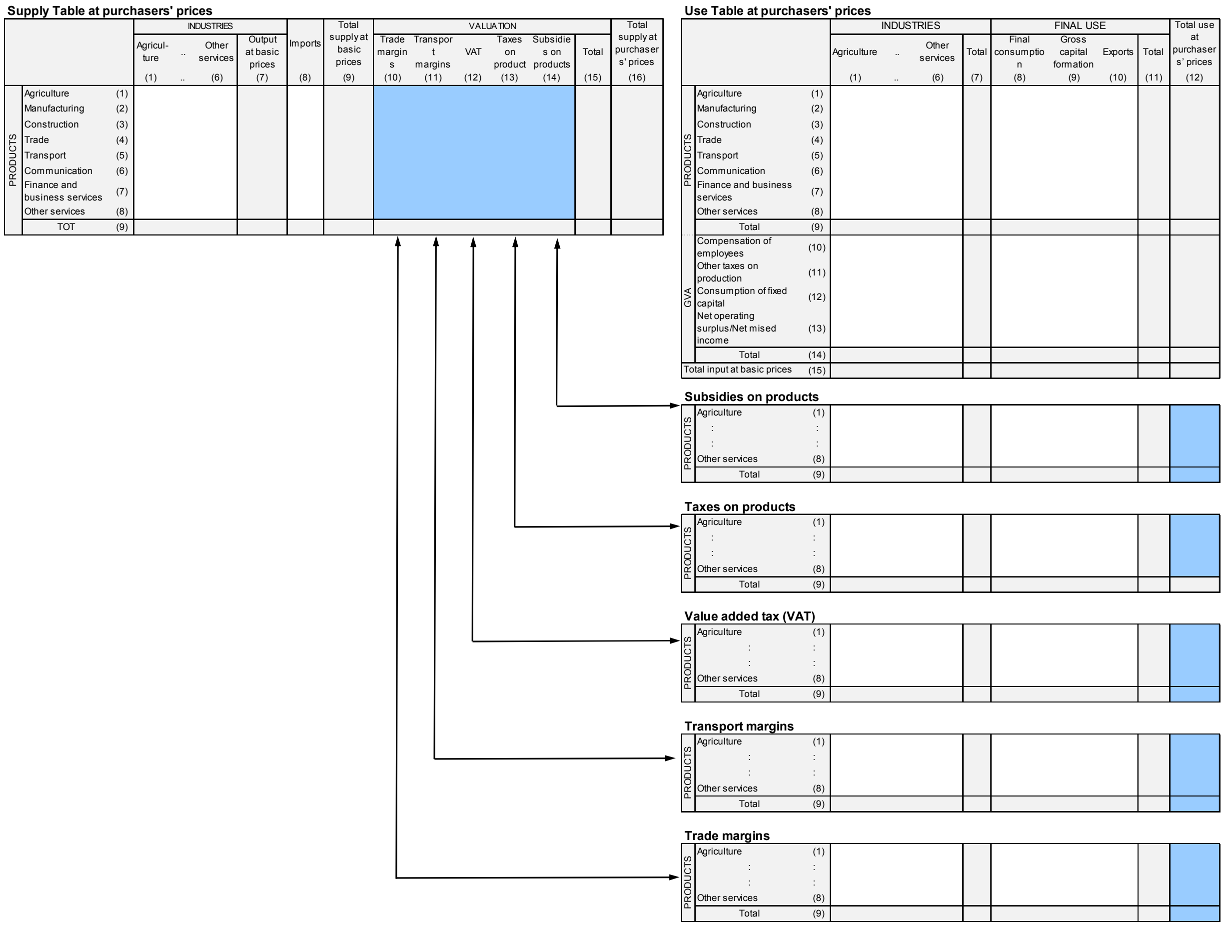
- Trade margins;
- Transport margins;
- Taxes on products (with non-deductible VAT treated separately from other taxes on products); and
- Subsidies on products (which are deducted).

5.16. It should be noted that when the Supply Table is shown with the final column summing to purchasers' prices, it is referred to as the Supply Table at purchasers' prices. This is actually just the Supply Table at basic prices with the valuation columns added. The production and import parts of the Supply Table have not been changed and remain valued at basic prices.

5.17. The task of compiling SUTs is a highly integrated process. This is particularly true for the estimation of the valuation vectors/matrices, where it is often necessary to rely also on estimates from the Use Table side in order to obtain the valuation vectors entered into the Supply Table. Figure 5.1 provides an overview of how the valuation matrix in the Supply Table is linked to a sequence of valuation matrices in the Use Table. The Figure also demonstrates the interconnections between the valuation matrices linking the Supply Table and Use Table. Therefore the estimation of the valuation matrices, considering both the Supply Table and the Use Table is dealt with in Chapter 7.

5.18. The rest of this Chapter focuses on the compilation of the Supply Table at basic prices.

Figure 5.1 Link between valuation matrices in the Supply Table and the Use Table



C. Domestic output

1. Structure of the domestic output table

5.19. The first and most elaborated part of the Supply Table is the domestic output matrix. This records data on the production of the economy classified according to two dimensions: the rows represent the type of products (based on the CPC Ver. 2.1) and the columns represent the different industry groupings (based on ISIC Rev. 4). Thus the domestic output matrix shows in the rows, a single product by producing industry and, in the columns, all the products produced by a single industry. However, albeit consistent with the CPC and ISIC, countries may use different and more detailed classifications, for example, reflecting country specific activities.

5.20. The domestic output matrix reflects the principal and secondary products of industries including by-products. It is the principal activity of the statistical unit that determines its classification to a specific industry. In the special case where the domestic output matrix is square (the number of products being equal to the number of industries), and the sequence of products arranged to reflect the sequence of the industries (based on their principal activities), the principal activity of an industry is reported on the diagonal of the matrix while the secondary activities of an industry are listed as off-diagonal entries.

5.21. However, in practice, it is common to have more products than industries. For this reason, the production part of the Supply Table is usually a rectangular matrix with more rows than columns as shown in Table 5.1. This reflects the fact that it may be more interesting to specify, for example, different kinds of agricultural crops, in the case of agriculture, and less interesting or practical to distinguish farms specialising in each of the possible sorts of crop. In this case, all the crops would still form the principal output of agriculture, whereas, for example, the production of wine or construction of buildings for own use would be treated as secondary output of the industry. The greater is the level of product detail, the more scatter of entries will be around the principal products. In these cases, it is not possible to observe directly the distinction of principal products versus secondary products/production in the rectangular domestic output matrix.

5.22. Annex A to Chapter 5 provides an extract of a survey questionnaire collecting data on sales of goods and services by type of product as well as other variables by product such as opening stocks (inventories), closing stocks (inventories) and trade margins.

5.23. Even though the "industry" concept is already being applied in the National Accounts, the existing level of detail or precise delimitation should not be taken as a constraint when compiling SUTs, and in particular when compiling benchmark tables. On the other hand, the way the statistical units are defined and classified in the business register and covered in basic statistics represents the real constraint on the possible choices concerning industries in the SUTs. Even though industries may, in the process of compiling SUTs, to some extent be redefined or otherwise modified relative to basic statistics, the options are much more limited than the range of choices available when it comes to the decision on the product classification to be applied.

5.24. The choice of level of detail for industries and products to be used in the SUTs must be based on a thorough examination of available statistics and considerations concerning the advantages of product details in balancing, in estimating margins and taxes on products by uses, final uses by purpose, and in volume estimates, etc. However, the general recommendation is to work with as much detail as possible, as any aggregation of basic statistics also implies a loss of information that could at some stage have contributed to the overall quality of the balanced SUTs. (See also Chapter 4)

5.25. It is also necessary to clarify any user requirements about the format that the final table should meet, including international reporting. In general, it would be an advantage to work at a more detailed level than warranted by current uses in order to extract maximum information from available data sources, and to be prepared for emerging new use as well as for transformation to comply with future changes to economic activity and product classifications.

2. Primary statistics and data sources

5.26. The structure of economic entities varies from small enterprises engaged in one or a few activities that are undertaken either at, or from, a single geographical location to large and complex enterprises engaged in many different activities. These enterprises may be horizontally or vertically integrated, that may be undertaken either at, or from, many geographical locations. The way producer units are defined, measured statistically, broken down or aggregated is of fundamental importance when compiling SUTs.

5.27. In practice, compilers of SUTs will not deal with the individual economic units but only with the aggregates of units in the form of industries usually based on current business statistics by economic activity. To fully understand the role of these statistics in the SUTs compilation, it is necessary to assess the delimitation of units influence the properties of the industries.

5.28. The most important prerequisite for the collection of basic statistics is the business register and the types of economic units held. Ideally business registers will contain two types of units, enterprise units and establishments.

5.29. Usually the enterprises form the core units of the business register, as they are easier to identify and track on a current basis because of their legal status. It depends on the adopted register policy how many establishments are created (i.e. how many enterprises are partitioned into establishments). Different geographical locations of the production units will be one important criterion for sub-dividing an enterprise into several establishments.

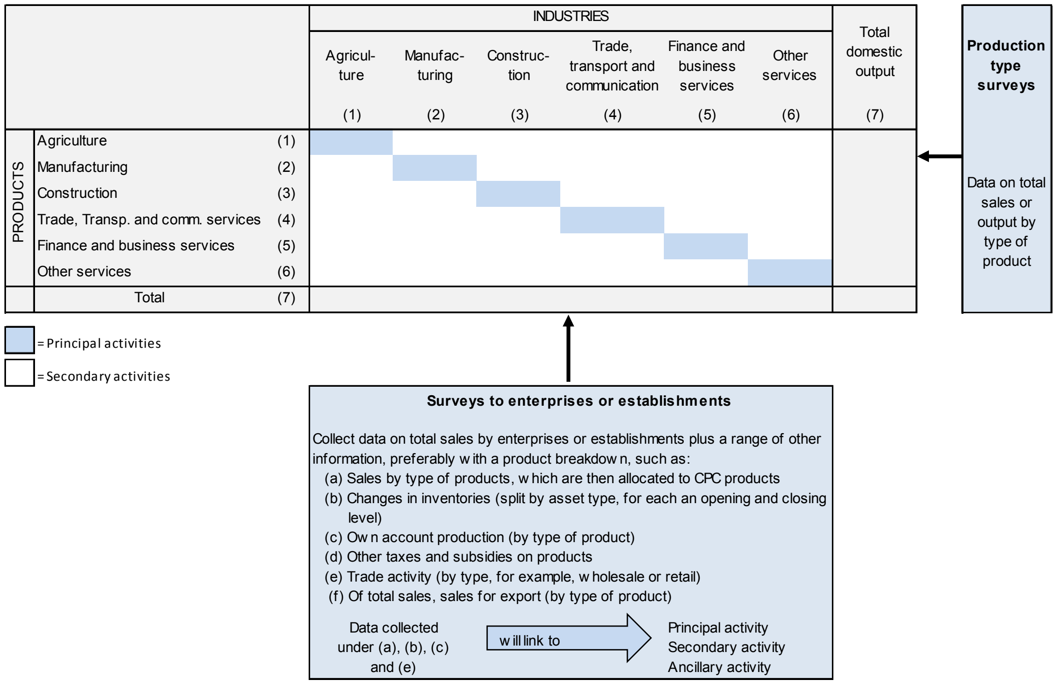
5.30. In the collection of basic statistics, the enterprise will usually be the collection entity, and to the extent that the enterprise is made up of several establishments, the enterprise will be requested to report a range of statistics for each of those establishments separately. This has implications for both the Supply Table and the Use Table, as some types of costs can only be reported at the enterprise level, whereas all regular production costs can be reported for the individual establishments.

5.31. As the large majority of enterprises are small or medium in size, and tend to engage in one kind of activity only, the enterprise and the establishment units may be identical in these cases. However, large enterprises which often contribute the major part of the production of an economy will often cover different kinds of economic activity and therefore formally be made up of several establishment units.

5.32. It is important to note that many primary sources, for example, enterprise surveys and production surveys, used to collect data feeding into the domestic output matrix, often also collect data at the same time through the same survey questionnaire but feeding into the Use Table (for example, the industries' input structures and GFCF). This approach provides a high degree of coherency and consistency of the data feeding into the SUTs.

5.33. The estimates of the domestic output matrix are usually based on two main types of sources of information: *enterprise surveys* and *production surveys*. Additional information, for example, administrative sources, company accounts, etc. will also be used. Figure 5.2 provides a simplified view of the different types of information used for compiling the domestic output matrix.

Figure 5.2 Different type of information for compiling the production matrix



5.34. Starting from the enterprise survey, its main objective is to supply information on the main structural characteristics of the different economic activities. The basic unit of this type of survey tends to be the enterprise. From this source, it is possible to estimate the total production by activity starting from its private accounting business systems. On the other hand, the production surveys allow the estimation of the total production by type of product.

5.35. Combining both sources of information, enterprise statistics and production statistics, it is possible to combine the data and obtain the production by type of product, by principal activities of the enterprise and by principal activities of the establishment that belongs to this enterprise. Thus, mainly for industrial products, the principal production and the secondary production of a product can be identified. In many cases, the lack of information makes it necessary to use reasonable assumptions about what products are produced by the industries as secondary production.

5.36. Many enterprises may perform some construction work, for example, own-account gross capital formation and minor maintenance and repair work. Often enterprises in the manufacturing and service industries are involved in either wholesale trade or retail trade or even both. Many service industry enterprises may provide retail trade services as a secondary activity. Finally, rental activities of real estate and of leasing of equipment are often secondary activities.

5.37. In basic statistics, output by products will usually be available for the goods producing industries like agriculture, mining and manufacturing industries, (at least for enterprises/establishments above a certain threshold), and similarly imports and exports of goods will be covered in great detail by external trade statistics. For service industries, a breakdown of output by individual kinds of services (as defined in the CPC classification) is less common, although many countries in recent years have developed such statistics. If there is a lack of product statistics for services, the output by the most detailed service activities of the ISIC may be used as proxy, assuming that all output consists of the services characteristic for that particular industry. Concerning the product breakdowns, construction will be placed between these two extremes.

5.38. For manufacturing units below a certain threshold, output statistics by products will usually be missing, whereas total output has been estimated based on either business surveys or administrative records. Working at the most detailed activity level available, output from these small units can be broken down into the products of the system, for example, by assuming that the composition by product is identical to what has been observed for the smallest category of those units for which output statistics by product exist. During the balancing process, this assumption may be modified and the output redistributed by product.

5.39. The products recorded in the domestic output part of the Supply Table should be output valued at basic prices at the time it is completed. For manufacturing industries, usually, only sales by product are given in the surveys, adjustments for change in inventories of finished goods and work-in-progress would need to be made to move from sales to output.

5.40. When information exists about opening and closing inventories by industry it can be assumed that the composition by product is identical to sales by product. By applying relevant price indices and assumptions about inventory valuation principles used by enterprises, the change in inventories of finished products and work-in-progress by product can be derived. However, as the reliability of these data by product is limited, and by definition, should always be identical on the supply side and the use side, there is no need to adjust the sales figures or enter them into the final use category of changes of inventories at this stage. In the system, it is actually the sales figures that are relevant for the distribution by users, and the estimated data for change in inventories can therefore just be imposed on the system after the balancing has been completed. This is, however, not the case for change in inventories of materials and fuels (recorded in the intermediate use part of the Use Table) and in trade. Change in inventories of agricultural products and mining products will usually have to be included in the system from the beginning as the output data will often not refer to sales but to actual output.

3. Principal and secondary products

5.41. The distinction between principal and secondary production has traditionally played a prominent role in I-O literature as the existence of secondary production requires some assumptions in order to compile IOTs. However, it should be noted, that a match between products and industries (determining in which industry a product is the principal output) is strictly speaking only necessary in those cases where the chosen techniques for deriving IOTs as a starting point requires the SUTs to be aggregated to square tables, where the sequence of the aggregated products is made comparable to the sequence of industries. For other techniques of compiling IOTs and for the purpose of the SUTs, there is no need for matching products and industries. Thus it should be noted that when Industry by Industry IOTs are derived on the assumption of fixed product sales structures, there is no need to first aggregate the rectangular SUTs.

5.42. When needed, the match between product and principal producer can be derived either theoretically (by identifying for each product the principal producer according to the ISIC definitions of the principal products of each industry - the correspondence keys are available on the UNSD classification website at: http://unstats.un.org/unsd/class/default.asp) or empirically (established by observing in the actual domestic output matrix, the industry being the main producer of each product).

5.43. In principle, the empirical match will be the most "precise" in the sense that it depicts the production relationships as they actually exist in this particular economy. The theoretical match may be the preferred approach when considering time series and international comparisons. These matching methods also demonstrate that the product classification applied when compiling SUTs can be chosen completely independently from the possible need to subsequently deriving square SUTs.

5.44. When the domestic output matrix is aggregated to a square matrix and arranged so that the entries for the primary products fall on the diagonal, the off-diagonal elements show the extent of secondary production. This is that part of a product which is produced by industries other than the one where it principally belongs either formally according to the industrial classification (theoretical aggregation key) or according to the industry which is actually the main producer (empirical aggregation key).

5.45. As the secondary production observed in the domestic output matrix depends on the level of aggregation both of products and of industries, secondary production does not possess any observable characteristics of its own. The elusive character of the concept of secondary production makes it difficult to justify that a product should be of particular interest statistically just because it is produced in two or more industries at a certain level of industry or product aggregation. When the industry and product classifications to be used in SUTs have been decided (inclusive of possibly redefinitions), the principal/secondary distinction plays no role in the following elaboration and balancing within the SUTs framework.

5.46. For most countries, the domestic output matrix is characterised by showing secondary production almost exclusively for manufacturing industries, whereas for most other industries, practically all of the production is found on the diagonal elements (or in the rectangular table – in the "diagonal field"). There are three main reasons for this:

- Basic statistics for manufacturing industries have traditionally included detailed product statistics and thus make identification of secondary production possible.

- For service industries, the diagonal structure is simply due to the fact that most often very limited details on the type of product breakdown on services are collected. Thus total output from establishments (or even enterprises) must be assumed to be primary output of the industries to which the units are classified in the business register.

- The activities of industries such as agriculture, construction and trade are often defined in a more pure form (the industries covering all their principal products, and only those) in the National Accounts and SUTs than in the business register. In this case, all secondary agricultural, construction and trade activities in other industries would have been transferred to their main activities. Alternatively, data for some activities may have been constructed in such a way that from the outset no secondary production exists, for example, the agricultural activity is measured as the sum of all agricultural products, construction activity as the value of new construction and repairs etc.

5.47. When the rectangular SUTs have been balanced, there may be a need to aggregate them into a square system either for dissemination purposes or for compiling IOTs by methods that require square SUTs. In a square system, the number of product groups must be identical to the number of industries, and furthermore, the products aggregated in such a way that the resulting product groups can be given corresponding "industry names", indicating the industry of which they are principal products. If aggregation is just made for dissemination purposes, the product aggregation could also be done to, for example, higher levels of the CPC - from which there, as mentioned above, is no direct correspondence to ISIC defined industries.

4. Ancillary activities

5.48. When the production of an enterprise takes place in two or more different establishments, certain ancillary activities may be carried out centrally for the benefit of all the establishments collectively. If a producer unit in that case is undertaking purely ancillary activities and is statistically observable, whereby separable accounts for the production it undertakes are readily available, or if it is in a geographically different location from the establishments it serves, it may be desirable and useful to consider it as a separate unit and allocate it to the industrial classification corresponding to its principal activity. Another exception is when some products are used both for own ancillary use and are supplied to another unit (see SNA 2008, paragraph 14.33). However, in SNA 2008, it is recommended that statisticians do not make extraordinary efforts to create separate establishments for these activities artificially in the absence of suitable basic data being available.

5.49. The fact that establishments, even at a detailed level, are classified to the same activity, does not imply that they are in all respects identical. Each establishment has its own unique institutional and organizational characteristics, which may influence the composition of its purchases as much as the underlying technical production processes. Two establishments producing identical products may have quite different input structures, depending on the degree of reliance on purchased semi-fabricated products, outsourcing of certain activities (see also Chapter 8, Section D on goods sent abroad for processing), whether it owns the capital equipment and buildings it uses rather than leasing or renting them, etc. and in general, on the degree of vertical integration of the various stages of the production processes. There is no way that these institutional characteristics inherent in the original source data are eliminated from the SUTs (or subsequently from the IOTs) nor does the SNA request the compilers to try doing so.

5.50. Institutional arrangements of production do not only differ between establishments classified in the same industry but also across countries and over time. It is obvious that viewing the SUTs (and the IOTs) as portraying the technical characteristics of a production system has serious limitations. From a statistical point of view the achievable elimination of institutional arrangements is obtained by applying establishments as production units (with the possible additional partitioning of vertically integrated enterprises mentioned as covered above), as establishments are designed with this purpose in mind and there are no official statistics providing production structures below this level.

5.51. In some countries, the recommended establishment unit approach may not be achievable in practice as for legal, practical or historic reasons statistics are only collected for enterprise units. Even though compilers of the SUTs may in this situation try to break down the most important multi-activity enterprises into their constituent establishment units there is in general no feasible alternative to working with the existing data. In this case, it is still possible to compile SUTs although the overall picture of the productive system will become less precise and to some extent blurred, which will also affect the resulting SUTs and IOTs adversely.

5.52. It should, however, be recognised that important objectives of compiling the SUTs may also be achieved when the data are based on enterprise units (see SNA 2008, paragraph 14.21), although some product flow and common sense type procedures may be more difficult to apply because of the less stringent definition of industries, as the composition of output from the enterprise units will also be crossing the borderlines between sections of the ISIC. For these reasons, an enterprise based approach will in general require more complete coverage of statistical source data. It should also be realised that there are no automatic methods available that can disentangle this dataset and transform it into SUTs or IOTs with analytical properties comparable with those resulting from SUTs based on establishment type units. Depending on the specific circumstances it may in such cases be decided to just compile SUTs and not IOTs.

5. Redefinitions

5.53. Redefinitions refer to adjustments made to the source data relative to the way they are obtained from the primary statistics in order to obtain more "pure" industries for use in the SUTs. This is an exception to the previous mentioned rule that SUTs compilers should not attempt to create their own versions of basic statistics. That would be neither cost effective nor supportive for the comparability of SUTs to other economic statistics or internationally. In practice, deviations from the way enterprises or establishments are defined in the business register and reflected in primary statistics should be limited in scope.

5.54. Such redefinitions can be seen as implementing the SNA recommendation to partition vertically or horizontally integrated enterprises or establishments that have production in two or more sections of the ISIC Rev. 4 (2008 SNA, paragraphs 5.52-5.54). Redefinitions are generally carried out "by hand" using product specific input-structures based on specific insight into the activities so that the results will come as no surprise or give rise to negative elements, as might have been the case if more automatic methods were applied. By reducing secondary production, redefinitions facilitate the subsequent compilation of IOTs, and compilers of SUTs should be aware of how the choice of compilation techniques will affect the subsequent calculation of the IOTs.

5.55. Redefinitions (more background is provided in Box 5.1) are usually concentrated on a few major activities, such as agriculture, energy, construction and trade, or a few major enterprises, for example, mining operations. Redefinitions affect all those activities from which secondary output is being removed. For some activities, redefinition-type adjustments may have been carried out already in the source data, for example:

- The EU System of Agricultural Accounts requires that all agricultural activity is covered by these accounts and there are very limited possibilities to retain non-agricultural secondary production within the system definition of agriculture.
- All rented dwellings are usually grouped together in one single industry (together with owner-occupied dwellings) independently of the activity of the actual owner.
- Trade activities outside the trade industries (trade as secondary activity), by definition, have already been separately identified when compiling the National Accounts, as only the trade margins and not the gross turnover of the traded products should be counted as output, and may have been grouped together with trade as primary activity.
- Construction activities are also frequently redefined to form one single "pure" construction activity, often because total output has been defined by adding up the values of specific types of construction output rather than output from building establishments, or alternatively input being determined from the supply of construction materials. Any of these approaches will also facilitate the distribution of building materials for intermediate consumption.

Box 5.1 Redefinitions

In Miller and Blair (2009) (page 141) redefinitions are defined as: "Factoring out the amount of secondary products produced as well as the inputs used in that production and reassigning both to the industry for which the product is classified as primary".

Further a distinction is made between **specific redefinition** and **mechanical redefinition** (page 215), where the former is the "by hand" procedure and the latter refers to the various mathematical procedures that can be applied to eliminate secondary production when producing IOTs from SUTs (covered in Chapter 12 of Miller and Blair (2009)).

The specific redefinition or *two-step process* emerges from the practice in several countries. It is explained in detail for the United States in Guo J. *et al*. (2002). The BEA paper was presented at the 14th International Input-Output Association Conference in Montreal, Canada 2002. The article also analyses the differences between the resulting tables when redefinitions are not applied (Case 1), and when they are applied (Case 2).

The redefinition method is also used in Canada and Denmark whereas Industry by Industry IOTs in Norway are more of the Case 1 type to retain to a maximum degree of micro-macro link.

The Industry by Industry IOTs of the Netherlands seems to fit somewhere between Case 1 and Case 2.

In France, the first step (redefinition) based on enterprise units and is carried out to an extent that the Supply Table becomes diagonal. The Use Table thereby also form the IOTs, and the second step (compiling the IOTs) becomes superfluous.

5.56. Although the redefinitions serve the purpose of creating more pure activities and thus facilitates I-O analysis, their main purpose is to arrive at an activity classification that is applicable for use in the National Accounts, and thus supportive to the integrated compilation of SUTs and National Accounts. Three different situations can be distinguished:

- Case 1 - no redefinitions take place in the national accounts, the SUTs and the Industry by Industry IOTs.
- Case 2 - redefinitions have been carried out for all national accounts data and in the SUTs prior to the calculation of the Industry by Industry IOTs.
- Case 3 - redefinitions are not carried out when the current national accounts are compiled but applied when the SUTs and the Industry by Industry IOTs are compiled.

5.57. In the first two cases, the consistency and comparability between the current national accounts (tables by industry), the SUTs and IOTs classifications are upheld but not in the third case. Ideally, the choice of redefinitions should be introduced already in the general classification of industries used in National Accounts. Not only will the redefinitions "by hand" be more precise at these earlier stages, but they will also facilitate the balancing of the system as a lot of small inputs entries to a large number of cells of the Use Table will be avoided.

D. Imports of goods and services

1. General description and definition

5.58. The second part of the Supply Table covers the total imports of goods and services. In National Accounts, imports refer to transactions that occur when there are **changes of economic ownership** of goods between residents and non-residents whether or not there are corresponding physical movements of goods across frontiers.

5.59. The main source of data for imports of goods is international merchandise trade statistics. International standards are given in International Merchandise Trade Statistics: Concepts and Definitions (IMTS 2010) (United Nations, 2011). The main source of data for import of services is either the details available in the Balance of Payments (BoP) statistics or specialised statistics on international trade in services (for example, business surveys) according to the international standards given in the Manual on Statistics of International Trade in Services 2010 (MSITS 2010) (United Nations *et al.* 2011) in connection with product classifications.

5.60. Some differences exist, however, between the concepts used in international trade statistics and the 2008 SNA and BPM 6, and therefore adjustments are needed to the basic statistics in order to use them in the SUTs. The BPM 6 identifies sources of difference between the IMTS and the 2008 SNA and BPM 6 concepts of imports that may occur in countries. In this regard, it recommended that a standard reconciliation table be compiled to assist users in understanding these differences.

5.61. One major difference is the valuation used to record imports of goods. While IMTS 2010 uses a CIF valuation for imports, the 2008 SNA and BPM 6 uses a uniform FOB valuation for both exports and imports of goods. The 2008 SNA states that:

> "Imports and exports of goods are recorded in the SNA at **border values**. Total imports and exports of goods are valued free-on-board (FOB, that is, at the exporter's customs frontier). As it may not be possible to obtain FOB values for imports for detailed product breakdowns, the tables containing product details on foreign trade show imports of goods valued at the importer's customs frontier (CIF, that is, cost, insurance and freight), supplemented with a global adjustment to FOB values. CIF values include the insurance and freight charges incurred between the exporter's frontier and that of the importer. The value on the commercial invoice may of course differ from both of these". (See 2008 SNA, paragraph 3.149)

5.62. The adjustments for the FOB and CIF valuation of imports are described in more detail in the next section.

5.63. Another difference is the time of recording. In the 2008 SNA and BPM 6, the time of recording of imports and exports correspond to the time the ownership of the goods is transferred. In contrast, IMTS follow the timing of customs processing. While this timing is often an acceptable approximation to the change of economic ownership principle, adjustments may be needed in some cases, such as for items with large values or goods sent on consignment (that is, dispatched before they are sold). It should be noted, in the case of goods sent abroad for processing with no change of economic ownership, the values of goods movements are included in the IMTS-based recording but are to be excluded from the ownership based recording in the National Accounts and Balance of Payments. However, the values of goods movements are recommended as supplementary items in the Balance of Payments to understand the nature of these arrangements.

5.64. Other adjustments to IMTS may be needed to bring estimates into line with the change of economic ownership of goods, either generally or because of the particular coverage of each country. Possible examples include:

- Merchanting;

- Non-monetary gold;
- Goods entering or leaving the territory illegally;
- Goods procured in ports by carriers; and
- Goods moving physically but where no change of economic ownership has taken place such as "operating leasing".

5.65. To maintain consistency with BPM 6, the 2008 SNA introduced new treatment relating to merchanting and goods sent abroad for processing. **Merchanting** is a process whereby a unit in economy X purchases goods from economy Y for sale in economy Z (sometimes within economy Y itself). The goods legally change ownership but do not physically enter the economy where the owner is resident. By convention, the purchases of the goods intended for resale is shown as negative exports. When the goods are sold, they are shown as [positive] exports. When the purchase and sale take place in the same period, the difference is shown as an addition to exports. If the purchase takes place in an accounting period, the negative export is offset by an increase in inventories of goods for resale, even though those goods are held abroad.

5.66. The "surplus" on this item in the foreign trade statistics is by its nature a trade margin and should be included in the output of the industry, in the main, this activity is predominantly in the trade industry. In exceptional cases, this may lead to an overall deficit on the item in the foreign trade statistics but the trade margin would usually still remain positive (the deficit + changes in inventories). As indicated, trade margins from merchanting activity mainly occur in the trade industry but can occur in many other industries, unless all trade is redefined to the trade industry. Given business statistics provide source data as a starting point for the compilation of SUTs, then merchanting activity can appear in various industries, for example, oil companies and pharmaceutical companies.

5.67. The new treatment of **goods sent abroad for processing** is dealt with in more detail in Chapter 8 of this Handbook.

5.68. A special category within imports is the **direct purchases abroad by residents**. This item covers all purchases of goods and services made by residents while travelling abroad for business or pleasure. Two categories must be distinguished because they require different treatments:

- Expenditure by resident business travellers. This item refers to intermediate consumption of several industries to which the travellers belong (in the Use Table) and imports of services (in the Supply Table); and
- Expenditure by other resident travellers on personal trips. This expenditure is recorded in Final Consumption expenditures by Households (in the Use Table) and imports of services (in the Supply Table).

5.69. Imports broken down by products in the SUTs do not include direct purchases abroad by residents. Consequently, these have to be included in an adjustment row to obtain the overall value of imports (row (11) in Table 5.1).

5.70. In Table 5.1 and Table 5.2, the estimates for CIF/FOB adjustment on imports and the direct purchases abroad by residents are shown separately in the rows. However, it should be noted that some countries do not show these estimates in the separate rows but consolidate the values in the product groups in the respective columns. This situation in turn leads to different product balances but no change to the imports aggregate total.

This is often due to the coverage of the data sources, and in these cases, appropriate adjustments should be applied to extract the corresponding entries to generate the separate entries.

5.71. Goods procured in ports by carriers may be included in a similar adjustment row. It should also be noted that imports and exports of ships and air planes may have to be given special attention as these transactions may be following special procedures of recording in the external trade statistics that may not be consistent with the way output or GFCF should be recorded in the National Accounts.

5.72. Imports of goods and services in SUTs are dealt with in more detail in Chapter 8.

2. The valuation for imports - the CIF and FOB valuation

5.73. In the 2008 SNA and BPM 6, the total imports of goods are valued FOB. However, the data on imports by detailed products from the foreign trade statistics used in the SUTs are usually available at CIF prices following the International Merchandise Trade Statistics (United Nations, 2011). To reconcile the different valuations used for total imports of goods and for the product components of imports, two types of adjustments are needed. These adjustments are presented below.

(a) Data adjustment

5.74. The first type of adjustment must be made to the data of the Balance of Payments prior to entering data from this data source into the SUTs system. This adjustment is necessary in order to start from a consistent set of data for imports and exports of goods and services that can be balanced across the SUTs. This adjustment is illustrated in Table 5.3.

5.75. The starting point is the account for the rest of the world as shown in columns (1) and (2) of Table 5.3 (which mirrors the Balance of Payments according to BPM 6), where (only) the entries for goods and services are shown and where imports of goods are valued FOB (372 in column (2) of Table 5.3). This is the value of the goods at the point of exit from the exporter's economy, including transport charges and trade margins up to the point of the border. The CIF value of imports (382 in column (6) of Table 5.3) of goods measures the value of a good delivered at the point of entry into the importing economy. The difference between the two values (10 in column (4) of Table 5.3) is made up of the costs of transportation, insurance and other expenditures between the point of exit of the exporter's country and the point of entry into the importers country.

5.76. The services linked to the difference between the FOB and CIF values can be delivered by either resident producers or non-resident producers. To the extent that non-resident producers are involved, the BPM 6 imports of services must be reduced with their services (7 in Column (4) of Table 5.3) to avoid double counting, as these services are now included in the CIF value of the imported goods. Adjustment for the services delivered by resident producers (3 in Column (3) of Table 5.3) is a bit trickier, as a service that according to the BPM 6 definition is a purely domestic transaction should now appear as an import of services included in the CIF value of imported goods. As this import originates from resident producers, it is necessary to introduce a balancing service export of the same value.

Table 5.3 Data adjustment for external trade of goods and services

	SNA/BPM Balance of Payments		Introducing imports CIF		SUTs Balance of Payments	
	Uses (FOB)	Resources (FOB)	Uses	Resources	Uses (CIF)	Resources (CIF)
	(1)	(2)	(3)	(4)	(5)	(6)
Imports of goods		372		10		382
Exports of goods	462				462	
Imports of services		84		-7		77
Exports of services	78		3		81	
Total	540	456	3	3	543	459
Balance		84		0		84

Note: In practice there will be a further breakdown of both goods and (in particular) services in the Balance of Payments, and therefore, also for the adjustments in Columns (3) and (4).

5.77. In Table 5.3, all data adjustments are shown in columns (3) and (4), and the resulting "SUTs Balance of Payments" in columns (5) and (6). It is noted that the balance of the adjustment items is zero, and consequently, the surplus on the transactions in goods and services (84 in column (2)) is identical in the two alternative ways of presenting the external transactions.

5.78. The "SUTs Balance of Payments" represents the framework of source data for external trade for SUTs with the appropriate product breakdowns. The composition by specific services making up the CIF and FOB difference will usually be available from the working tables of the Balance of Payments compilers, as their starting point for the FOB recording of imports will usually have been imports of goods from the external trade statistics valued at CIF. Regular surveys may also have been carried out to inform about the CIF and FOB difference and the related service structure.

5.79. It is important to underline that the above data adjustment is **not** the CIF and FOB adjustment often seen as a separate row in SUTs or IOTs. The data adjustment must be made before starting compiling SUTs. At the detailed product level, the supply and use of the individual services are adjusted so that they can meaningfully be balanced under the CIF valuation of goods, and these data adjustments will not be separately identifiable in the completed SUTs.

(b) The CIF and FOB adjustment row

5.80. The CIF and FOB adjustment is an **ex post** adjustment made at the macro-level to the totals for exports and imports of goods and services to derive the corresponding totals found in the System of the National Accounts (the goods and services account and the rest of the world account).

5.81. In principle, the purpose of this adjustment is to demonstrate that the data in SUTs are consistent with the rest of the National Accounts and to avoid double-counting of CIF type services provided by residents. The CIF and FOB adjustment row has no balancing or other methodological functions in the SUTs, and it may be omitted from the SUTs as well as the IOTs if there is no special need to maintain the exact conceptual relationship to the National Accounts.

5.82. Table 5.4 illustrates the place and contents of the CIF and FOB adjustment row in SUTs, here albeit limited to containing external trade data only.

Table 5.4 CIF and FOB adjustment row

	Supply Table Imports		Use Table Exports	
	Goods	Services	Goods	Services
SUT total	382	77	462	81
CIF/FOB adjustment	-10	7		-3
BOP total	372	84	462	78

5.83. The row "SUT total" contains the totals for imports and exports of goods and services in the balanced SUTs system, consistent with the "SUTs Balance of Payments" in Table 5.3.

5.84. In order to obtain totals for the external transactions identical to those found in the rest of the National Accounts (and the Balance of Payments), the adjustments shown in the row "CIF/FOB adjustment" of Table 5.4 are introduced. These adjustments mirror those that were made as data adjustments in Table 5.3. However, the two types of adjustments have quite different roles:

- Those in Table 5.3 relate in principle to columns of the SUTs and must necessary be carried out prior to the balancing, and there is no way to avoid this adjustment.
- On the other hand, the CIF/FOB adjustment in Table 5.4 is a kind of "memo" row of the SUTs that can be added ex-post, or even be omitted if there is no need to demonstrate consistency with the National Accounts.

5.85. It should be noted that if goods and services are lumped together in SUTs, the CIF/FOB adjustment row will only contain the adjustments item -3 for both imports and exports.

5.86. From a bookkeeping perspective, the **data adjustment** for exports of services (3 in Table 5.3) could alternatively be recorded as a negative import, even though this recording implies a less logical explanation of how the domestic output of services are disposed of and also requires that existing imports of those services are sufficient to prevent a negative net result.

5.87. With this approach, there would be adjustments in Table 5.3 for imports only, showing identical numerical changes for goods and services, respectively. The CIF/FOB adjustment row in Table 5.4 would in this case have entries only for imports (-10 for goods and +10 for services), and if imports were not shown separately for goods and for services, the CIF/FOB adjustment row would be empty. Further details covering issues of consistency in the SNA are provided in Box 5.2.

Box 5.2 Consistency issues with the CIF/FOB adjustment

The CIF/FOB adjustment is dealt with in both the *Eurostat Manual of Supply, Use and Input-Output Tables* (Eurostat, 2008) and in the Supply and Use Table Chapters 14 and 28 of the 2008 SNA.

In the numerical example in Eurostat (2008) (pages 60, 70 and 122), external trade in goods and services are lumped together and, as explained above, for this case, the CIF/FOB adjustment row therefore contains identical negative adjustments for imports and exports. In the more elaborated numerical example (pages 113-115) where comparisons are also made to the treatment in the 1993 SNA, ex ante data adjustments are mixed up with the ex post CIF/FOB adjustment in a complicated manner.

The CIF/FOB adjustment table has both a column and a row dimension, and the final outcome is incorrect because the ordinary export of services linked to exports of goods are included in the adjustment.

The exposition of the CIF/FOB adjustment in the 2008 SNA is unclear because it starts out from the assumption that the SUTs have been balanced using inconsistent data, namely imports of goods valued CIF, and services as defined as in the BPM 6 based on imports being valued FOB. This shortcoming can obviously not be remedied by ex post adjustments to columns and rows, as any new column data would require a new balancing of the SUTs.

The final outcome in the 2008 SNA are SUTs with a CIF/FOB column in the Supply Table (Table 14.12 of the 2008 SNA) in addition to the CIF/FOB adjustment row with adjustments for imports only (the resident producers' delivery of services linked to imports CIF being treated as negative imports).

If the CIF/FOB adjustment column in the Supply Table (Table 14.12 of the 2008 SNA) is added to the column for imports of services, services as defined in the "SUTs Balance of Payments" are obtained, so that in principle this could be taken to indicate the ex-ante data adjustment but this is not easily understood from the exposition, and to complete the lack of clarity the CIF/FOB adjustment is being distributed by user (in Table 14.15 of the 2008 SNA), a step for which there is no explanation.

Annex A to Chapter 5: Example questionnaire collecting sales of goods and services, inventories of goods and trade related data

A5.1 The extract shown in Figure A5.1 is from a business survey questionnaire from the Statistical Office of the Republic of Serbia. The data are collected for each industry and by product covering the:

- Sales of goods produced by the enterprise;
- Closing stocks of products and work in progress;
- Sales of merchandise;
- Trade margin; and
- Closing stocks of goods for resale.

A5.2 The full coverage of goods and services produced to calculate the industry totals is achieved via further tables collecting data on the sales of industrial and non-industrial services, an extract is shown in Figure A5.2. This data allows for the calculation of industry output by product and trade margins required to populate the domestic output part of the Supply Table and the trade margins column as shown in Table 5.2. In some countries, opening stock values are collected.

Figure A5.1 Extract of questionnaire covering sales of goods, inventories of goods and trade activity

No.	Code	Product description	Sales of goods produced by the enterprise (group of accounts 61)	Closing stocks of products and work in progress (group of accounts 10 and 11)	Sales of merchandise (group of accounts 60)	Trade margins amount rate %	Closing stocks of goods for resale (group of accounts 13)
1	2	3	4	5	6	7	8
1000		TOTAL					
		AGRICULTURAL PRODUCTS, RAW AND UNPROCESSED PRODUCTS OF PLANT AND ANIMAL ORIGIN					
1001	01.11.1 - 01.11.4	Cereals, all kinds (except rice), cereal seeds					
1002	01.11.6, 01.11.7	Green leguminous vegetables (beans, peas, lentils and other)					
1003	01.11.8	Soya beans, groundnuts (row) and cotton seed					
1004	01.11.9	Other oil seeds - sunflower, sesame, flax, etc.					
1005	01.11.12	Rice, not husked					
1006	01.13 except 01.13.7	Vegetables, raw and seeds					
1007	01.13.7	Sugar beet and sugar beet seed					
1008	01.13.8	Mushrooms and truffles					
1009	01.15	Unprocessed, raw tobacco					
1010	01.16	Fibre crops (flax, cotton, hemp and other, used in textile industry)					
1011	01.19.1	Forage crops and vegetative matter for livestock feeding unprocessed form					
1012	01.19.2	Flower and flower seeds					
1013	01.21	Grapes					
1014	01.22, 01.23	Tropical and subtropical fruits, all kinds (including citrus, figs etc.)					
1015	01.24, 01.25 except 01.25.3	Other fruits, tree and bush fruits, except nuts (apples, pears, cherries, berries etc.)					
1016	01.25.3	Nuts (almonds, hazelnut, walnuts, etc.)					
1017	01.26	Olives, coconuts (raw, unprocessed)					
1018	01.27	Coffee beans, tea leaves, cocoa beans, not roasted					
1019	01.28	Spices, aromatic, drug and pharmaceutical crops					
1020	01.11.5, 01.14, 01.19.3, 01.29, 01.3	Vegetables and fruit seeds, other seeds; grass, unprocessed straw and other residues of cereals; seeds for trees and seedings; planting materials, sugar cane and other raw, unprocessed and untreated products of plant origin n.e.c.					
1021	01.4. except 01.45.3 & 01.49.3	Live animals and animal products (unprocessed milk, eggs, natural honey; seeds and embryos of animals, except raw skins, shorn wool and skins, etc.)					
1022	01.45.3, 01.49.3	Raw fur skins, shorn wool, skins (excluding products of slaughterhouses and industrial meat production, see 1036)					
1023	01.49, part	Other agricultural animal origin products, raw, unprocessed and untreated, n.e.s.					
1024	01.7	Hunting and trapping products, raw, unprocessed					
		PRODUCTS OF FORESTRY					
1025	02.2	Wood in the rough - logs, fuel wood and other raw products of forestry, odds and ends included					
1026	02.1, 02.3	Forest trees and seeds, wild growing edible products; natural cork, varnish, balsams and other naturals gums and resins and other raw products of forestry n.e.c.					
		FISH AND OTHER FISHING PRODUCTS, UNPROCESSED AND UNTREATED					
1027	03	Fish, sea food and other fishing products; aquaculture products (raw, unprocessed and untreated)					
		MINING AND QUARRYING PRODUCTS, UNPROCESSED; CRUDE AND NATURAL GAS					
1028	05.1, 05.2	Coals, hard coal and lignite (coal for heating included)					
1029	06.1	Crude petroleum, bituminous or oil shale and tar sands. Note petroleum products entered in row 1082					
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
		MANUFACTURING INDUSTRY PRODUCTS					
		Food products and other processed products of plant and animal origin; used as reproduced material					
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
		Production of electricity and manufactured gas (excluding natural gas extraction and petrol gases in refineries); trade and distribution of electricity and manufactured gas					
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
		Construction					
1162	41, part	Development of building projects					
1163	41, part	Construction works of residential and non-residential buildings					
1164	42	Construction and construction works of civil-engineering					
1165	43	Specialised constructions works					

Source: Statistical Office of the Republic of Serbia.

Figure A5.2 Extract of questionnaire covering sales of industrial and non-industrial services

No.	CPA code	Code and service description	Sales of services (groups of accounts 61 and 65, part)
1	2	3	4
2000		TOTAL	
		Support services directly linked with the production of goods and services	
2001	01.6 part	Support agricultural services to crop production	
2002	01.6 part	Support services to animal production (animal farming ; veterinary services excluded (row 2059)	
2003	02.10.2, 02.4	Support services to forestry (cultivation and logging of trees, excluded)	
2004	09	Mining support services, services to petroleum and natural gas extraction	
2005	13.3	Textile finishing services - bleaching, dyeing, printing etc.	
2006	16.10.9	Drying, impregnation or chemical treatment services of timber and product of wood; support services in the processing of wood and wood products n.e.c.	
2007	25.5	Forging, pressing, stamping and roll-forming services of metal	
2008	25.6	Treatment and coating services of metals; machining	
2009	24.5	Casting services of metal and steel	
		Subcontracted services in industry and construction, trade services and other intermediation commissions. Note: enter only the value of the services, value of materials of goods excluded	
2010	14, part	Subcontracted operations in textile industry (excluding value of materials)	
2011	15, part	Subcontracted operations in footwear and leather production industry (excluding value of materials)	
2012	16, part	Subcontracted operations in production of processed wood and wood products (value of materials, excluded)	
2013	25, part	Subcontracted operations as part of machine industry - processing and finishing materials services (value of materials, excluded)	
2014	-	Other subcontracted operations in production of goods of other enterprises (value of materials, excluded), please specify	
2015	46.1	Trade commissions	
2016	-	Other intermediation commissions please specify	
		Repair, maintenance, installation services; conversion, reconstruction and fitting out of transport equipment	
2017	33.1	Repair and maintenance services of fabricated metal products, machinery and equipment, except motor vehicles	
2018	95.1	Repair services of computers and communication equipment	
2019	95.2	Repair services of personal and household goods	
2020	45.2	Maintenance and repair services of motor vehicles	
2021	33.2	Installation services of industrial machinery and equipment	
2022	29.20.4, 29.20.5	Reconditioning, assembly, fitting out and bodywork services of motor vehicles, except installation, maintenance and repair services	
2023	30.11.9, 30.20.9, 30.30.6	Conversion, reconstruction and fitting out services of other transport equipment, except installation, maintenance and repair services	
		Transportation services Note include transportation equipment rental services with driver and removal services	
2024	49.1 and 49.3	Land transport services - passengers, taxi include	
2025	49.2 and 49.4	Land transport services - freight	
2026	50.1	Water transport services - passengers	
2027	50.2	Water transport services - freight	
2028	51.1	Air transport services - passengers	
2029	51.2	Air transport services - freight	
2030	52.2	Support services for transportation (loading, unloading, hauling, towing, parking service, etc., transportation excluded)	
		Other services	
2031	18	Printing services and services related to printing (newspaper printing, pre-press, binding and related services, reproduction services of recorded media)	
2032	35.30	Steam, hot water, air conditioning supply services	
2033	36	Natural water, water treatment, supply and distribution services	
2034	37	Sewerage services, removal and treatment services	
2035	38	Waste collection, treatment and disposal services	
⋮	⋮	⋮	⋮
		Donations and state subsidies (group accounts 64), lease of intangible assets and income from fees and charges. Note: 2089 and 2090 positions are not entered	
2086		Donations and other unconditioned transfers in cash or in kind by resident legal and natural persons (account 640 and 641)	
2087	-	Donations and other unconditioned transfers in cash or in kind by foreign legal and natural persons (account 640 and 641)	
2088	-	Subsidies, grants, donations and transfers of state and local government bodies (account 640 and 641)	
2089	-	Income from fees for usage of public non-produced assets (this is filled out only by budgetary units - account 741500)	
2090	-	Income from administrative and legal fees (this is filled out only by budgetary units - account 742200)	

Source: Statistical Office of the Republic of Serbia.

Chapter 6. Compiling the Use Table

A. Introduction

6.1. This Chapter primarily deals with the construction of an initial, unbalanced version of the Use Table. The values entered into the tables should, as far as possible, reflect all available knowledge and data on the product structure of each column, although many values may need to be changed when the SUTs system is balanced. This applies to estimated totals as well as the values for specific products. Before balancing takes place, the estimates for intermediate consumption, final uses and GVA, and the components of GVA (if available in this stage of the process), should be checked for credibility, and if necessary adjusted as appropriate. These will then form the starting point for the balancing process.

6.2. This Chapter starts with an overview of the structure of the Use Table in Section B and describes the main blocks of the table. Section C focuses on the intermediate consumption; Section D on the GVA part of the table; Section E on the final consumption expenditure; Section F on the gross capital formation; and Section G on the exports of goods and services. Two annexes relevant to this Chapter are provided: Annex A (to Chapter 6) provides an example of a questionnaire for the collection of data on the purchase of goods and services for intermediate consumption. Annex B (to Chapter 6) provides a description of the impact the change in treatment of research and development according to the 2008 SNA.

B. Structure of the Use Table

6.3. The Use Table shows the use of goods and services by product and by type of use for intermediate consumption by industry, final consumption expenditure, gross capital formation and exports. The Use Table also shows the components of GVA by industry for compensation of employees, other taxes less subsidies on production, consumption of fixed capital, and net operating surplus and net mixed income. Table 6.1 illustrates the structure of the Use Table.

6.4. The Use Table has two main objectives:

- the columns show the cost structure of each industry and the product structure of each type of final use; and
- the rows show the distribution of each product and primary input (labour and capital) by uses.

6.5. It is common to compile the Use Table, at least initially, at purchasers' prices. This valuation relates most closely to the basis of the data collected via business and household surveys and is known by the purchasers of the products.

Table 6.1 Use Table at purchasers' prices

Million euro

			INDUSTRIES							FINAL USE								
										Final consumption expenditure								
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at purchasers' prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 583	6 570	16	371	34	49	9 623	3 595			180		- 27	1 161	4 909	14 532
	Manufacturing	(2)	2 205	107 190	12 441	16 874	6 015	8 797	153 522	71 438		3 180	26 756	2 183	3 034	123 252	229 842	383 364
	Construction	(3)	105	2 440	9 528	2 446	3 907	1 604	20 029	1 667			25 155		- 38	563	27 348	47 377
	Trade	(4)	33	1 883	119	2 240	259	308	4 842	3 325			67	45		753	4 189	9 032
	Transport	(5)	14	4 386	267	8 399	822	321	14 208	5 833		3 370				8 453	17 656	31 865
	Communication	(6)	34	2 563	299	9 359	5 919	1 833	20 008	26 444		121	5 976		67	6 905	39 514	59 522
	Finance and business services	(7)	457	13 578	4 736	20 359	29 166	9 134	77 430	38 838		1 006	11 170		- 178	11 145	61 981	139 411
	Other services	(8)	8	382	59	1 171	415	1 794	3 829	14 923	5 416	53 373	113	107	1	567	74 500	78 329
	Total at purchasers' prices before adjustments	(9)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
Adjustments	CIF/FOB adjustments on exports	(10)														- 97	- 97	- 97
	Direct purchases abroad by residents	(11)								6 675							6 675	6 675
	Purchases in the domestic territory by non-residents	(12)								- 12 945						12 945		
	Total at purchasers' prices	(13)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	466 517	770 009
GVA	Compensation of employees	(14)	551	30 679	10 239	37 906	22 997	41 971	144 343									
	Other taxes less subsidies on production	(15)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
	Consumption of fixed capital	(16)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
	Net operating surplus/net mixed income	(17)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
	Gross operating surplus/gross mixed income	(18)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
	GVA	(19)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Total input at basic prices	(20)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

Empty cell by construction

Austria 2011

6.6. The upper part of the Use Table (rows (1) to (9) in Table 6.1) shows how the use of goods and services is distributed as intermediate consumption by industry, final consumption expenditure, gross capital formation and exports. The rows of this part of the table correspond to the same rows of the Supply Table. Each row in upper part of the SUTs represents a product balance for each product.

6.7. In the lower left part of the Use Table (rows (14) to row (19) in Table 6.1), the components of GVA are shown below intermediate consumption for each industry. If the industry output is given and the intermediate consumption of products determined in the Use Table, GVA of an industry can be estimated, in the first instance, as a residual variable. However, if the income measure components of GVA (compensation of employees, other net taxes on production, consumption of fixed capital) are known, the residual value is net operating surplus and net mixed income. Net operating surplus can also be estimated using Business Accounts (after making various adjustments to move Business Accounts based data onto an SNA basis) providing an alternative for data confrontation with the residual approach – linking between Business Accounts and National Accounts is covered in Chapter 2. For each industry, the sum of intermediate consumption at purchasers' prices and GVA at basic prices will equal the value of output at basic prices shown as column totals in the Supply Table.

6.8. The columns of the Use Table cover the following categories:

- Industries (columns (1) to (6) in Table 6.1). Intermediate consumption will be shown with the same breakdown (number of columns) as for the industries' domestic production in the Supply Table.
- Final consumption expenditure (columns (8) to (10) in Table 6.1), which consists of final consumption of Households, NPISHs and General Government. The latter is typically broken down into individual and collective consumption.

- Gross capital formation (columns (11) to (13) in Table 6.1), which is broken down in its components of total value of the gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables. It can further be broken down by types of assets and/or industries.

- Exports of goods and services (column (14) in Table 6.1), which may be shown as a single column or as goods and services in separate columns. Furthermore, they can be further broken down as columns for export of domestically produced products and re-exports. Exports can also be broken down by countries or geographical or market groupings of countries.

6.9. As described in Chapter 4, the actual number of rows and columns in the SUTs will depend among other aspects on resources and availability of source data.

6.10. The Use Table also contains a number of rows (in particular, rows (10) to (12) in Table 6.1) which contain adjustments. In particular, these rows contain the adjustment for the valuation of exports (CIF/FOB adjustments on exports), direct purchases abroad by residents, and purchase in the domestic territory by non-residents. In the SUTs, total imports and exports are valued FOB. However, data on detailed flows of imports from foreign trade statistics are valued at CIF prices. To reconcile the different valuations used for total imports FOB and the imported products CIF, a total CIF/FOB adjustment row on imports is added to the Supply Table. The same negative entries are shown in the CIF/FOB adjustment row for exports. More details on the CIF/FOB issues are covered in Chapter 5.

6.11. The adjustments for direct purchases abroad by residents and purchases in the domestic territory by non-residents have to be made because final consumption expenditure of households, as broken down by product, includes direct purchases of non-residents in the domestic territory which have to be treated as exports. Similarly, direct purchases of residents abroad have to be treated as imports and thus included in total final consumption expenditure of households.

6.12. The purchases of residents abroad are treated as both imports and final consumption expenditure of households. Thus an appropriate positive amount has to be entered in the imports column of the Supply Table and at the same time as positive entry in the column of final consumption expenditure of households in the Use Table. The purchases in the domestic territory by non-residents are treated as exports and deducted from households' final consumption expenditure. Thus the corresponding amount entered in the exports column with a positive value is deducted in the column of final consumption expenditure of households. The balance of the row is zero.

6.13. The SUTs provide a framework whereby, the supply and use of all products are balanced, and the total outputs and inputs of each industry are balanced. However, in this stage of the compilation process, it is recommended to populate the SUTs using data based on the best possible data sources before the balancing process takes place. Preferably, regular (quarterly and annual) business surveys based on a high-quality comprehensive business register as well as household based surveys and the use of administrative data should be used.

6.14. A simple method for drawing up product balances – traditionally referred to as the "product flow" method is to distribute the value available for domestic use based on the characteristics of each product. This may work well for products that have specific uses, for instance, as input in a particular industry or as GFCF. Most of the products in the SUTs are, however, broad categories of goods or services that may have several different uses. Estimates of the use side that are solely based on the supply of specific products can, however, be used where information from the use side is unavailable.

6.15. For compiling the Use Table, two general options are available: the input approach and the output approach. In the input approach, the cost structures of industries and input structures of final uses categories are compiled on the basis of specific survey results, while in the output approach the allocation of goods and services is determined with the "product flow" method. As the input approach is based on collected data, it is the recommended approach for populating the intermediate use part of the Use Table. The output approach is an alternative, providing a cross-check and forming the basis of balancing process.

6.16. There is no absolute rule on deciding whether to give priority to columns or rows of a Use Table. It depends on basic surveys and specific country practices of National Accounts as well as indicators such as quality and coverage of the data. However, it is recommended to start the compilation process by column because data received from basic sources are fully reflected. At the same time, this method is consistent with the institutional approach to identify the input structures for industries by intermediate consumption and GVA, and for the categories of final use (consumption, gross capital formation, exports) by product. However, a distinction has to be made between population of the tables with a tendency by column and the balancing of the tables with a stronger row dimension.

6.17. The prime objective of the Use Table is to identify the cost structures of industries and the input structure of final uses. The input approach can be implemented if survey results are available which identify the main cost structures – the survey approach to collect input data is recommended. The main types of sources for the input approach are: Establishment Survey, Consumer Expenditure Survey, Government Expenditure Survey, and Capital Expenditure Survey. At the same time, the Use Table identifies the use of products and primary inputs. The main sources of the output approach are: Production Statistics and Foreign Trade Statistics.

6.18. The output approach (product flow method) is highly dependent on survey results from production statistics and foreign trade statistics.

6.19. Provided that survey results are available, the input approach is the best option to identify cost structures of industries or any information from input methods. The "product flow" method can also be considered as it can be useful to compile the rows in a first stage, even if later in the process, for example, they are changed during the balancing process. If product flows are compiled at a very detailed level, one will be able to break down intermediate consumption between some industries, even in the absence of complete and direct information on cost structures. There are specific products, for example, ships, military aircraft, nuclear fuels, etc. the "product flow" method could be preferred.

6.20. The "product flow" method (output approach) is often used to compile Use Tables. The "product flow" method can also be considered to complement, and help cross-check, the input approach. The "product flow" method facilitates identifying the output structure of goods and services, for example, the more homogeneous goods and services are, the easier it will be to allocate the use in specific industries or categories of final uses. The "product flow" method is widely applied for rectangular systems of products and industries in which the number of products is much larger than the number of industries. The "product flow" method allows identifying a more refined structure of intermediate and final uses in terms of specific products. The "product flow" method is also a powerful tool when it comes to balancing the system.

6.21. Nevertheless, the first stage is always to compile the totals of industries in terms of output, intermediates and GVA. This is done in the production accounts of the system. Then the categories of final uses are added which were derived from specific surveys and statistics and product flow accounts.

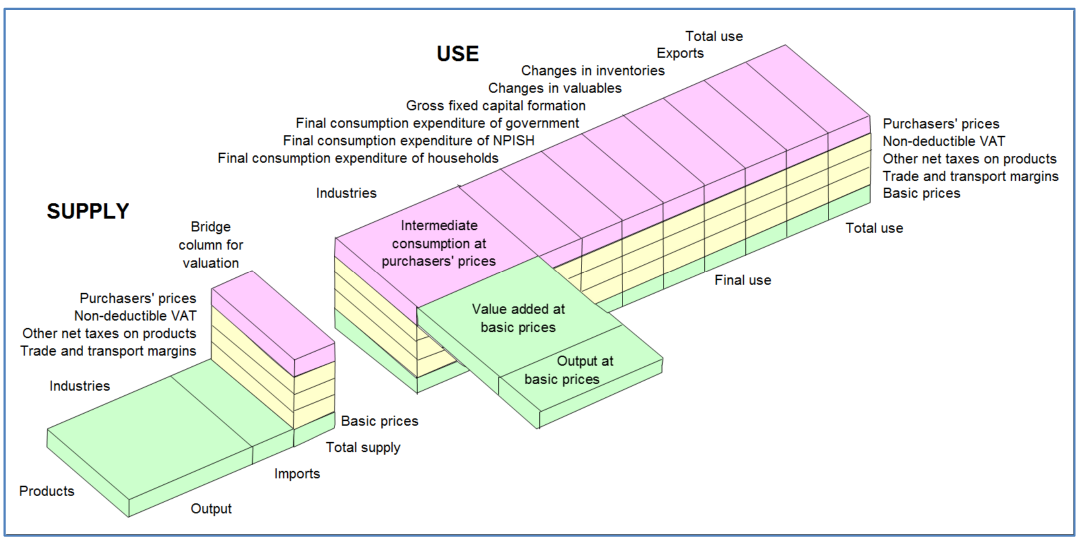
1. Three-dimensional presentation of the SUTs

6.22. Trade and transport margins, taxes less subsidies on products (except VAT) and non-deductible VAT must be distributed by products in the valuation table (sometimes referred to as the "bridge column") shown as part of the supply by products at purchasers' prices. It is recommended where the supply-values from the different levels of the valuation table are distributed by uses in "valuation layers", matrices with the same size and format as the upper part of the Use Table at purchasers' prices.

6.23. Figure 6.1 shows how the layers can be shown as stacked one above the other as a three-dimensional representation of the Use Table. In this way, it will be possible to look at each product balance as a "vertical slice" from left to right from the SUTs, where the supply is shown at basic prices while the uses can be seen as a table showing how purchasers' prices are transformed into basic prices by removal of trade and transport margins, net taxes on products excluding VAT and non-deductible VAT.

6.24. The exact distributions of trade and transport margins and net taxes on products by uses cannot usually be observed in the data sources and therefore need to be estimated based on whatever data are available as well as assumptions based on common sense considerations, further details are covered in Chapter 7. Hence the establishment of the full three-dimensional system will require some additional resources. It can, however be very useful as a tool to keep track on the use of trade and transport margins and net taxes on products by uses and they are also needed for estimation of SUTs in volume terms and IOTs (both in current prices and in volume terms).

Figure 6.1 Three-dimensional view of SUTs



C. Intermediate consumption part of the Use Table

6.25. This section describes how to put together an initial unbalanced version of the intermediate consumption part of the Use Table and the data sources that can be used.

6.26. Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital (2008 SNA, paragraph 6.213). It thus includes all non-durable goods and services with an expected life of less than one year which are used up in the process of production by industries, thus excluding any goods purchased for resale without any further processing. The 'bought and not-consumed' goods are entered in changes in inventories. Goods paid for by employers for the benefit of their staff can be regarded as remuneration in kind entered in compensation of employees.

6.27. The compilation methods for the intermediate consumption vary across countries depending on the data sources available. The recommended approach is to have regular (for example, annual) data collection on input structures, even more so, with globalization and new technologies contributing to rapid structural change. However, the most commonly used approach consists of starting from the total intermediate consumption by industry, i.e. the row 'Total' (row (9) in Table 6.1). Then, there is a balancing process with the amounts which are available for intermediate use of the various products (see next sections). Finally, an equilibrium is obtained between the sum of the row 'Total' and the sum of the column 'Total'.

6.28. Nevertheless, in some countries, especially countries in which accounts rely on data sources on enterprises (institutional approach), intermediate consumption may be initially known at a high level of aggregation. Thus, the main problem consists of distributing this total intermediate consumption among industries.

6.29. Intermediate consumption can be broken down by industries according to ISIC and by institutional sectors. As for the Supply Table, it is also possible to distinguish between market producers, non-market producers and producers for own final use and between producers in the formal and the informal economy. The columns in the Use Table correspond to the same classifications used in the Supply Table. However, the number of columns does not necessarily need to be identical when estimating the input structure, although it is recommended that the industry columns headings in the Supply Table and the Use Table are eventually the same.

6.30. The separated columns of an ISIC category (for example, market and non-market) can have significantly different input structures. Trade margins on their inputs may also differ due to the use of different trading channels, discounts and taxation rules may vary, for example the deductibility of VAT.

6.31. When a distinction is made between market producers, non-market producers and producers for own final use, the inputs in each of these categories of units could be shown as separate sub-matrices. This would, however, leave many input columns empty or almost empty. A practical solution could be to separate only market and non-market producers within the same ISIC category into different columns where both have a significant size, for example, in the case of health and education services. Similarly, production on own account or informal activity may be shown in separate columns, if it is of special interest, for instance within agriculture, construction or trade.

1. Initial, unbalanced version of the intermediate consumption part of the Use Table

6.32. The information used for the construction of an initial set of estimates for the intermediate consumption part of the Use Table will draw from various source data.

6.33. For some industries, the source data can consist of a complete picture of outputs and inputs by products. These estimates will typically combine information on physical volumes and prices and may also use information from accounting data. The estimates may be carried out outside the actual SUTs compilation process. Similar is the case for the grossing up of survey results to cover the entire industries in question, for example, agriculture, forestry and fishing. From the perspective of the National Accounts and SUTs compilation, the values of all inputs are assumed to be already grossed up and ready to be entered into the SUTs framework.

6.34. It is important to ensure consistency between estimated outputs, inputs and change in inventories within each industry. Products delivered between units within the industry should appear with the same value for sales and purchases of the industry, except for the costs of change of ownership.

6.35. If different data sources are used to draw up the output and input sides of an industry, it is important to make sure that the units behind the data are defined in a similar way. Otherwise there is a danger that the industry's GVA could be over-estimated or under-estimated. It is also important to ensure that all the inputs are covered and that less important inputs are not missing from the input structure.

6.36. As mentioned before, the most common method to fill the initial and unbalanced version of the intermediate consumption part of the Use Table is to (a) estimate the values for total intermediate consumption by industry; (b) enter in the table 'known' values of intermediate consumption by product and by industry when available; and (c) use additional information on cost structures to estimate all other values in this part of the Use Table.

(a) Total intermediate consumption by industry

6.37. The data sources for populating the Use Table to obtain the value of total intermediate consumption by industry (see Chapter 4 for more detail) include statistical surveys, accounts based statistics and VAT based statistics. It should be noted that often the same source for the industry providing data feeding into the Supply Table also forms the source for the data feeding into the Use Table

6.38. For some industries, all inputs are provided by the data supplier and total intermediate consumption is calculated as the sum of these inputs. For most industries, however, total intermediate consumption needs to be estimated from annual and/or quarterly business surveys based on information from business accounts, government accounts and other sources such as annual reports and financial statements of the economic units themselves.

(b) Inputs by products for each industry

Known values for specific cells, rows or columns

6.39. Some values for cells of the intermediate consumption part of the Use Table may be known from source data, or they may already have been calculated within the framework of independent "sub-systems", for instance the use of energy, FISIM or insurance services by industries. For some industries, the entire columns of initial inputs can be drawn up in sub-systems from which they can be transferred to the SUTs framework. Entire rows and columns may be filled in this way. The source data used to calculate such values may not necessarily be available at purchasers' prices and they may need to be converted using the best possible assumption on trade and transport margins, net taxes on products and non-deductible VAT.

Input structures

6.40. Surveys on cost structures and other information on the input structure could be used for estimating the input structure in the intermediate consumption part of the Use Table.

6.41. Ideally, detailed purchases of goods and services should be collected annually covering all industries through surveys of cost structures. These annual surveys typically capture various aspects such as:

- year-on-year structural changes;
- technological innovation and change;
- contracting-out;
- company restructurings, mergers and takeovers;
- non-consolidation of businesses/industries;
- technological product and import substitution;
- economies of scale;
- inventory control; and
- price changes.

6.42. Collecting regular purchases details also allows for better measurement of sudden economic change, for example, due to the swine flu crisis (affecting agricultural/slaughtering industries), storm damage (affecting construction and insurance industries), growth of Internet activity, or other natural disasters which may affect the supply and price of certain intermediate products and impact the production chains, etc.

6.43. Annual surveys of cost structure would also considerably facilitate the production of good quality SUTs in volume measures, which has a key annual focus. Annex A to Chapter 6 provides an example of the type of costs and inventories questions, by type of product covering all goods and services that could be put on a questionnaire.

6.44. The information from surveys based on business accounts may contain some useful sub-totals, for example, purchases of goods or indirect production costs but it would usually be insufficient to provide a full breakdown by product and by industry. Similarly, government accounts may contain supplementary information on the input of products, but generally not with sufficient detail for full input structures.

6.45. Known totals and sub-totals must be supplemented by other information. Surveys on the use of raw-materials and/or services are typically used to serve the needs of National Accounts, specifically the Use Table. The coverage of such surveys has traditionally been limited to manufacturing and other industries that have a significant input of raw materials. However, the cost structures of construction, distribution and service industries should also be surveyed. The level of detail should preferably make it possible to aggregate the collected data into the products used in the SUTs but for practical reasons, it can just as well be the product categories from surveys that need to be split into more detailed categories used in the SUTs - the latter approach generates lower quality estimates. A survey may only exist for earlier or later years than the year for which the SUTs are being compiled, in which case the revaluation of the values to prices of the year in question should be considered.

6.46. Surveys of cost structures may not have total coverage. They may exclude units below a threshold or they may be based on small samples. When results are grossed up to industry totals, uncertainty is added to the figures. Input structures of small establishments that are not covered by the survey will probably be unlike the structures found in the survey. Furthermore surveys may collect data for enterprises rather than establishments. Enterprise based data will include inputs of establishments classified in other industries, and therefore reflect some inputs which should not be included here but in another industry.

6.47. Cost structures typically also include some acquisition of capital equipment originally treated as current expenditure in business accounts.

6.48. If annual surveys are not available, the use of older SUTs, where a more detailed survey may have been conducted can be used to form an initial structural base for a more recent period. Where such periodic surveys exist, different processes can be applied to generate more recent time series and meaningful data using more recent control totals applied to old structures.

6.49. Finally, respondents do not always know all their inputs, and categories whose descriptions begin with “Other” or finishes with “not elsewhere classified (n.e.c.)” will usually be overstated in such surveys. It can be feasible to apply some common sense corrections to the survey data before it is used to create input structures. The grossed-up values of inputs by products calculated from surveys are probably, despite their inaccuracy, often the best possible initial estimates of input structures but should be used with some caution.

6.50. The availability of statistics on cost structures can vary greatly among countries. For example, there are countries where surveys on cost structure are conducted yearly for all industries, there are countries where only manufacturing industries are surveyed annually and most other industries are surveyed with regular intervals; and there are countries where such surveys are missing, scarce or outdated.

6.51. It is advisable that the need for new surveys is considered well in advance when new benchmark SUTs are planned, as it may take several years to plan and implement and obtain useable results from such surveys. Where no statistics are available, the possible existence of alternative data sources should be investigated as well.

6.52. In some countries, it is common for annual reports and accounts of enterprises to contain detailed descriptions of the use of inputs, for example, supporting purchase ledger details. The information is, however, typically shown in a rather unsystematic way. To make this detail useful, the data must be categorized in a way that corresponds to the product classification used in SUTs. A similar approach can be used for inputs in general government, if the accounts for central and local government contain detailed information that can used to create input structures.

6.53. If nothing is known about inputs for some industries, it may be possible to use input structures from other industries that are assumed to be similar but with some modifications based on expert opinions. One can, as a last resort, look at input structures from neighbouring countries or similar activities in other countries, in particular, if those structures are based on actual source data as well as taking account of possible differences in the extent of processing, etc. The initial inputs that are based on these kinds of approaches are uncertain, and they are more likely to be adjusted – within reasonable limits – in the balancing process.

6.54. In countries where the informal economy forms a considerable share of output in specific industries, the structure of inputs used in informal units can be expected to be different from the structure found in surveys of formal businesses. Within agriculture and related activities, the input in informal units may be covered by agricultural statistics. Otherwise it can be appropriate to make a separate estimation of the input structure in informal economy. Information on the use of inputs in informal activities may be found in household budget surveys or labour force surveys, as mentioned above, if not in special studies of the informal activities. Such data may give an incomplete picture of the outputs and inputs and it may be necessary to add some supplementary assumptions based on expert knowledge before it can be used in SUTs.

(c) Putting together "known" values and information on product structure

6.55. Information on the "known" values and information on the input structure can be put together in order to fill an initial version of the values of intermediate consumption by product of an industry. Box 6.1 provides a numerical example of how all the available information can be combined.

Box 6.1 Example of a calculation of the values of an input column

In this example the total input, 2,500, is supposed to be known. A survey-based input structure sums to 100%.

The values of input of products 2 and 5 are known as 150 and 300 respectively. The known values are treated as predetermined and subtracted from the total value that is going to be distributed by products.

The residual total value of inputs, 2,500 - 450 = 2,050 is now distributed proportionally with the "survey-based input structure excluding the "known values".

Finally, the known and the calculated input values are added together to form the complete initial column of intermediate consumption for the industry in question.

Input in an industry / Products	Survey based input structure	"Known" (Predetermined) values	Survey-based input structure excl. known values	Inputs estimated from survey-based structure	Result: Input column
	%	Value	%	Value	Value
	(1)	(2)	(3) = (1) * 100.0/80.0	(4) = (3) * (2500-450)/100	(5) = (2) + (4)
Product 1	16.0	0	20.0	410	410
Product 2	6.0	150	0.0	0	150
Product 3	7.0	0	8.8	179	179
Product 4	44.0	0	55.0	1 128	1 128
Product 5	14.0	300	0.0	0	300
Product 6	8.0	0	10.0	205	205
Product 7	5.0	0	6.3	128	128
Total	100.0	450	100.0	2 050	2 500

(d) Grossed up data versus the data collected by surveys

6.56. Putting together information from different kinds of sources in the SUTs framework generally will result in an unbalanced set of SUTs. Thus the total uses of a product will differ from the total supply for most products. In the final, balanced version of the Use Table such differences are removed either by manual adjustments and/or automatic methods.

6.57. The corrections that are necessary to remove the differences between the first estimates of supply and use should as far as possible retain those values that are considered to be reliable statistics. For this purpose it is useful to be able to distinguish between:

- Inputs by product that have actually been reported as primary statistics by respondents and values that are found in annual reports, government accounts or other reliable sources; and

- Initial inputs by product that are result of grossing up to the estimates for total input in each industry.

6.58. In most cases, the difference between the two will represent the value that can be removed during the balancing process when total initial use exceeds total initial supply for a product. It can be useful if the "reliable" parts of the input values are shown together with the grossed up values in the tables presented to the people working on the manual balancing of SUTs.

6.59. An example, of 'part' of an industry input structure (column) with supplementary "reliable" values at purchasers' prices in the rightmost column is shown in Table 6.2. Column (6) and (7) show values from the two approaches, which in turn should be investigated to achieve a plausible industry input structure, and in turn, an agreed estimate for each product. Apart from wood-wool, all the other products show significant differences, which question the reliability of the data feeding into the SUTs for the input structure for this industry.

Table 6.2 Intermediate consumption of selected inputs into "Manufacture of rubber and plastic products"

	Transaction (1)	Basic price (2)	Margins (3)	Net taxes on products (excl. VAT) (4)	VAT (5)	Purchasers' price (6)	Reported values (7)
	..	..	..	..	..	..	..
Wood-w ool	P.2	22	0	0	0	22	20
Wood in logs or roughly cut	P.2	5 625	607	0	0	6 232	2 340
Plyw ood, laminated w ood	P.2	10 286	1 024	0	0	11 310	10 539
Packaging material, w ood	P.2	20 085	580	0	0	20 665	12 816
Other w ood products	P.2	20 352	1 854	0	0	22 206	20 353
Paper in rolls and sheets	P.2	3 027	46	0	0	3 073	1 329
…	..	..	..	..	..	..	..

P.2: Intermediate consumption.

6.60. An example showing part of a product balance (row) with supplementary "reliable" values in the rightmost column is shown in Table 6.3. Here the reported values on the supply side refer to basic prices while the reported values at the use side refer to purchasers' prices. Although the basic price estimates are in balance (allowing for rounding differences), the Column (6) and (7) show significant differences at purchasers' prices between the estimated value and the reported value.

Table 6.3 An example product balance for "Gelatine and gelatine derivatives"

Supply

	Transaction (1)	Basic price (2)	Reported values (3)
Oher food products, n.e.c.	P.1	12	12
Paints and soap, etc.	P.1	230 779	230 779
Imports	P.1	136 245	136 244
Gelatine amd gelatine derivatives	Total	367 036	367 035

Use

	Transaction (1)	Basic price (2)	Margins (3)	Net taxes on products (excl. VAT) (4)	VAT (5)	Purchasers' price (6)	Reported values (7)
Meat products	P.2	14 029	4 749			18 778	3 498
Fish products	P.2	932	31			963	
Dairy products	P.2	9 925	7 958			17 883	
Bakery products	P.2	133	110			243	134
Other food prod. n.e.c.	P.2	109 577	22 735			132 312	67 143
Paints and soap, etc.	P.2	34 113	7 170			41 283	26 765
Pharmaceuticals, medicine	P.2	64 658	9 516			74 174	7 315
Rubber and plastic products	P.2	17 812	3 754			21 566	10 436
	..	..	..	..	..	..	..
Change in inventories, materials	P.52	736	141			877	
Change in inventories, goods for resale	P.52	736	141			877	
Exports of domestic production	P.6	98 487	357			98 844	97 197
Re-exports	P.6	10 287	35			10 322	10 150
Gelatine amd gelatine derivatives	Total	367 035	56 697				222 638

P.1: Output
P.2: Intermediate consumption
P.6: Exports of goods and services
P.52: Changes in inventories

D. The GVA part of the Use Table

6.61. Once the intermediate consumption part of the use table has been estimated, it is possible to calculate the GVA for each industry. The GVA at basic prices is estimated as total output at basic prices from the Supply Table minus total intermediate consumption at purchasers' prices from the upper part of the Use Table. The GVA can be broken down into the following components:

- Compensation of employees;
- Other taxes less subsidies on production;
- Gross operating surplus and gross mixed income.

6.62. Gross operating surplus can be further split into net operating surplus and consumption of fixed capital on gross operating surplus. In addition, gross mixed income can be further split into net mixed income and consumption of fixed capital on gross mixed income. If information is available, these breakdowns could be shown in the Use table as follows:

Gross value added:
Compensation of employees

Other taxes on production
Other subsidies on production
Gross operating surplus
Consumption of fixed capital on gross operating surplus
Net operating surplus
Gross mixed income
Consumption of fixed capital on mixed income
Net mixed income

6.63. Each of the categories of GVA is described below together with the relevant data sources.

1. Compensation of employees

6.64. Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period (2008 SNA, paragraph 7.5). Compensation of employees has two main components: wages and salaries payable in cash or in kind; and social insurance contributions payable by employers (actual and imputed) (2008 SNA, paragraph 7.42). Generally, statistics drawn from business accounts and government accounts show values for wages and salaries and possibly also other costs related to employment. In both cases, there may be conceptual differences from the National Accounts concepts due, for example, to the different treatment of particular issues such as fringe benefits, employers actual and imputed social contributions, etc. In addition, the information usually needs to be grossed up to cover the part of each industry that is not covered by the statistics (for example, non-exhaustive business register) and values that are only available for enterprises which would need to be distributed by establishments before use.

6.65. Information from tax collecting authorities can provide data on compensation of employees that will also cover industries not fully covered by accounts statistics or surveys. This information may contain a distribution by industries that can be more or less consistent with the industry classification used in other statistical sources. If a business register is used to classify data from the various sources, it is likely that the figures from various sources are classified in the same way. As the structure of many economic units will change over time, the same units may nevertheless be classified differently in different data sources. One should be aware that data collected for administrative purposes may refer to units that are neither enterprises nor establishments, thus for the purposes of National Accounts further alignment may be necessary for inconsistency.

6.66. In some countries, data for compensation of employees in a number of industries is estimated based on labour force surveys, household budget surveys or occasional industrial censuses in combination with population censuses. This is specifically relevant when a considerable share of economic activity takes place in the informal economy.

2. Other taxes less subsidies on production

6.67. The other component of GVA at basic prices consists of other taxes less subsidies on production. Other taxes on production consist of all taxes except taxes on products that enterprises incur as a result of engaging in production (2008 SNA, paragraph 7.97). Similarly, other subsidies on production consist of subsidies except subsidies on products that resident enterprises may receive as a consequence of engaging in production. There are different types of taxes and subsidies on production. They may include taxes/subsidies on payroll or workforce, subsidies to reduce pollution, recurrent taxes on land, buildings or other structures, etc.

6.68. Generally, government accounts contain information on the total taxes and subsidy on production for each type of taxes and subsidies as they cover the various taxes and subsidies contained in the legislation.

6.69. The distribution of the taxes and subsidies by industries may be available from source data, however, when this is not the case, the total taxes and subsidies on production have to be allocated to relevant industries (proportionally to the items they relate). The amounts should be shown at an accrual basis.

3. Operating surplus and mixed income

6.70. The value of "gross operating surplus and gross mixed income" is obtained as a residual when compensation of employees and other taxes and subsidies are subtracted from GVA at basic prices by industry. Estimates of these industry totals are usually available early in the process of compilation of the Use Table and should be checked for credibility before balancing SUTs. However, as covered in Chapter 2, direct estimates of mixed income and gross operating surplus can be estimated using administrative sources as well as business accounts (after making various adjustments to move Business Accounts based data onto an SNA basis). In doing so, a complementary estimate can provide data confrontation with the residual estimate.

6.71. The consumption of fixed capital on operating surplus and mixed income are usually based on the perpetual inventory model method. The corresponding values for net operating surplus and net mixed income are usually calculated in one of the final steps in the compilation of SUTs as the calculation of consumption of fixed capital requires finalized data on GFCF broken down by industries, by institutional sector and by type of asset.

E. The final consumption expenditure part of the Use Table

6.72. Final consumption expenditure is the amount of expenditure on consumption goods and services. (2008 SNA, paragraph 9.7). Final consumption expenditure can be disaggregated between individual consumption expenditure and collective consumption expenditures. The first consists of expenditures on individual consumption goods or services that are acquired by a household and used to satisfy the needs or wants of members of that household. The latter consists of the expenditures for collective consumption services which are services provided simultaneously to all members of the community or to all members of a particular section of the community, such as all households living in a particular region.

6.73. Final consumption expenditure is disaggregated in the Use Table in final consumption expenditure by households, NPISHs or general government. Table 6.4 shows the structure of the final consumption expenditure in the Use Table.

Table 6.4 Categories of final consumption expenditure

Products	FINAL CONSUMPTION			
	Households	NPISHs	General Government	Total
Product 1				
Product 2				
:				
Product N				
Total				

6.74. The manner of compiling the sub-matrix of the Use Table showing the use of products for final consumption is similar for each of the three types of final consumer (households, NPISHs and general government) but starts from a different classification for each of them reflecting the way (and the basic functional classifications) in which the basic data are collected.

1. Household final consumption expenditure

6.75. Household final consumption expenditure consists of the expenditure, including expenditure whose value must be estimated indirectly, incurred by resident households on individual consumption goods and services, including those sold at prices that are not economically significant and including consumption goods and services acquired abroad. (2008 SNA, paragraph 9.113)

6.76. Information on consumption by households usually starts from household surveys. In these surveys, household expenditures are classified according to the Classification of Individual Consumption According to Purpose (COICOP) (United Nations, 1999b) - see Box 6.2. Therefore, it is recommended to underpin the compilation of this part of the Use Table with a table linking data on the final consumption expenditures by purpose and by products. This will greatly improve the quality of the data and will ensure that the different analyses of household final consumption expenditure are consistent and coherent with the balanced SUTs. This will also ensure homogeneity in the deflation process, thus ensuring better quality volume data.

Box 6.2 Classification of Individual Consumption According to Purpose

COICOP is an integral part of the SNA, but it is also intended for use in three other statistical areas: household budget surveys, consumer price indices and international comparisons of gross domestic product (GDP) and its component expenditures. The purposes defined in COICOP are based on the classifications of consumer expenditures which national statistical offices have developed for their own use to serve a variety of analytic applications. Although COICOP is not strictly linked to any particular model of consumer behaviour, the classification is designed to broadly reflect differences in income elasticities. There are 14 divisions in COICOP:

01 - Food and non-alcoholic beverages

02 - Alcoholic beverages, tobacco and narcotics

03 - Clothing and footwear

04 - Housing, water, electricity, gas and other fuels

05 - Furnishings, household equipment and routine household maintenance

06 - Health

07 - Transport

08 - Communication

09 - Recreation and culture

10 - Education

11 - Restaurants and hotels

12 - Miscellaneous goods and services

13 - Individual consumption expenditure of non-profit institutions serving households (NPISHs)

14 - Individual consumption expenditure of general government

The first 12 divisions add up to total individual consumption expenditure of private households. The last two identify those parts of consumption expenditure by non-profit institutions serving households and general government that are treated as social transfers in kind. Together all 14 items represent actual final consumption by households.

6.77. Table 6.5 shows the table that is used to cross-classify data of final consumption expenditures by purpose (COICOP classes) and by products (CPC classes). The list of products in this table is the same as the one used for the Supply Table and the intermediate consumption part of the Use Table. Of course, the greater the level of disaggregation, the better the quality and precision of allocation to products as well as homogeneity for deflation purposes.

6.78. The compilation of Table 6.5 relies on different data sources and is often based on household budget surveys which directly collect details of expenditure on goods and services by households as well as retail trade surveys (although some adjustments are needed). These data sources are discussed in the following sections.

Table 6.5 Table linking final expenditures by purpose (COICOP) and product (CPC)

Consumption COICOP groups / Products	Household consumption (COICOP)				
	Food 01.1	Non-alcoholic beverages 01.2	… …	Other services n.e.c 12.7	Total 01.1-12.7
Product 1					
Product 2					
:					
Product N					
Total					

6.79. Some adjustments may be needed to ensure that the final consumption expenditures by households reflect the final consumption expenditures of "resident" households. This means that if the starting point is the final expenditures that took place in the territory by households, adjustments are needed to remove the expenditures in the country by non-resident households and include the final expenditures of resident households abroad. When distributions by COICOP groups of these adjustment items are unknown, they can be placed in one or two supplementary columns with positive and a negative value as appropriate.

6.80. Very few products are exclusively used for household final consumption expenditure. For example, some domestic supply of typical consumer-related goods (for example, food) is used as intermediate consumption in restaurants, transport services and government institutions, as individual consumption of NPISHs and general government or – in the case of durables – as fixed capital formation. Therefore, the amounts spent by households (this is considered as final consumption expenditures by households) cannot be determined from the supply of such products without the knowledge of the other uses.

6.81. For some products, full information on household final consumption expenditure can be provided by sub-systems established outside the SUTs framework. The underlying data may have the form of physical volume and price information, for example, energy. Administrative sources can provide a rich source of detail, for example, covering purchases of motor vehicles, school fees and other outlays such as education, prescription medicine, and other expenses on health services.

6.82. Table 6.6 provides a numerical example of the link between household final consumption expenditure of households in the Use Table and the COICOP by product breakdown. In this example, the largest expenditures are spent for housing, followed by transportation, restaurants and food.

Table 6.6 Final consumption expenditure of households (by COICOP headings)

		CLASSIFICATION OF INDIVIDUAL CONSUMPTION BY PURPOSE (COICOP)												
COICOP		Food and non-alcoholic beverages COICOP 01	Alcoholic beverages, tobacco and narcotics COICOP 02	Clothing and footwear COICOP 03	Housing, water, electricity, gas and other fuels COICOP 04	Furnishings, household equipment and routine household maintenance COICOP 05	Health COICOP 06	Transport COICOP 07	Communication COICOP 08	Recreation and culture COICOP 09	Education COICOP 10	Restaurants and hotels COICOP 11	Miscellaneous goods and services COICOP 12	Total use at purchasers' prices
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Agricultural products	(1)	2 240	60	0	434	0	0	0	0	860	0	0	0	3 595
Manufactured products	(2)	14 016	5 537	9 749	7 090	10 198	2 254	12 809	2 548	2 767	0	0	4 470	71 438
Construction	(3)	0	0	0	1 667	0	0	0	0	0	0	0	0	1 667
Trade, transport, communication	(4)	0	0	0	0	0	0	7 827	3 361	4 407	0	20 008	0	35 602
Financal and business services	(5)	0	0	0	26 218	747	0	1 339	0	2 590	0	0	7 944	38 838
Other services	(6)	0	0	194	77	212	3 730	235	133	4 204	1 221	0	4 918	14 923
Total	(7)	16 257	5 597	9 943	35 487	11 157	5 984	22 209	6 041	14 827	1 221	20 008	17 332	166 063

Austria 2011

Note: the products “Trade”, “Transport” and “Communication” of Table 6.1 are presented together in Table 6.6

6.83. COICOP also distinguishes household final consumption expenditure according to the following product classes: services (S), non-durables (ND), semi-durables (SD) and durables (D). This supplementary classification provides data for other analytic applications, such as assessing household stocks of goods and the cyclical variation in consumer demand. For example, to estimate the stock of “capital goods” held by households, goods in COICOP classes that are identified as durables provide the basic elements for such estimates. Box 6.3 provides a description of durable, semi-durable, non-durable goods and services.

Box 6.3: Non-durable, semi-durable and durable goods

Non-durable goods are defined as goods that can be used only once, for example: food, non-alcoholic beverages, alcoholic beverages, tobacco, materials for the maintenance and repair of dwellings, pharmaceuticals, fuels, energy, garden plants, flowers, pets, newspapers and stationery.

Semi-durable goods differ from durable goods in that their expected lifetime of use, though more than one year, is significantly shorter, and their purchase price is typically less than for durable goods. For example: clothing, footwear, household textiles, motor vehicle spare parts, recording media, games, toys, books, and electrical appliances for personal care.

Durable goods are those goods which can be used repeatedly or continuously over a period of more than a year, for example: furniture and furnishings, carpets, major tools, vehicles, telephone equipment, computers, photographic equipment, jewellery, clocks and watches.

Services include cleaning and hire of clothing, actual and imputed housing rental, repair services, domestic services, outpatient and hospital services, transport services, post and telecommunication services, recreational and cultural services, education, catering, accommodation, hairdressing, insurance and financial services.

(a) Household budget surveys

6.84. Household budget surveys provide a good source on expenses classified by purpose and by product according to internationally agreed standards. Such surveys may also include information on a wider range of household activities and living conditions, and sometimes may be named “Living Standard Surveys”. Household budget surveys are generally used to compile or update the ‘weights’ for the basket of goods used in the Consumer Price Indices (CPI) and to collect information on households income, possession of assets, type and equipment of dwellings, outlays for repair and maintenance, production for own use and other informal economic activity. This supplementary information is often useful for National Accounts and Purchaser Power Parities (PPPs) and may actually have been collected with this purpose in mind as well as satellite accounts like Social Accounting Matrices (SAMs). Household budget surveys can contain information relating to consumption of goods produced for own consumption and services from owner occupied dwellings which in some countries may not be available from other data sources.

6.85. Household expenditure surveys frequently use the COICOP as the basis for the collection of household expenditure information. The results are reallocated to products classified by CPC and then used to estimate the vector of household final consumption expenditure by product for the SUTs.

6.86. Household budget surveys often provide good initial estimates feeding into household final consumption expenditure. However, attention should be paid to the coverage of the survey in order to ensure that the survey results can be used for final consumption expenditures by households. For example, some household budget surveys may not cover the year for which the SUTs are being compiled in which case the survey data should be referenced to prices of the actual year, and if possible, corrected for the development in volumes from the surveyed period. In addition, since household final consumption expenditure refer to the total resident population, the statistician has to ensure that the results of the household budget surveys are grossed up to cover the total population.

6.87. If no household budget survey exists for the SUTs reference year, an alternative approach may be to use the structure of expenditure from the last household budget survey and then constrain to the estimate for total expenditure. This clearly assumes a fixed basket of spending on goods and services (this does not allow for relative price changes or changes due to new products or products not consumed anymore) and then allowing the balancing process to provide feedback on changes.

(b) Retail trade surveys

6.88. Household final consumption is linked to turnover of retail trade after adjusting for sales to businesses and non-residents. Consumers buy most of their goods from retail outlets. Retail trade statistics provide data on turnover broken down to product groups. However, retail trade statistics do not include imputed transactions like imputed rentals of owner occupied dwellings and FISIM which are included in household final consumption expenditure. These are compiled using different sources and affect other parts of the National Accounts, not just household final consumption expenditure.

6.89. The use of retail sales statistics feeding into household final consumption expenditure needs to include appropriate adjustments. For example, although consumers purchase most of their goods and services from retail outlets, they also purchase goods and services from units not classified to the retail industry, for example, directly from manufacturers and service industries. On the other hand, sales by retail outlets are not all consumed by resident household consumers but purchases from these retail outlets are also made by non-residents (for example, visitors) which is treated as an export and by businesses which is treated as intermediate consumption.

6.90. Therefore, the turnover of retail trade and some services disaggregated by detailed industries can provide valuable information on household final consumption expenditure only by broad categories of products and there is no one-to-one correspondence between retail trade turnover by industries and household final consumption expenditure by COICOP groups.

6.91. It should also be borne in mind that informal activities may also contribute significantly to household final consumption expenditure. The development in retail trade is particularly useful to extrapolate column totals from already existing SUTs to form initial estimates for subsequent years.

(c) Products subject to regulations, taxes or subsidies

6.92. It is often possible to obtain detailed data on products that are subject to regulation, taxation or subsidization, since this information is available from the responsible authorities.

6.93. Motor vehicles, alcohol and tobacco are typical example of such products subject to regulation. It may, for example, be possible to use information on motor vehicle registrations to determine household final consumption expenditure of motor vehicles. Information on the use of alcohol or tobacco (for example, related to duties paid) could be used to determine consumption of products that are used for household final consumption expenditure taking into account that these products could also be used for hospitality by businesses or an input used by restaurants, in which case they would be treated as intermediate consumption and thus excluded from final consumption expenditures by households.

2. Final consumption expenditure of NPISHs

6.94. Final consumption expenditure of NPISHs consists of the expenditure, including expenditure whose value must be estimated indirectly, incurred by resident NPISHs on individual consumption goods and services and possibly on collective consumption services. (2008 SNA, paragraph 9.115).

6.95. Similar to the final consumption expenditure of households, it is useful to cross-classify the consumption expenditures of NPISHs by products (according to CPC) and by purpose. The reference classification of these expenditures by purpose is the Classification of the Purposes of Non-Profit Institutions Serving Households (COPNI) (United Nations, 1999b), see Box 6.4. By convention, all consumption expenditures of NPISHs are treated as individual consumption (see 2008 SNA, paragraph 9.107). Thus, all consumption expenditures of NPISHs are described in COPNI as well as in Division 13 of COICOP.

6.96. Table 6.7 shows the matrix that links the final consumption expenditures by NPISHs by purpose (according to COPNI) and by product (according to CPC).

6.97. In some countries, NPISHs may produce most of the services within education, health or social protection while in other countries such services may mainly be produced by general government and private enterprises. It can be appropriate to show separate columns for COPNI Divisions in the Use Table. Where NPISHs activity is negligible, its detailed breakdown can be considered to be less relevant.

6.98. Various data sources will be used to cover NPISHs detail by industry and by product, for example, it is recommended that a business survey is used based on a sample of NPISHs selected from the business register. The grossing-up methodology for a sample survey would need to reflect that NPISHs are non-market bodies and not market bodies, i.e. output is the sum of costs and not related to turnover. Other sources may also include company accounts, regulatory bodies and collective group accounts covering say a group of trade unions or religious bodies.

Box 6.4 Classification of the Purposes of NPISHs

The main use of COPNI is to classify expenditures by NPISHs in a manner consistent with the purposes of the individual consumption expenditures of households and general government in order to obtain the SNA aggregate of actual final consumption of households.

COPNI can also be used to facilitate international comparisons of the activities of NPISHs. In many countries, activities of these institutions are an important complement to government activities in respect of supplying education, health and social protection services to the population. In some countries, NPISHs are also becoming prominent in non-traditional areas such as environmental protection, the protection of human rights and the defence of minority groups.

There are nine divisions are distinguished in COPNI:

01 - Housing

02 - Health

03 - Recreation and culture

04 - Education

05 - Social protection

06 - Religion

07 - Political parties, labour and professional organizations

08 - Environmental protection

09 - Services n.e.c.

Note that the nine division of COPNI corresponds to Division 13 of COICOP which classifies the Individual consumption expenditure of NPISHs. (see Box 6.2)

Table 6.7 Table linking final consumption expenditures of NPISHs by purpose (COPNI) and by product (CPC)

COPNI Division / Products	Final consumption of NPISHs (COPNI)				
	Housing 01	Health 02	… …	Other services n.e.c. 09	Total 01-09
Product 1					
Product 2					
:					
Product N					
Total					

3. Final consumption expenditure of general government

6.99. General government final consumption expenditure consists of expenditure, including expenditure whose value must be estimated indirectly, incurred by general government on both individual consumption goods and services and collective consumption services (2008 SNA, paragraph 9.114).

6.100. Final consumption expenditures of general government can be classified in several ways. For example:

- According to whether the goods or services have been produced by market or non-market producers.
- According to whether the expenditures are on collective services or individual goods or services.
- By function or purpose according to the Classification of the Functions of Government (COFOG).
- By type of good or service according to CPC.

6.101. The column of final consumption of general government in the Use Table is usually underpinned with a matrix linking the final consumption of general government by product and by purpose. The reference classification of final consumption of general government by purpose is COFOG (United Nations, 1999b) (see Box 6.5). Data from government accounts is usually classified by COFOG groups. This classification may be more or less detailed but should in most cases make it possible to distinguish between individual consumption and collective consumption. Individual consumption corresponds to Group 14 of COICOP.

Box 6.5 Classification of Functions of Government

A major use of COFOG is to identify consumption expenditures that benefit individual households and that are transferred to Division 14 of COICOP in order to derive the SNA aggregate of actual final consumption of households (or actual individual consumption). The divisions, groups and classes covering these expenditures are clearly indicated in the classification. COFOG also permits trends in government outlays on particular functions or purposes to be examined over time.

COFOG is used in the analysis and presentation of statistics on the government finance. COFOG consists of ten divisions:

01 - General public services

02 - Defence

03 - Public order and safety

04 - Economic affairs

05 - Environmental protection

06 - Housing and community amenities

07 - Health

08 - Recreation, culture and religion

09 - Education

10 - Social protection

Each class of COFOG is clearly identified as collective services or individual services. In general, all of classes 01 to 06 are collective services, as are section 07.5 and 07.6 of health, sections 08.3 to 08.6 of recreation, culture and religion, sections 09.7 and 09.8 of education, and sections 10.8 and 10.9 of social protection. These sections cover expenditures on general administration, regulation, research that is not recorded as capital formation and so on. The remaining sections of health, recreation, culture and religion, education and social protection (which dominate each of the classes) are individual services. (2008 SNA paragraph 9.100).

6.102. Table 6.8 shows the table linking consumption expenditures of the general government by purpose (COFOG) and by product (CPC). An alternative would be to have column headings in terms of industries (ISIC) and the row headings by product (CPC).

6.103. The function to industry transformation is important, for example, as many regulatory/administrative functions could be classified to the Public Administration and Defence industry and not industries like health and education. Again the level of detail is determined by its importance in the country. A split by level of government could depict different characteristics in terms of COFOG categories, inputs and outputs.

Table 6.8 Table linking final consumption expenditure of general government by COFOG and CPC

Collective services

Divisions (COFOG)	Collective consumption general government (COFOG)				
	General public services	Defence	...	Social protection	Total
Products	01	02	...	10	
Product 1					
Product 2					
:					
Product N					
Total					

Individual services

Divisions (COFOG)	Individual consumption general government (COFOG)				
	Health	Recreation culture and religion	Education	Social protection	Total
Products	07*	08*	09*	10*	
Product 1					
Product 2					
:					
Product N					
Total					

6.104. Individual consumption of general government consists of two parts which may be shown as separate columns in the Use Table:

- goods and services produced by general government as a non-market producer; and
- goods and services purchased by general government from market producers for onward transmission to households either free or at prices that are not economically significant. These goods and services are not included in the output of general government.

6.105. Data sources for general government primarily rely on central government and local government administrative data, and mainly provided by the finance ministries and local government bodies. This is often supplemented with specific survey data such as very detailed local government expenditure. Furthermore, some estimates are based on models such as the Perpetual Inventory Model estimating the consumption of fixed capital for both the central government and local government sectors. All of these sources may use a COFOG basis or an industry basis – in both cases, they will need a CPC product breakdown.

F. The gross capital formation part of the Use Table

6.106. Gross fixed capital formation (GFCF) is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets. (2008 SNA, paragraph 10.32) Gross capital formation (GCF) is measured by the total value of the GFCF, changes in inventories and acquisitions less disposals of valuables. (2008 SNA, paragraph 10.31). In the Use Table, GCF is usually at least broken down in three separate columns to show its components separately as shown in Table 6.9. They are discussed in the next sections.

Table 6.9 Categories of gross capital formation

	Gross capital formation			
Products	Gross fixed capital formation	Changes in inventories	Aquisitions less disposals of valuables	Total
Product 1				
Product 2				
:				
Product N				
Total				

1. Gross fixed capital formation

6.107. GFCF is measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets (2008 SNA, paragraph 10.32). Fixed assets are produced assets that are used repeatedly or continuously in production processes for more than one year (2008 SNA, paragraph 10.11). GFCF is also described as capital investment or fixed investment or capital expenditure.

6.108. One approach for the compilation of this part of the Use Table is the demand-based approach which requires detailed information on investment. Under this approach a matrix is compiled linking GFCF by industries (according to ISIC), by type of asset (see Box 6.6) and by products (according to CPC). This matrix is often referred to as the 'investment matrix'. In order to develop such a matrix by industry, and by institutional sector, for each type of asset there should be an allocation to the appropriate product. In some cases, there may be a one-to-one relationship between the asset and product but for example in the case of machinery, there are many one-to-many relationships.

Box 6.6 Gross fixed capital formation by type of asset

Gross fixed capital formation is usually shown by type of asset. The types of assets distinguished in the 2008 SNA are the following (see 2008 SNA, Chapter 10, Table 10.2).

Gross fixed capital formation by type of asset:

- Dwellings
- Other buildings and structures
    - Buildings other than dwellings
    - Other structures
    - Land improvements
- Machinery and equipment
    - Transport equipment
    - ICT equipment
    - Other machinery and equipment
- Weapons systems
- Cultivated biological resources
    - Animal resources yielding repeat products
    - Tree, crop and plant resources yielding repeat products

Costs of ownership transfer on non-produced assets

Intellectual property products

Research and development

Mineral exploration and evaluation

Computer software and databases

Computer software

Databases

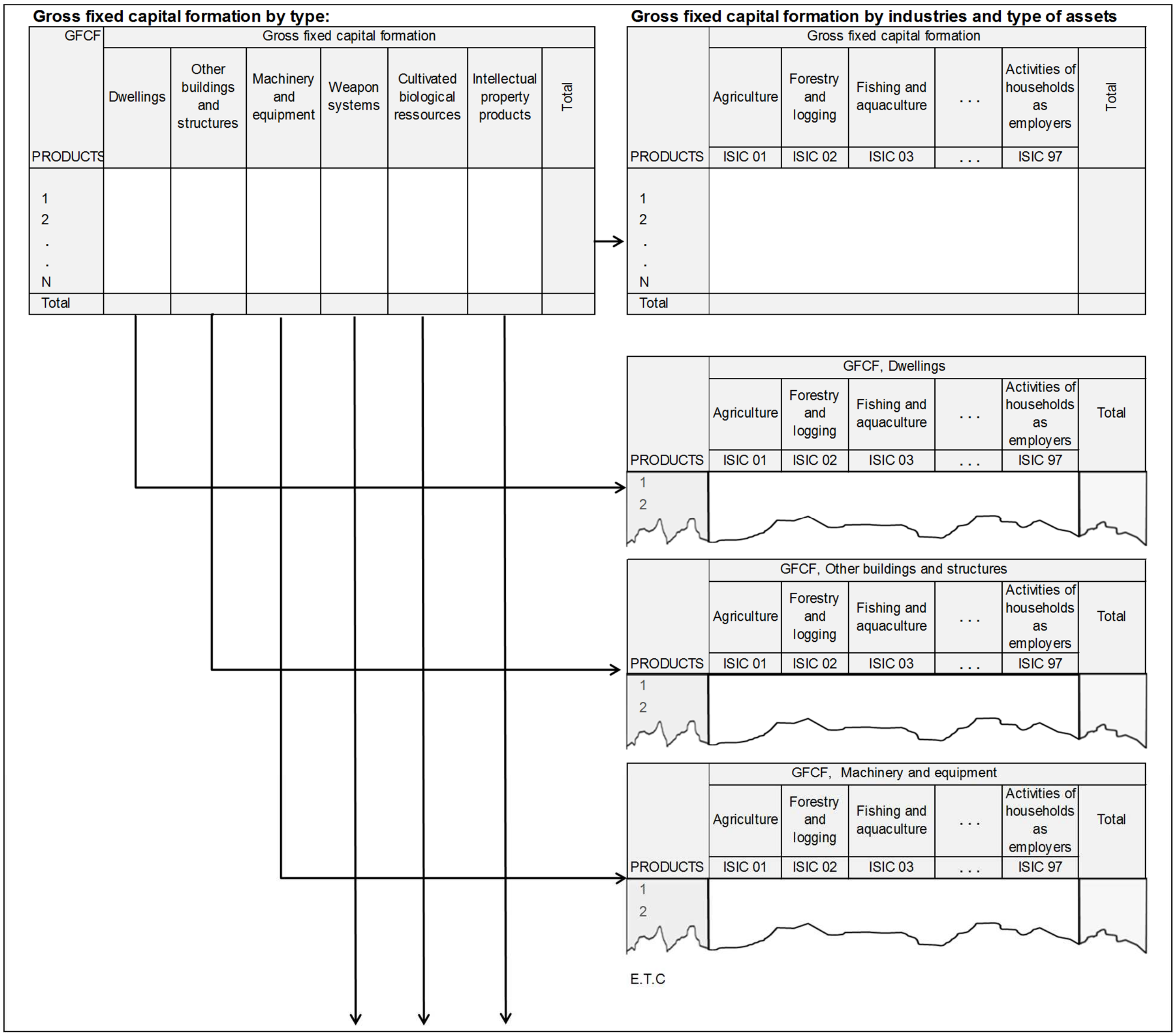
Entertainment, literary or artistic originals

Other intellectual property products

Recognizing the output and capital formation of Research and development are particularly difficult to measure. In theory, the value of the output of research and development is equal to the value of discounted future benefits the business gets from their research and development investment. These future benefits are difficult to estimate. Furthermore, most research and development is produced on own-account. Therefore the sum of costs approach for valuation of output will usually be applied. More detail on the impact of capitalizing research and development costs on SUTs and IOTs are covered in Annex B in this chapter.

6.109. Table 6.10 shows the structure of the matrix linking GFCF by type of asset, by product and by industry. Typically this matrix is based on surveys on capital expenditure which tend to focus on institutional sectors, industries and assets; however supplementary data source(s) are often also needed, such as, for example, specifically designed surveys which collect and provide investment detail by type of product. Detailed information on investments are particularly important for GFCF, which tends to be an erratic series and cannot be modelled easily, for example, all businesses do not buy vehicles every year, and the length of their use will vary across, and within, industries.

Table 6.10 Table linking GFCF by industries, assets and products



6.110. In countries where such level of detail data is not available, the "product flow" approach may be applied using assumptions linking the output of a product to the destination of the product in terms of its purpose. This is a less optimal approach but allows output and demand to be matched.

6.111. It is important to note, that GFCF - like other product based variables in the Use Table - are valued at purchasers' prices. However, GFCF is recorded by including any non-deductible VAT and excluding any deductible VAT. This will impact on those industries and products where exemption applies and will be consistent with the valuation of the intermediate inputs for the corresponding industries.

6.112. In its simplest version, the Use Table may show GFCF as a single column, and this would also fulfil the requirements for compiling SUTs and some users' needs. The single column approach may be preferred if information on GFCF is missing or incomplete. It should, however, be possible to distinguish between broad groups of assets based on the product classification used in the SUTs framework.

6.113. However, the quality of the product breakdown is greatly enhanced with the greater level of detail linking industries, institutional sectors, assets and products. The disaggregation of GFCF by industries and institutional sectors is also needed for calculation of consumption of fixed capital by industry, and in turn, for the calculation of the value of non-market producers' output. The breakdown can be done by columns that correspond fully to the columns for output and intermediate consumption. It may, however, be feasible to limit the number of columns in such a breakdown due to lack of precise information from source data.

6.114. If all combinations of GFCF by types, industries and institutional sectors of a detailed matrix were shown as columns in the Use Table, these columns would completely dominate the presentation. Furthermore, a disproportionate share of the resources needed to balance the SUTs might be required to distribute products between the GFCF columns, and finalization of the SUTs might be delayed unnecessarily.

6.115. One practical solution could be to show columns for a few broad categories of industries. Another practical solution could be to show only columns for different types of capital formation within the SUTs framework. The breakdown by industries can instead take place outside the central SUTs framework in a sub-system of investment matrices. Here, GFCF by product from the final balanced version of the Use Table can be allocated to specific industries, institutional sectors as a separate process.

6.116. Estimates of GFCF by industries have, however, an important role in the preparation of initial column totals for GFCF for the Use Table. Furthermore, a preliminary version of GFCF by products and industries can provide the starting point for the GFCF columns of the Use Table.

6.117. Table 6.11 illustrates the GFCF by industry and product link to the GFCF column in the Use Table. In essence, this identifies the producers of capital goods in the rows and the investing industries in the columns.

Table 6.11 Gross fixed capital formation by investing industry

INDUSTRIES		INVESTING INDUSTRIES						
		Agriculture	Manufacturing	Construction	Trade, transport, communication	Financial and business services	Other services	Total at purchasers' prices
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agricultural products	(1)	128	2	0	4	36	10	180
Manufactured products	(2)	1 223	7 225	664	5 893	9 124	2 626	26 756
Construction	(3)	828	1 752	224	3 822	15 995	2 534	25 155
Trade, transport, communication	(4)	12	1 206	189	2 280	1 672	684	6 043
Financal and business services	(5)	124	4 331	82	1 324	3 065	2 245	11 170
Other services	(6)	0	0	0	0	0	113	113
Total	(7)	2 314	14 516	1 160	13 323	29 892	8 212	69 418

Austria 2011

Note: the products "Trade", "Transport" and "Communication" of Table 6.1 are presented together in Table 6.11

6.118. The GFCF matrix has further roles to play. The calculation of capital stock data and the calculation of a valuation matrix for non-deductible VAT require an assessment of GFCF by product (by producing industry) and investor (by investing industry). In the investment matrix, the user concept of capital - and not the owner concept of capital, should be reflected.

6.119. The assessment of consumption of fixed capital as a component of GVA should be based on empirical capital stock data. The man-made capital stock is derived from cumulative investment of the past in buildings, machinery and transport equipment based on the actual lifetime of a capital good, allowing for retirements and obsolescence by using the perpetual investor method (see OECD, 2009).

6.120. Consumption of fixed capital is calculated at current replacement cost of the net capital stock. The net capital stock is defined as the financial value of the gross capital stock still in use. It is obvious that it will be easier to estimate these types of matrices on the basis of a rectangular SUTs system with many disaggregated homogeneous products.

(a) Sources for GFCF

6.121. For industries that are covered by business statistics, the source data will usually include information on purchases and sales of capital equipment. It is usually possible to distinguish between GFCF in buildings, structures and machinery and equipment. Investment in intellectual property products is usually also shown but is not necessarily classified by categories that can be used for National Accounts. For example, these sources will often include purchased software and may also show a value for bigger software projects produced on own account. Inclusion of acquisitions of patents, franchises and goodwill and the fact that R&D may or may not be wholly or partially capitalized but not necessarily at the time when it should have been as recorded for National Accounts, is difficult to measure.

6.122. The distinction between intermediate consumption and GFCF in business accounts has similar consequences but with opposite sign for estimates of GFCF as it has for intermediate consumption. There are other conceptual differences between company accounts and National Accounts, for example:

- Business accounts may not fully show GFCF according to economic ownership. Some financially leased assets may be included in investment by their legal owners.
- Sales of existing assets should be treated as a negative GFCF valued at the actual prices obtained by the seller. When the sale takes place between two resident producers, the positive and negative investment will cancel out for the economy as a whole except for costs of change of ownership. In business accounts, the figures for disposals of assets will often be shown at historical cost while the corresponding cumulated depreciation is shown as a separate item. The difference is the bookkeeping value of the sold asset. If the actual price obtained differs from this value, the residual is included in secondary income, and should be reviewed and adjusted for as appropriate. In practice, it can usually be assumed that the difference between the negative GFCF and the bookkeeping value of the sold asset is insignificant but there may be important exceptions where figures from company accounts are misleading.
- In business accounts, it is common practice to treat minor or regular purchases of equipment as current expenses. Such acquisitions may not always be identifiable in the accounts. For some big corporations, the threshold for classifying purchases as investment can actually be high, say, $10.000 or more but practices may vary between countries due to differences in legislation and taxation rules.
- Own account production of capital goods may be capitalized in business accounts. Even if this is not the case the accounts may contain information on the value of own account production. However, the value shown may not be at basic prices as it may only include the direct cost of raw materials and wages and salaries attributed to its production, in which case a correction for indirect costs and gross operating surplus can be appropriate.
- Own account production of intellectual property products may not be directly identifiable in company accounts. Production of software, databases, R&D and literary, artistic or entertainment originals may

sometimes have been capitalized as intangible assets in company accounts. For some intangibles, GFCF may be covered by business surveys. In the absence of further detail, it is recommended that GFCF is estimated based on the wages and salaries paid for this kind of work with an appropriate mark-up for other expenses and typical gross operating surplus. More details are covered in the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010).

6.123. Information on GFCF within general government can usually be found in government accounts. Many of the above issues are also relevant to investment within general government. Accounts of central and local government will usually contain a level of detail that reveals the distinction between intermediate consumption and GFCF. Extra-budgetary units within general government may, on the other hand, provide less information on the nature of their costs as it may also be the case for NPISHs.

6.124. Special care should be taken when projects are partially or wholly financed by capital transfers from outside, for instance from international organizations. In such cases, the accounts may show values that are net of financing from outside. In national accounts, GFCF should record the full value of such projects.

6.125. The value of investment covered by business accounts will often give an incomplete picture of total GFCF because some industries are only partially covered or lack information on some types of investment. The initial estimates of GFCF may be prepared within an investment matrix framework that shows investment by industries, institutional sectors, types and products. Despite the use of uncertain data and “guestimates” in many cells within such a framework, it can indicate those cells that are badly covered by source data but should definitely contain values.

(b) GFCF by products

6.126. It is recommended to use regular business surveys as the key source for GFCF by product especially since as GFCF is an erratic time series and cannot be modelled easily. If possible, these surveys should be linked to those collecting details on purchases of goods and services for intermediate consumption, in order to avoid double-counting or missing expenditure. Surveys of the product structure of GFCF may exist but may not cover all industries. As for intermediate consumption, it may be possible to find detailed information in annual reports of enterprises.

6.127. Government accounts contain information providing much more detail than a simple distribution by main types of investment. This information can, also for investment products, typically appear in an unsystematic form and it will need to be coded by product categories in SUTs before it can be used.

6.128. For many industries available information on the product dimension of investment is limited to a few categories or even non-existent. Initial estimates will therefore require some common sense decisions.

6.129. In the end, the product structure of GFCF will to a large extent be determined by the availability of investment products within the SUTs framework. In the simplest case, where other information is unavailable, GFCF will alone be determined by the supply of typical investment products that are largely not used for other purposes.

6.130. Very few products are used exclusively for GFCF. In most cases, the distribution between intermediate consumption, household final consumption expenditure and GFCF that can be estimated using information from business surveys and company accounts is uncertain, especially if the rows of the SUTs represent broad categories of products. The disaggregation of products can reduce this uncertainty, when the necessary source data are available. For some products, the distribution may be based on other types of information, examples include:

- If an official register of motor vehicles is accessible, it may be possible to identify the changes from year-to-year in the numbers of different types of cars and trucks by age, size and ownership. Combined with typical prices for the various groups of vehicles it may be used to estimate household final consumption expenditure as well as GFCF by industry of new and used vehicles. Registers may also provide information to help distribute registration taxes by purpose.
- Similarly, it may be possible to use register information to follow the capital stock, and change in capital stock for other types of transport equipment.
- Official registers of buildings may also include information on type, size, use and owners and may be used for distribution of buildings by purpose. For dwellings and private commercial buildings that are not completely covered by company accounts or business surveys, register information can be used in the estimation of the value of investment.
- Information on investment in buildings, transport equipment or specific types of machinery and investment may be collected by business surveys. Some countries carry out quarterly and annual business surveys covering GFCF and underlying details. On the other hand, some countries occasionally carry out comprehensive industrial censuses that may contain information on the use of capital equipment for units that are not covered by other kinds of statistics.
- Household budget surveys can include information on investment in new dwellings and capital repairs. In countries with a large informal economy, household budget surveys may be the most important source for estimation of investment in buildings, machinery and equipment in small farms (that may, however, also be included in agricultural censuses), small retail trade and repair workshops.

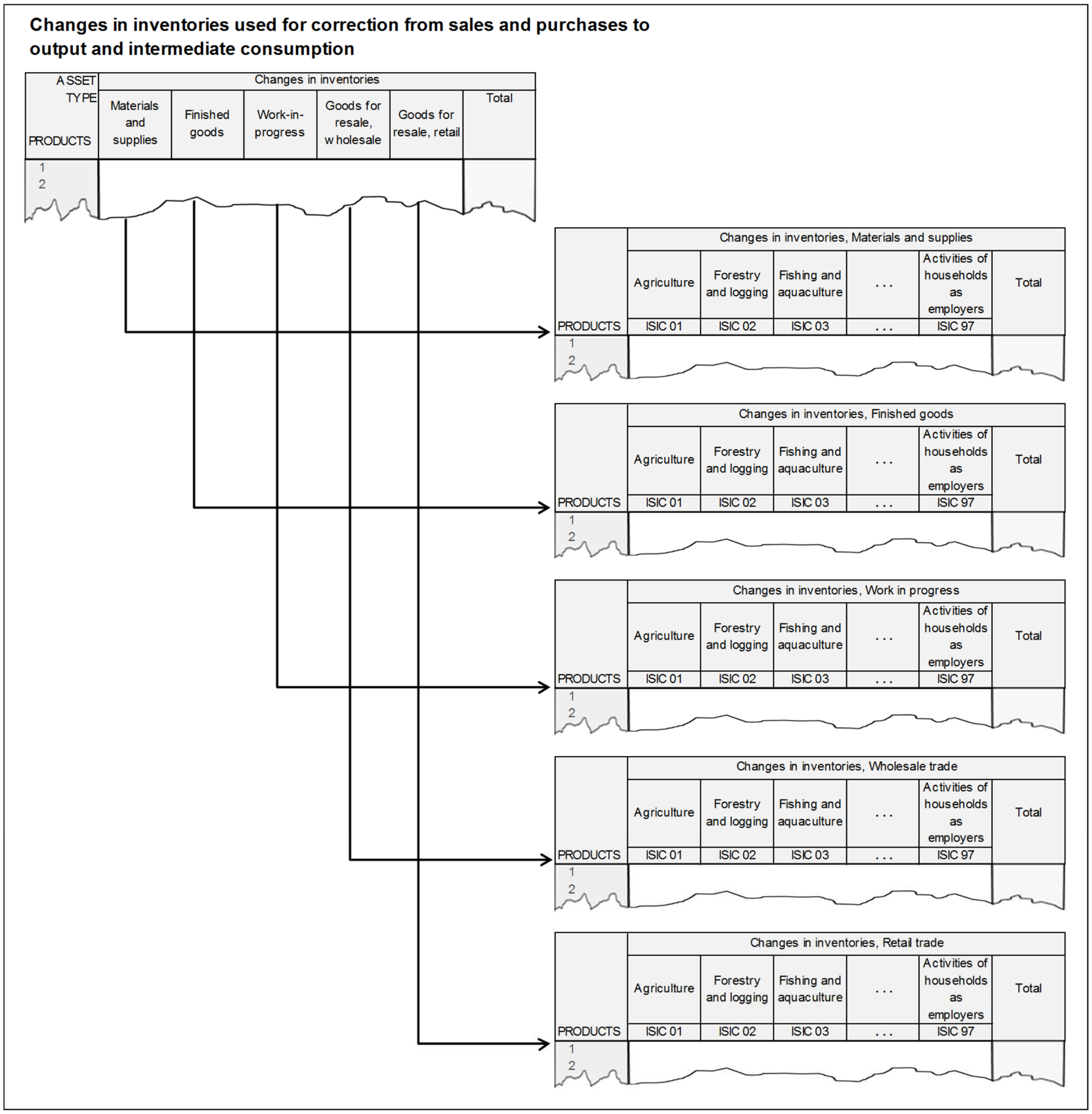
6.131. Furthermore, the product structure of investment tends to be more volatile than the structure of input cost structures. Nevertheless, an initial version of investment by products estimated from the uses side is, despite its uncertainties, usually preferred to an estimated distribution based alone on the supply of specific products.

2. Changes in inventories

6.132. In order to define changes in inventories, it is useful to define first, what is covered by inventories. Inventories are produced assets that consist of goods and services, which came into existence in the current period or in an earlier period, and that are held for sale, use in production or other use at a later date (2008, SNA, paragraph 10.12). Changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period. Some of these acquisitions and disposals are attributable to actual purchases or sales but others reflect transactions that are internal to the enterprise (2008 SNA, paragraph 10.118).

6.133. The column of change in inventories in the Use Table should be underpinned with a matrix linking as column headings, classification of industries (for example, ISIC), and as row headings, the product grouping (for example, CPC) as appearing in the SUTs for each type of asset. Changes in inventories can be analysed by industry and by types of assets, which need to be linked via the CPC in the SUTs as illustrated in Table 6.12.

Table 6.12 Table linking change in inventories industries, assets and products



6.134. The change in inventories should separately distinguish among the following types of assets:

- Materials and supplies, which consist of all products that an enterprise holds in inventory with the intention of using them as intermediate inputs into production;
- Work-in-progress, which consists of output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units;
- Finished goods, which consist of goods produced as outputs that their producer does not intend to process further before supplying them to other institutional units;
- Military inventories, which consist of single-use items, such as ammunition, missiles, rockets, bombs, etc., delivered by weapons or weapons systems. Some single-use items such as ballistic missiles highly

destructive may be classified as fixed assets in the sense that they provide deterrence services against aggressors; and

- Goods for resale, which are goods acquired by enterprises, such as wholesalers or retailers, for the purpose of reselling them to their customers.

6.135. Although change in inventories for all asset types appear in the final uses part of the Use Table, they also play a role across other parts of the Supply Table and Use Table:

- For each industry, intermediate consumption can be calculated as purchases goods and services less change in inventories of materials, fuels and raw materials.
- For each industry, output can be calculated as sales plus change in inventories of work-in-progress and finished goods. Producers of services may actually have inventories of work-in-progress in the form of projects lasting for more than one accounting period like movies, advertising campaigns, legal contracts, etc.

6.136. The output value in trade can be calculated as sales less purchases less change in inventories of goods purchased for resale without any further processing. If a distinction between wholesale and retail trade is made in SUTs, then the calculation of the output value for each of these industries requires separate values for change in inventories of goods for resale.

6.137. For estimating output and intermediate consumption, changes in inventories are usually estimated by industry and institutional sector. These detailed breakdowns are, however, seldom shown in the Use Table.

6.138. It must be noted that the changes in inventories reported by the survey respondents should be adjusted to fulfil National Accounts definitions, for example, the changes in inventories should not include any holding gains or losses. Source data may be presented as output and intermediate consumption instead of sales and purchases. In practice, the data collected may nevertheless contain values of sales and purchases. This may be replaced by a correction that uses inventories that appear in the company accounts. If such changes include any holding gains or losses, the correct treatment is to remove the original correction for inventory changes and replace it by a correction that uses inventory changes according to National Accounts definitions.

6.139. Statistics based on company accounts usually contain information on inventory changes as well as stocks of inventories. The value shown for change in inventories will usually include holding gains/losses and will be misleading if significant price changes take place during the year. A correction for holding gains/losses can usually be based on the nominal values of opening and closing stocks, or the book value levels. It will require the existence of adequate information on price changes during the year. The correction can typically be carried out by inflation or deflation of opening and closing stocks to the average prices of the year before calculation of the difference. To calculate constant price values of stock of inventories (and changes in current prices), they should be broken down into products for which price indices or volume indicators can be found.

6.140. Annual company accounts may not contain information of opening stocks, in which case it can be necessary to use values of closing stocks from the previous year as a measure of opening stocks. As coverage changes and establishments are reclassified, the observed differences between closing stocks and opening stocks may then need some adjustments at the industry level.

6.141. Given the links between sales, purchases and inventories as well as other variables, it is recommended that the data on inventories is collected via the same survey questionnaires to ensure coherency across the variables being collected via the same source and at the same point in time.

6.142. The Eurostat-OECD Compilation Guide on Inventories (Eurostat and OECD, 2017) provides a lot more detail in terms of compilation issues and guidance.

(a) Estimation of changes in inventories by product

6.143. To fill in of the columns for changes in inventories, the totals for such item must be broken down into changes in inventories for the products used in the SUTs and have to be completed as part of generating the estimates of output and intermediate consumption.

6.144. For some products, the values of changes in inventories may be calculated based on knowledge of physical opening stocks and closing stocks and information on the development in prices, for example, for crops and livestock in agriculture and for energy products. The calculation of changes in inventories should be an integral part of sub-systems used to provide the complete product balances for such products.

6.145. The inventories of most industries contain a broad selection of products that are usually not known from statistical sources. The totals of opening stocks and closing stocks used to calculate changes in inventories need to be distributed by products based on assumptions on the product structure for each total. Examples include:

- Inventories of finished goods and work-in-progress can be distributed proportionally with those outputs of each industry that can appear in inventories of goods. Caution will be needed on service products
- Inventories of raw materials and fuels can be distributed proportionally with the use of inputs of each industry that can appear in inventories.
- Inventories of goods for resale can be distributed using various proxies for the product structure, for example, output or input in specific industries, household final consumption expenditure in specific COICOP groups or GFCF of specific types.
- Values of inventories of specific products may already be known from other calculations. Such values can be retained as pre-determined values.
- Some products, for instance electricity, are not likely to appear in inventories. Services should only appear in inventories as work-in-progress.

6.146. Calculating the distribution of changes in inventories by products in this way is of course uncertain and it may be adjusted during the balancing of SUTs. There is also a danger that errors in source data are not detected if changes in inventories are used as balancing items or not adequately quality assured. One should, at least, only adjust the total of changes in inventories in ‘exceptional cases’, where this is believed to be the most realistic solution to a balancing problem.

6.147. It should be noted that any balancing adjustment to the asset composition of changes in inventories, or to the total changes in inventories, will impact the Supply Table and Use Table and have no net differential impact between the production, income and expenditure approaches to measuring GDP. This is because the various components of changes in inventories feed into the estimation of output and intermediate consumption, thus the impact of any adjustment will be equal on production, income and expenditure. It is more likely that quality adjustments are made to source data, where such changes will, and should, change corresponding industries' intermediate consumption and output and, in turn, GVA.

3. Acquisitions less disposals of valuables

6.148. Valuables are produced goods of considerable value that are not used primarily for purposes of production or consumption but are held as stores of value over time (2008 SNA, paragraph 10.13). Valuables include precious metals and stones, antiques and other art objects and other valuables. The aim of the acquisitions less disposals of valuables is to capture these alternative forms of investments. Capital formation in valuables usually needs to be based on domestic supply of specific goods, that is, imports less exports plus the margin. Valuables are by nature difficult to distribute by industries based on establishments as they share some properties with financial assets, and the industry breakdown does not reflect those valuables held by say, households.

6.149. Trade data by product provide a good source for such items. Whereas the margin or fee type data may be collected via surveys to say, auctioneers. For SUTs, the product breakdown is key thus the relevance of imports less exports by type of product. In terms of ownership, this is less important, as the owner could be industry, government or households.

G. Exports

6.150. Exports are shown in the Use Table by product. Depending on the specific user's need, additional breakdown by column could be provided by destination. It should be noted that the treatment, issues and sources of data applied to imports of goods and services are also applicable to exports of goods and services. More details on imports of goods and services are covered in Chapters 4, 5 and 8, including issues like the new treatment of goods sent abroad for processing.

6.151. In the Use Table, exports are valued FOB at the point of exit from the exporter's economy. It includes the cost of transport from the exporter's premises to the border of the exporting economy. FOB price includes:

- the value of goods at basic prices;
- trade and transport services to the border;
- taxes minus subsidies on products; there is no VAT on exports.

6.152. Since data on exports on goods are collected on a FOB basis, no further transformation is needed.

1. Data sources

6.153. Most countries have comprehensive foreign trade statistics for goods. Data are generally collected according to HS, valued at FOB and often available with a high level of detail, say by 6-digit or 8-digit HS codes. Thus the only adjustment needed to the basic data is the conversion between HS codes and CPC. It is usually possible to convert the data from the HS classification using a correspondence table from the UN website (http://unstats.un.org/unsd/class/default.asp) supplemented by a conversion table that define the SUTs products as aggregates of CPC classifications.

6.154. Various adjustments would be needed to move the foreign trade statistics onto a balance of payments basis in line with BPM 6 such as the change in economic ownership and the difference crossing the border.

6.155. Foreign trade statistics will also usually include the distribution of exports of goods by countries for all products.

6.156. Enterprises with exports below certain threshold values can be allowed to report their foreign trade without a distribution by products, for example with survey based external trade statistics. In this case, the values of exports by products will need to be grossed up to cover total exports. The difference between grossed up and reported values is uncertain, and may need to be corrected during the balancing of SUTs. As for inputs, information on the reported values can be shown together with the grossed-up values in the tables presented to those working on the manual balancing of SUTs before any automated balancing process.

6.157. The main source for data on exports of services is the balance of payments based data and the sources used to produce this data. The classification according to the EBOPS 2010 (United Nations *et al.* 2011 and IMF, 2009) will usually provide sufficient detail for conversion into the classification used in the SUTs. Otherwise one may have access to statistics that shows imports and exports by industries. A conversion into detailed SUTs based products can be established based on the coding in balance of payments and the information on the industry classification of exporting units.

Annex A to Chapter 6: Example questionnaire collecting purchases of goods and services for intermediate consumption

A6.1 The extract shown in Figure A6.1 is from a business survey questionnaire from the Statistical Office of the Republic of Serbia. The data are collected for each industry and by product covering the:

- Cost of materials; and
- Closing stocks of materials and fuels.

A6.2 Full coverage of goods and services consumed as intermediate consumption to calculate the industry totals is achieved via further tables collecting data on the costs of industrial and non-industrial services, an extract is shown in Figure A6.2. This data allows for the calculation of intermediate consumption by product required to populate the intermediate use part of the Use Table as shown in Table 6.1.

Figure A6.1 Extract of questionnaire covering costs and closing stocks of raw materials and other material inputs

No.	Code	Product description	Cost of materials (group of account 5.1)	Closing stocks (group of accounts 10)
1	2	3	4	5
3000		TOTAL		
		AGRICULTURAL PRODUCTS, RAW AND UNPROCESSED PRODUCTS OF PLANT AND ANIMAL ORIGIN		
3001	01.11.1 - 01.11.4	Cereals, all kinds (except rice), cereal seeds		
3002	01.11.6 - 01.11.7	Green leguminous vegetables (beans, peas, lentils and other)		
3003	01.11.8	Soya beans, groundnuts (row) and cotton seed		
3004	01.11.9	Other oil seeds - sunflow er, sesame, lin etc.		
3005	01.11.12	Rice, not husked		
3006	01.13 except 01.13.7	Vegetables, raw		
3007	01.13.7	Sugar beet and sugar beet seed		
3008	01.13.8	Mushrooms and truffles		
3009	01.15	Unmanufactured tobacco		
3010	01.16	Fibre crops (lin, cotton and other fibre crops, used in textile industry)		
3011	01.19.1	Forage crops and vegetative matter for livestock feeding unprocessed form		
3012	01.19.2	Flow ers and flow er seeds		
3013	01.21	Grapes		
3014	01.22 - 01.23	Tropical and subtropical fruits (citrus, figs etc.)		
3015	01.24, 01.25 except 01.25.3	Other fruits, tree and bush fruits, except nuts (apples, pears, cherries, berries etc.)		
3016	01.25.3	Nuts (almonds, hazelnut, w alnuts etc.)		
3017	01.26	Olives, coconuts (row , unprocessed)		
3018	01.27	Coffee beans, tea leaves, cocoa beans, not roasted		
3019	01.28	Spices, aromatic, drug and pharmaceutical crops		
3020	01.11.5, 01.14, 01.19.3, 01.29, 01.3	Vegetables and fruit seeds, other seeds, grass, unprocessed straw and other residues of cereals, seeds for trees and seedings, planting materials, sugar cane and other raw , unprocessed and untreated products of plant origin n.e.c.		
3021	01.4. except 01.45.3 & 01.49.3	Live animals and raw animal products (unprocessed milk, eggs, natural honey, except raw skins, shorn w ool and skins, see line 3022, etc.)		
3022	01.45.3, 01.49.3	Raw fur skins, shorn w ool, skins (excluding products of slaughterhouses and industrial meat production, see 1036)		
3023	01.49. part	Other animal products, raw , unprocessed an untreated		
3024	01.7	Hunting and trapping products, raw		
		PRODUCTS OF FORESTRY		
3025	02.2	Wood in the rough - logs, fuel w ood and other row products of forestry		
3026	02.1, 02.3	Forest trees and seeds, w ild grow ing edible products; natural cork, varnish, balsams and other raw products of forestry n.e.c.		
		FISH AND OTHER FISHING PRODUCTS, UNPROCESSED AND UNTREATED		
3027	03	Fish and other fishing products; aquaculture products (raw , unprocessed and untreated)		
		MINING AND QUARRYING PRODUCTS; UNPROCESSED		
3028	05.1, 05.2	Coals, hard coal and lignite		
3029	06.1	Crude petroleum, bituminous or oil shale and tar sands. Note petroleum products - fuels are entered in the row 3118		
3030	06.2	Natural gas, processed (Manufactured gas distributed though mains, heating gas and petroleum gases from refineries should be reported in row s 3116 and 3119)		
3031	07.1	Iron ores		
3032	07.2	Other metal ores		
3033	08.1	Stone, sand, and clay and other raw materials for construction, industrial and craft activities		
3034	08.9	Other mining and quarrying products n.e.c.		
		MANUFACTURING INDUSTRY PRODUCTS		
		Food products and other processed products of plant and animal origin; used as reproduced material		
3035	10.11 except 10.11.4 & 10.12.5	Meat (red meat, including frozen) except live animals and unprocessed and untreated products of animal origin (goes to row s 1021 -1024); raw offal and edible fat and oils		
⋮	⋮	⋮	⋮	⋮
		Electricity, refined petroleum products for energy purposes, gas (excluding natural gas), steam, hot w ater, air conditioning (including energy products use for heating)	Account 513	
3115	35.11	Electricity costs		
3116	35.22	Manufactured gas for industrial purposes and for heating - gas distributed through mains (excluding natural gas, see 3030, petroleum gas from refineries, see 3119 and industrial and medical gases, see 3069)		
3117	35.30	Steam and hot w ater, air conditioning supply services		
3118	19.2	Refined petroleum products - motor, engine and other fuels		
3119	19.2	Petroleum gases - propane, butane etc. (excluding natural gas and industrial and medical gases)		

Source: Statistical Office of the Republic of Serbia

Figure A6.2: Extract of questionnaire covering costs of industrial and non-industrial services

No.	CPA code	Product description	Costs of services	Account code
1	2	3	4	5
4000		TOTAL		
		Support services directly linked with the production of goods and services		
4001	01.6 part	Support agricultural services to crop production		530
4002	01.6 part	Support services to animal production; veterinary services excluded (row 4044)		
4003	02.10.2, 02.4	Support services to forestry		
4004	09	Mining support services; services to petroleum and natural gas extraction		
4005	13.3	Textile finishing services - bleaching, dyeing, printing etc.		
4006	16.10.9	Drying, impregnation or chemical treatment services of timber and product of wood; support services in the processing of wood and wood products n.e.c.		
4007	25.5	Forging, pressing, stamping and roll-forming services of metal		
4008	25.6	Treatment and coating services of metals, machining		
4009	24.5	Casting services of metal and steel		
		Subcontracted services in industry and construction, trade services and other intermediation commissions. Note: enter only the value of the services, value of materials of goods excluded		
4010	14, part	Subcontracted operations in textile industry (excluding value of materials)		530, 539
4011	15, part	Subcontracted operations in footwear and leather production industry (excluding value of materials)		
4012	16, part	Subcontracted operations in production of processed wood and wood products (excluding value of materials)		
4013	25, part	Subcontracted operations as part of machine industry - processing and finishing materials services (excluding value of materials)		
4014	41, 42, 43	Subcontracted operations in construction		
4015	-	Other subcontracted operations in production of goods of other enterprises (excluding value of materials), please specify		
4016	46.1	Trade commissions		
4017	-	Other intermediation commissions, please specify		
		Transportation costs, postal and courier services		
4018	49	Land transport of freight, taxi operation services including rental services of land transport vehicles with operator		531
4019	50	Water transport		
4020	51	Air transport		
4021	52.2	Support services for transportation (loading, unloading, hauling, towing, parking services, etc., transportation excluded)		
4022	53	Postal services under universal obligation		
4023	53	Other postal and courier services		
		Repair, maintenance, installation services; conversion, reconstruction and fitting out of transport equipment		
4024	33.1	Repair and maintenance services of fabricated metal products, machinery and equipment, except motor vehicles		532
4025	43	Repair and maintenance services of buildings and electrical, plumbing, heating and similar installations		
4026	45.2	Maintenance and repair services of motor vehicles		
4027	95.1	Maintenance and repair services of computers and communication equipment		
4028	95.2	Repair services of personal and household goods		
4029	33.2	Installation services of industrial machinery and equipment		
4030	29.20.4, 29.20.5	Reconditioning, assembly, fitting out and bodywork services of motor vehicles, except installation, maintenance and repair services		
4031	30.11.9, 30.20.9, 30.30.6	Conversion, reconstruction and fitting out services of other transport equipment, except installation, maintenance and repair services		
		Rentals, rents on land, warehousing and storage services		
4032	68.2, part	Rental costs on buildings and office space owned by legal persons (except rents on land)		533
4033	68.2, part	Rental costs on buildings and office space owned by natural persons (except rents on land)		
4034	68.2, part	Rents on private land		
4035	68.2, part	Rents on public/state land		
4036	77	Rental and leasing services of motor vehicles, machinery, equipment and tangible goods (excluding real estate and financial lease)		
⋮	⋮	⋮	⋮	⋮
		Expenditure related to the intellectual property (royalties, licence fees, rights of usage, publication, reproduction, transmission, broadcasting and the like), other services n.e.c. Note: services as expenditures; if not capitalised		
4089	58,1	Royalties for the publication of books, magazines, newspapers, etc.		539 or 559
4090	58,2	Royalties and similar payments for usage of software		
4091	59	Royalties for publishing (music & movies, TV series)		
4092	60	Royalties (broadcast rights, etc.) in the production and broadcast of radio and television programs		
4093	71,2	Certification of products and processes		
4094	77,4	Royalties and fees for the use of intellectual property if it is not capitalised		
4095	96,01	Laundry and washing of textile and fur		
4096	-	Other industrial and non-industrial services n.e.c. Please specify		

Source: Statistical Office of the Republic of Serbia

Annex B to Chapter 6: Impact of capitalising the costs of research and development in SUTs and IOTs

A. Research and development as fixed capital formation

B6.1 The 2008 SNA introduced changes with regard to the treatment of research and development. Research and development is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and enable this stock of knowledge to be used to devise new applications. The 2008 SNA does not treat the research and development activity as an ancillary activity and it recommends that a separate establishment should be distinguished for research and development when possible.

B6.2 The output of research and development should be capitalized as "intellectual property products" except in cases where it is clear that the activity does not entail any economic benefit to its producer (and hence owner) in which case it is treated as intermediate consumption.

B6.3 The 2008 SNA now includes expenditures for both bought-in and own-account research and development as GFCF and the depreciation of these assets as consumption of fixed capital.

B6.4 Table B6.1 shows a summary of the impact of these changes using a simplified hypothetical example just to demonstrate the capitalization impact. The example is simplified in the sense that it only shows two years and where capitalization of Research and development (R&D) is assumed to be introduced in year 1, there is no increase in consumption of fixed capital in year 1. In reality, the capitalization costs will be over several successive years and consumption of fixed capital will occur in year 1 and throughout the life-length of the asset.

B6.5 Under 1993 SNA, own-account R&D activity was treated as an **ancillary activity** and no separate output was estimated in the system, and expenditures for this purpose were not separately identified. Only in those, usually unimportant cases, where R&D services were purchased from outside specialist producers, were classified in the research and development activity (ISIC Rev. 4 Division 72) or imported, R&D services appear as intermediate consumption in the SUTs.

B6.6 With the capitalization of R&D expenditures under the 2008 SNA, the output of own-account R&D is separately estimated and allocated to GCF or exports. In practice, the introduction of own-account R&D output in the system has just resulted in **additional output** with the intermediate inputs being left unaffected, as the intermediate inputs needed to produce the own-account R&D were already included. With the 2008 SNA change of treating research and development not as an ancillary activity, the question for the compilation of SUTs and IOTs is whether the R&D output from own-account R&D activity should be seen as a secondary product from that particular branch or the principal product of the activity "Scientific research and development" ISIC Rev. 4 Division 72. This issue of reclassification of own-account R&D activity is considered in the following Section.

B6.7 The challenging methodological and practical problems related to the actual estimates of output of own-account R&D are not being dealt with at this point; reference is made to the Manual on Measuring Research and Development in ESA 2010 (Eurostat 2014), the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) and specific country documentations, such as for example, the UK (ONS, 2014). In the following, only some problems of special interest for the compilation of SUTs and IOTs will be highlighted.

Table B6.1 Summary of the impact of capitalization of R&D in the new 2008 SNA

Indicative impact	Change in the treatment of Research and Development					
	Market producers		Non-market producers			
	Own account	Bought-in	Own account		Bought in	
	(1)	(2)	(3)		(4)	
Intermediate consumption	0	-500	0		-500	
Non-market consumption of fixed capital	0	0		(+200)		(+100)
GoS	+1000	+500		(+200)		(+100)
GVA	+1000	+500		(+200)		(+100)
Total output	+1000	0		(+200)	-500	(+100)
Output for own final use	+1000	0	+1000		0	
GG FCe or NPISHs Fce	0	0	-1000	(+200)	-500	(+100)
GFCF	+1000	+500	+1000		*500	
Impact on GDP	+1000	+500	0	(+200)	0	(+100)

(a) For own account value of production is 1000. For non-market producers, consumption of fixed capital in Year 2 is 200.

(b) For bought-in, value of intermediate consumption is 500. For non-market producers, consumption of fixed capital in Year 2 is 100.

(c) Year 1 estimates. Estimates in brackets to relate to consumption of fixed capital to impact in Year 2 for non-market producers.

B. Implications of valuation of output as sum of costs

B6.8 Output for own final use should be valued at the basic prices at which the goods and services could be sold if offered for sale on the market. When reliable market prices cannot be obtained, a second best procedure must be used in which the value of the output of the goods or services produced for own final use is deemed to be equal to the sum of their costs of production, that is, as the sum of: intermediate consumption; compensation of employees; consumption of fixed capital; a net return to fixed capital; and other taxes (less subsidies) on production. By convention, no net return to capital is included when own-account production is undertaken by non-market producers. (2008 SNA, paragraph 6.125).

B6.9 The calculation of the output of own-account R&D from the sum of costs approach implies that the cost structure for this particular type of output will be separately specified, this is contrary to the usual situation where intermediate and primary inputs used for various types of outputs will be indistinguishably lumped together. Based on the known cost structure, it would in principle be possible to create separate establishments for the own-account R&D activity, and if further this activity was seen as secondary, to reclassify these establishments from the original activity they are classified to, for example, pharmaceuticals, electronics etc., to the specialist activity for scientific research and development (ISIC Rev. 4 Division 72).

B6.10 However, for various analytical, methodological and practical reasons such a reclassification is not recommended. Examples of some of the main reasons being:

- There is an analytical interest in keeping track of those economic activities that are R&D active and this information would be lost through such a reclassification.

- As each R&D output is uniquely defined, the own-account R&D is usually not suitable for delivery outside the producing unit, and a reclassification would not reflect the economic reality of the activity.

- Due to the lack of any other information, it is assumed that the producing unit is also the owner of the resulting R&D capital stock and charged with the related consumption of fixed capital – this is often not valid.

- The cost structures calculated to derive the estimate of R&D output will not usually have product details corresponding to the SUTs product requirement, and in general, will only exist as internal worksheet exercises not intended for a wider audience.

- If all R&D were reclassified to the ISIC Rev. 4 Division 72, this division would in many developed countries increase to the same size or even larger than the agricultural sector, and seriously distort the relative proportions, in particular between manufacturing industries and service industries. It would also make the R&D active industries (such as the pharmaceutical industry) rather meaningless truncated "residuals" compared with the usual notion of the size and structure of these industries and thus the reclassifications are counter-productive from the point of view of users' needs and a wide-range of analytical purposes.

C. Own-account R&D as principal or secondary output

B6.11 Research and development services, CPC Ver. 2.1 Division 81, also existed prior to the capitalization of R&D, and were mainly made up of the services actually sold in the market by enterprises classified in ISIC Rev. 4 Division 72, "Scientific research and development". However, this was in general small when compared with the total value of own-account R&D estimated in connection with the capitalization.

B6.12 In CPC Ver. 2.1 Division 81, the sub-classes are organised according to the type of research (for example, chemistry, biotechnology, etc.), and not according to the economic activities carrying out the R&D, and all R&D services are indicated as characteristic products of ISIC Rev. 4 sub-classes 7210 and 7220. This follows logically from the fact that the CPC Ver. 2.1 was not designed for a situation where the overwhelming share of R&D services comes into existence as estimated own-account output in ISIC industries other than ISC Rev. 4 Division 72.

B6.13 Under the system of estimated own-account output of R&D services, it would be more appropriate to introduce a CPC structure for R&D similar to the structures for "Maintenance, repair and installation (except construction) services" (CPC Ver. 2.1 Division 87) and for "Manufacturing services on physical goods owned by others" (CPC Ver. 2.1 Division 88) where the sub-classes (4 digit) are made up industry specific outputs, each corresponding to a characteristic ISIC class (4 digit). This implies in particular that outputs of these services in R&D active industries form **principal outputs**. When this approach is followed for own-account R&D services, there will be as many sub-classes of CPC Division 81 as there are industries with R&D activities, and own-account R&D will formally change from a secondary to a principal activity of the producing industries. The adoption of this approach will also have important implications when deriving IOTs from the

SUTs, as it will prevent major structural differences between Industry by Industry IOTs and Product by Product IOTs, and in particular avoid "truncated" R&D intensive product-adjusted industries in the Product by Product IOTs.

B6.14 In practice, specialised R&D departments of enterprises with major own-account R&D activity may for various reasons (legal, tax-related, etc.) already been classified in ISIC Rev. 4 Division 72 in the business register, and thus in business statistics be included with this activity and not with the principal activity (for example, pharmaceutical, electronic etc.) of the parent enterprise.

B6.15 In such cases, the flows between the R&D department classified in ISIC Rev. 4 Division 72 and the parent enterprise as well as the applied valuation principles should be assessed carefully. In this connection, it is important to realise that business accounting practices will usually not follow the principle of capitalising R&D expenditures. Thus the total output (however estimated) from an R&D department classified in ISIC Rev. 4 Division 72 may in the business accounts reappear as intermediate consumption in the accounts of the parent enterprise. Depending on the circumstances, one solution might be to reclassify the R&D department back to the activity of the parent enterprise. In National Accounts, sometimes legal structures may be overruled if they are found not to reflect economic realities. Alternatively, the intermediate consumption of R&D services could just be removed from the parent enterprise and instead treated as GFCF but this may leave a truncated enterprise of little analytical interest, as noted above, and it would still be necessary to deal with the valuation of reported output of the R&D department.

D. Balancing supply and use of R&D services

B6.16 Assuming that output of R&D services (market, non-market and for own-use) by industry are available from the current National Accounts calculations, **allocation by user** should be in principle be fairly straightforward, as these services under the 2008 SNA treatment of R&D should be allocated to GFCF. There are, however, two problem areas worth mentioning:

- some research and development purchases are still to be treated as intermediate consumption; and
- foreign trade in research and development services must be taken into account when balancing the R&D services.

B6.17 When market R&D services are purchased by an own-account producer of R&D from a commercial R&D producer (usually, though not necessarily, classified in ISIC, Rev. 4 Division 72) or imported, it must be decided whether this is an acquisition of an asset or an intermediate product used as an input into the own-account production of R&D. As there is usually not enough information available on the individual transactions to allow an informed decision, it is in the absence of any strong evidence to the contrary recommended by the Eurostat Manual that all purchases by own-account R&D producers from units classified in ISIC Rev. 4 Division 72 (as well as purchases by other units in ISIC Rev. 4 Division 72) should be treated as intermediate consumption. This assumption will also ease the distribution in cases where no product statistics for the output from ISIC Rev. 4 Division 72 are available, as some output may be non-R&D services that would nonetheless usually be allocated to intermediate consumption.

B6.18 However, the above mentioned case with a specialised R&D department classified in ISIC Rev. 4 Division 72 may interfere with this solution, and it is recommended that the SUTs compilers coordinate closely with the compilers of the R&D estimates made for the National Accounts.

B6.19 In the Manual on Statistics of International Trade in Services (MSITS), 2010 (United Nations *et al.* 2010) and Extended Balance of Payments Services Classification (EBOPS 2010), there are special entries on "R&D services", which are explicitly separated from transactions on the results of R&D (for example, royalties and license fees paid for use of patented entities).

B6.20 It would therefore appear that the balancing of the R&D services, taking into account also imports and exports would be straightforward. However, the transactions registered in the Balance of Payments are actual economic transactions where the "prices" may be quite different from the cost-based valuation of the domestic own-account output of R&D services, and the delimitation of the R&D concept may also deviate. Further Balance of Payments transactions in R&D may include significant elements of transfer pricing and trade with subsidiaries in low-tax jurisdictions. When consistency with existing Balance of Payments data are aimed at, the final balancing of the R&D services may be quite difficult, even though the capitalised R&D services allows trade in "used" R&D so that GFCF may in principle (though no very realistically) become negative. For more details on these problems, it is recommended to refer to Chapter 7 of The Impact of Globalisation on National Accounts (UNECE, 2011).

Chapter 7. Compiling the Valuation Matrices

A. Introduction

7.1. The compilation of valuation matrices is a fundamental step in the compilation process of SUTs. These matrices are necessary to bridge the different valuation concepts of the product flows. This Chapter covers the main concepts and methodologies of compiling matrices for trade margins, transport margins, taxes on products and subsidies on products. In particular, this Chapter starts in Section B with an overview of the valuation concepts in the 2008 SNA and of how the valuation matrices fit within the SUTs presented in Chapters 5 and 6. Sections C to E elaborate on each component of the valuation matrices and describe the main compilation steps. The Annex to Chapter 7 provides further explanation on how to compile trade margins for the SUTs from survey data based on a country practice.

B. Valuation of product flows

7.2. Transactions are valued at the actual prices agreed upon by the purchasers and sellers. Market prices are thus the main reference for the valuation of transactions in the SUTs system in line with 2008 SNA. In the absence of market transactions, the valuation is made according to costs incurred (for example, for non-market services produced by government) or by reference to market prices for analogous goods and services (for example, for services of owner-occupied dwellings).

3. Valuation concepts in the 2008 SNA

7.3. More than one set of prices may be used to value outputs and inputs depending on how taxes and subsidies on products, trade and transport margins are recorded. The 2008 SNA distinguishes three main valuation concepts of the flows of goods and services: the two main recommended valuations being basic prices and purchasers' prices and the lesser used producers' prices.

7.4. The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. (2008 SNA, paragraph 6.51)

7.5. The producers' price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any value added taxes (VAT), or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer. (2008 SNA, paragraph 6.51)

7.6. The purchasers' price is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchasers' price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place. (2008 SNA, paragraph 6.64)

7.7. The difference between these valuation concepts for a product relates to trade margins, transport margins and taxes on products and subsidies on products. The relationship between the three types of prices is as follows:

Basic prices	+	Taxes on products excluding invoiced VAT
	-	Subsidies on products
	=	Producers' prices
	+	Wholesalers' trade margins
	+	Retailers' trade margins
	+	Separately invoiced transport charges
	+	VAT not deductible by the purchaser
	=	**Purchasers' prices**

7.8. The basic price measures the amount retained by the producer and therefore the price most relevant for the producers' decision-making and is often reported in business surveys. For imported products, taxes on products include import duties. When the relationship between basic prices and purchasers' prices is compiled for the total economy, the transport charges and trade margins will cancel out because they only form a reallocation of value across products.

7.9. The concept of producers' prices does not form any of the main valuations. The preferred valuation of output and GVA in the SNA is at basic prices and for intermediate consumption at purchasers' prices. It is worth recognising that source data from business surveys for sales may be valued at producers' prices. In these cases, data should be adjusted to a basic price valuation before entering them into the SUTs. If this step is not completed, then a different recording of taxes on products and subsidies on products have to be established, and GVA by economic activity would be partly at "market prices", which is not recommended by the SNA.

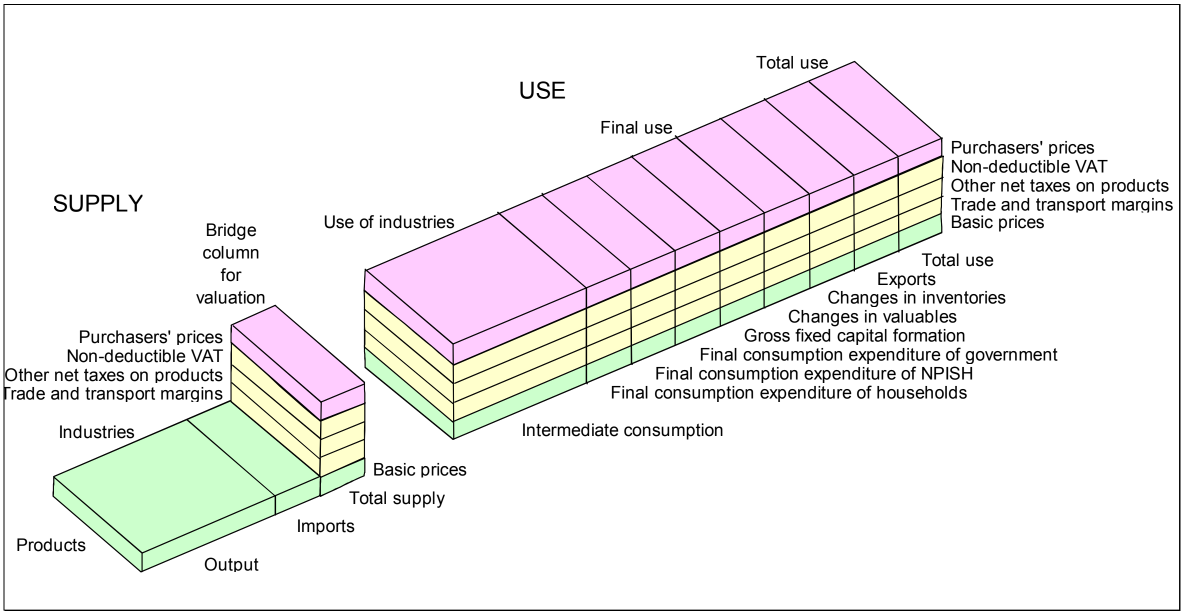
7.10. It is important to note that the relationship between basic price and purchasers' price does not describe 'a process over time' for an identifiable product. In this case, the difference between basic prices and purchasers' prices is likely to contain an element of holding gains and losses while the product is with the producer and with wholesale and retail traders (2008 SNA, paragraph 3.148). The SNA value concepts are consistently defined in such a way that holding gains and losses do not become part of GVA and GDP. Hence a trade margin is relative to the replace price of the good 'at the time it is sold', and the price of intermediate consumption relates to what the producer would have to pay to replace it 'at the time it is used'.

7.11. The source data used to fill the cells in the SUTs may have different valuations:

- Production and output data are valued at basic prices.
- Intermediate consumption and final uses are valued at purchasers' prices.
- Imports are valued at CIF prices. This is the valuation of a good delivered at the point of entry into the importing economy or the price of a service delivered to a resident, before the payment of any import duties or other taxes on imports or trade and transport margins within the country. In the SUTs framework, for national SUTs, the CIF value is taken to be the basic price of imports of goods.
- Exports are valued at FOB prices. The valuation of a good at the point of exit from the exporter's economy or the price of a service delivered to a non-resident, including transport charges and trade margins up to the point of the border, and including any taxes less subsidies on the goods exported. In the SUTs framework, the FOB value is taken to be the purchasers' price of exports of goods.

7.12. It is recommended that the different valuation components of the product flows are separated to ensure the SUTs framework is balanced in a fully coherent and consistent manner. One of the purposes of the valuation matrices is to bridge the difference between the valuation at basic prices and the valuation at purchasers' prices and to arrive to SUTs at basic prices. Figure 7.1 illustrates how the valuation matrices link the Supply Table with the Use Table. They comprise all flows that are related to the supply and use of trade margins and transport margins and to taxes and subsidies on products.

Figure 7.1 Schematic representation of the valuation matrices in the SUTs



7.13. In the Supply Table, the valuation matrices consist of columns, (the "bridge column" in Figure 7.1) which transform the supply of each product from basic prices to purchasers' prices, and, in turn, match the product values in the use table compiled at purchasers' prices.

7.14. In the Use Table, the valuation matrices consist in product by industry matrices of trade margins, transport margins, taxes on products and subsidies on products which allow for the transformation of the values of the Use Table from purchasers' prices into basic prices. The availability of such matrices allows for balancing of SUTs at basic prices and purchasers' prices and, as recommended in the Handbook, both valuations should be balanced simultaneously.

7.15. Although it is not strictly necessary that a balanced SUTs framework ends up with tables showing valuation both at purchasers' and at basic prices, this is recommended for several reasons. For analytical purposes, the SUTs data must have the same valuation, and usually the basic price version is the most appropriate. This is also the case for the transformation process of the SUTs into IOTs and for the volume estimates in a consistent SUTs framework leading to the estimation of GVA in volume terms using "double deflation".

7.16. For these I-O based analytical purposes, a valuation as uniform as possible of the cells in a row of the Use Table is essential. The values at purchasers' prices in the different uses will usually be affected by differences in trade and transport margins, and by differences in taxes on products and subsidies on products, according to the specific user. The uniformity requirement is therefore best fulfilled by values at basic prices, although the cells valued at basic prices may still show user specific price variation, this is the most uniform valuation concept that in practice can be achieved.

4. The valuation matrices in the SUTs framework

7.17. The valuation matrices comprise information on trade margins, transport margins, taxes on products and subsidies on products. Valuation matrices can be established for the Supply Table (supply-side valuation matrices) and the Use Table (use-side valuation matrices). In a balanced SUTs system, the use-side valuation matrices and the supply-side valuation matrices will sum to the same totals. In this Section, the full set of valuation matrices is described.

(a) Supply-side valuation matrices

7.18. The supply-side valuation matrix consists of a set of columns added to the Supply Table at basic prices to derive the supply at purchasers' prices. These columns consist of trade margins, transport margins, VAT, taxes on products and subsidies on products. Table 7.1 shows the structure of Supply Table at basic prices, including a transformation into purchasers' prices. The table corresponds to Table 5.2 of Chapter 5 and is reproduced here for ease of reference. The left part of this table starts with the domestic output of the various industries by products at basic prices. The inclusion of the imports valued at CIF prices by products generates the total supply by products at basic prices as shown in Column (9).

7.19. In the Supply Table, the output at basic prices of trade services (of which, trade margins forms the major part) is included in Row (4) and that of transport services in Row (5). To arrive at purchasers' prices for each product, the trade margins and transport margin shares of this output have to be reallocated from trade margins and transport services to the traded and transported products. Columns (10) and (11) of Table 7.1 contains the allocation of trade margins and transport margins respectively with positive entries (+) in the rows of the traded and transported products and negative entries (-) in the rows of trade services and transport services. The totals by row of Columns (10) and (11) of trade and transport margins respectively are always zero.

7.20. The columns of taxes less subsidies of products - Columns (12) to (14) of Table 7.1 - are also added to total supply at basic prices in order to arrive to the total supply at purchasers' prices. Taxes on products comprise VAT type taxes, taxes and duties on imports and other taxes on products. Similarly, subsidies on products comprise import subsidies and other subsidies on products. Taxes and subsidies on products should be compiled separately although they may be shown as a single column.

7.21. Adding Columns (10) to (14) to total supply at basic prices of Column (9) gives total supply at purchasers' prices in Column (16). Columns (10) and (14) are thus the necessary bridge to compare and balance total supply with total use when both sides are valued at purchasers' prices.

7.22. Both trade margins and transport margins can be produced by any industry outside the trade and transport industries. However, the bulk of the output of trade margins is generally produced by the trade industries and the bulk of transport margins by the transport industries as illustrated in Rows (4) and (5) of Table 7.1.

Table 7.1 Supply Table at basic prices, including a transformation into purchasers' prices

			INDUSTRIES						Output at basic prices	Imports	Total supply at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services			
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PRODUCTS	Agriculture	(1)	8 782	0	0	0	0	0	8 782	3 271	12 052
	Manufacturing	(2)	796	182 982	643	1 808	133	44	186 405	124 590	310 995
	Construction	(3)	83	961	43 060	734	255	179	45 272	563	45 835
	Trade	(4)	1	4 773	311	54 204	640	257	60 187	600	60 787
	Transport	(5)	13	465	66	25 538	128	125	26 335	8 150	34 485
	Communication	(6)	160	1 781	139	43 912	1 253	982	48 228	6 234	54 463
	Finance and business services	(7)	29	8 902	698	7 588	106 909	3 381	127 508	7 061	134 569
	Other services	(8)	3	85	13	1 053	143	74 346	75 643	824	76 467
	Total	(9)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	151 293	729 653
Adjustments	CIF/FOB adjustments on imports	(10)								- 97	- 97
	Direct purchases abroad by residents	(11)								6 675	6 675
	Total	(12)	9 867	199 950	44 931	134 837	109 461	79 314	578 360	157 871	736 230
	Total of w hich:										
	Market output	(13)	9 763	195 916	41 462	127 401	88 330	18 116	480 989		
	Output for ow n final use	(14)	104	4 029	3 468	2 134	19 890	2 670	32 295		
	Non-market output	(15)	0	4	0	5 302	1 241	58 528	65 075		

			Total supply at basic prices	VALUATION MATRICES						Total supply at purchasers' prices
				Trade margins	Transport margins	VAT	Taxes on products	Subsidies on products	Total	
			(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	12 052	1 926	274	329	57	- 107	2 479	14 532
	Manufacturing	(2)	310 995	48 838	2 540	13 175	7 866	- 49	72 370	383 364
	Construction	(3)	45 835	0	0	1 529	13	0	1 542	47 377
	Trade	(4)	60 787	- 52 341	0	575	11	0	- 51 755	9 032
	Transport	(5)	34 485	0	- 2 800	558	71	- 448	- 2 620	31 865
	Communication	(6)	54 463	1 493	9	3 375	217	- 34	5 059	59 522
	Finance and business services	(7)	134 569	0	- 22	2 706	2 159	0	4 842	139 411
	Other services	(8)	76 467	85	0	1 201	576	0	1 861	78 329
	Total	(9)	729 653	0	0	23 447	10 969	- 638	33 778	763 431
Adjustments	CIF/FOB adjustments on imports	(10)	- 97						- 97	- 97
	Direct purchases abroad by residents	(11)	6 675						6 675	6 675
	Total	(12)	736 230	0	0	23 447	10 969	- 638	40 356	770 009
	Total of w hich:									
	Market output	(13)								
	Output for ow n final use	(14)								
	Non-market output	(15)								

Austria 2011

(b) Use-side valuation matrices

7.23. The use-side valuation matrices consist of a sequence of matrices - mirroring the shape of the intermediate use and final use parts of the Use Table - for each component of the valuation, namely for: trade margins, transport margins, taxes on products and subsidies on products.

7.24. Table 7.2 illustrates the Use Table at purchasers' prices. This table corresponds to Table 6.1 of Chapter 6 and is reproduced here for ease of reference. It shows the structure of the table which comprises the following three sub-matrices:

- intermediate consumption matrix showing intermediate consumption for each industry by product;
- final uses matrix showing final uses by type of final use and by product; and
- GVA matrix showing the components of GVA for each industry.

Table 7.2 Use Table at purchasers' prices

			INDUSTRIES							FINAL USE									Total use at purchasers' prices
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total		
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)
PRODUCTS	Agriculture	(1)	2 583	6 570	16	371	34	49	9 623	3 595			180		- 27	1 161	4 909		14 532
	Manufacturing	(2)	2 205	107 190	12 441	16 874	6 015	8 797	153 522	71 438		3 180	26 756	2 183	3 034	123 252	229 842		383 364
	Construction	(3)	105	2 440	9 528	2 446	3 907	1 604	20 029	1 667			25 155		- 38	563	27 348		47 377
	Trade	(4)	33	1 883	119	2 240	259	308	4 842	3 325			67	45		753	4 189		9 032
	Transport	(5)	14	4 386	267	8 399	822	321	14 208	5 833		3 370				8 453	17 656		31 865
	Communication	(6)	34	2 563	299	9 359	5 919	1 833	20 008	26 444		121	5 976		67	6 905	39 514		59 522
	Finance and business services	(7)	457	13 578	4 736	20 359	29 166	9 134	77 430	38 838		1 006	11 170		- 178	11 145	61 981		139 411
	Other services	(8)	8	382	59	1 171	415	1 794	3 829	14 923	5 416	53 373	113	107	1	567	74 500		78 329
	Total at purchasers' prices before adjustments	(9)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939		763 431
Adjustments	CIF/FOB adjustments on exports	(10)														- 97	- 97		- 97
	Direct purchases abroad by residents	(11)								6 675							6 675		6 675
	Purchases in the domestic territory by non-residents	(12)								- 12 945						12 945			
	Total at purchasers' prices	(13)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	466 517		770 009
GVA	Compensation of employees	(14)	551	30 679	10 239	37 906	22 997	41 971	144 343										
	Other taxes less subsidies on production	(15)	- 1 627	1 077	546	1 755	2 004	1 103	4 858										
	Consumption of fixed capital	(16)	1 845	12 750	1 542	10 917	18 934	7 480	53 469										
	Net operating surplus/Net mixed income	(17)	3 658	16 453	5 138	23 040	18 989	4 921	72 198										
	Gross operating surplus/gross mixed income	(18)	5 503	29 203	6 680	33 957	37 923	12 401	125 667										
	GVA	(19)	4 427	60 959	17 465	73 618	62 923	55 475	274 868										
	Total input at basic prices	(20)	9 867	199 950	44 931	134 837	109 461	79 314	578 360										

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7.25. The matrices covering intermediate consumption and final uses are valued at purchasers' prices, thus they include trade margins and transport margins as well as taxes on products less subsidies on products. Therefore, the sum of total intermediate consumption at purchasers' prices (Column (7) of Table 7.2) and total final use (Column (15) of Table 7.2) gives the total use by product at purchasers' prices, which, in a balanced system, is equal to the total supply by products at purchasers' prices in Column (16) of the Supply Table in Table 7.1.

7.26. Table 7.3 shows the use-side valuation matrices covering trade margins (which is split between wholesale and retail trade margins), transport margin, VAT, taxes on products and subsidies on products. These matrices have the same structure and dimension as the intermediate consumption and final uses sub-matrices of the use table at purchasers' prices. They show the allocation of the trade margins, transport margins, taxes and subsidies on products to each element of the Use Table at purchasers' prices. They represent the amounts that must be deducted from the each element of the Use Table at the purchasers' price in order to arrive to the Use Table at basic prices.

Table 7.3 Use-side valuation matrices

			INDUSTRIES							FINAL USE								Total use at purchasers' prices
										Final consumption expenditure								
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Wholesale trade margins																		
PRODUCTS	Agriculture	(1)	31	440	2	63	4	6	547	326			10		4	165	506	1 052
	Manufacturing	(2)	164	6 450	1 415	1 879	326	1 049	11 284	5 941		560	2 718	15	265	8 995	18 493	29 777
	Construction	(3)																
	Trade	(4)	- 196	- 6 910	- 1 420	- 1 997	- 367	- 1 082	- 11 972	- 6 464		- 569	- 2 776	- 15	- 273	- 9 232	- 19 329	- 31 301
	Transport	(5)																
	Communication	(6)	0	20	3	55	37	27	141	197		9	48		4	72	330	472
	Finance and business services	(7)																
	Other services	(8)																
	Total	(9)	0	0	0	0		0	0	0		0	0		0	0	0	0
Retail trade margins																		
PRODUCTS	Agriculture	(1)		3	0	13	0	1	17	856							856	873
	Manufacturing	(2)	19	56	20	339	38	90	562	16 781		477	1 142	99			18 499	19 061
	Construction	(3)																
	Trade	(4)	- 19	- 86	- 25	- 431	- 104	- 150	- 815	- 18 363		- 511	- 1 168	- 184			- 20 226	- 21 040
	Transport	(5)																
	Communication	(6)	0	27	5	79	66	59	236	725		34	26				785	1 021
	Finance and business services	(7)																
	Other services	(8)												85			85	85
	Total	(9)	0		0	0		0	0	0		0	0				0	0
Transport margins																		
PRODUCTS	Agriculture	(1)	7	201	1	7	0	1	217	44			2		1	11	57	274
	Manufacturing	(2)	20	1 125	191	127	30	64	1 557	303		21	144	2	26	486	983	2 540
	Construction	(3)																
	Trade	(4)																
	Transport	(5)	- 27	- 1 321	- 191	- 135	- 31	- 65	- 1 771	- 347		- 21	- 146	- 2	- 27	- 487	- 1 030	- 2 800
	Communication	(6)		0	0	1	1	0	4	3		0	2		0	1	5	9
	Finance and business services	(7)	0	- 5	- 1	- 1	0	0	- 7	- 3		0	- 2	0	0	- 10	- 15	- 22
	Other services	(8)																
	Total	(9)	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Value added tax (VAT)																		
PRODUCTS	Agriculture	(1)	0	0	0	0	0	3	4	324			1				325	329
	Manufacturing	(2)	18	71	18	68	200	942	1 317	10 624		368	734	132			11 858	13 175
	Construction	(3)	0	1	7	4	242	185	439	265			825				1 090	1 529
	Trade	(4)	3	16	4	20	17	39	100	467			2	7			476	575
	Transport	(5)	0	1	0	9	8	17	36	487		34					521	558
	Communication	(6)	0	1	0	16	207	150	374	2 888		10	103				3 001	3 375
	Finance and business services	(7)	0	3	3	28	561	713	1 308	1 235			163				1 398	2 706
	Other services	(8)	0	0	0	1	17	44	63	921		209		8			1 138	1 201
	Total	(9)	22	93	32	147	1 252	2 093	3 639	17 210		621	1 830	147			19 807	23 447
Taxes on products (excl. VAT)																		
PRODUCTS	Agriculture	(1)	0	50	0	1	0	0	51	5			1		0	0	6	57
	Manufacturing	(2)	62	834	179	1 068	212	544	2 898	4 272		6	284	5	7	393	4 968	7 866
	Construction	(3)	0	1	3	1	1	0	5	0			7				8	13
	Trade	(4)	0	5	0	4	0	0	10	1			0	0			1	11
	Transport	(5)	0	7	1	8	11	3	30	26		0				14	40	71
	Communication	(6)	0	6	1	14	47	5	72	130		0	0		0	15	145	217
	Finance and business services	(7)	9	88	18	142	172	37	467	936			755				1 691	2 159
	Other services	(8)	0	0	0	0	0	0	1	574		1		0			575	576
	Total	(9)	71	991	202	1 238	443	590	3 535	5 944		8	1 048	6	7	422	7 434	10 969
Subsidies																		
PRODUCTS	Agriculture	(1)	0	- 89	0	0	0	0	- 89	- 2			- 5		0	- 11	- 18	- 107
	Manufacturing	(2)	0	- 16	- 2	- 3	- 1	- 1	- 24	- 9		0	- 2	0	0	- 14	- 25	- 49
	Construction	(3)																
	Trade	(4)																
	Transport	(5)	0	- 26	- 2	- 33	- 6	- 10	- 77	- 300		- 71				- 1	- 371	- 448
	Communication	(6)				0			0	- 34							- 34	- 34
	Finance and business services	(7)																
	Other services	(8)																
	Total	(9)	- 1	- 131	- 5	- 36	- 6	- 11	- 190	- 344		- 71	- 7	0	0	- 25	- 448	- 638
Trade and transport margins																		
PRODUCTS	Agriculture	(1)	38	644	3	83	4	8	781	1 226			12		5	176	1 419	2 200
	Manufacturing	(2)	203	7 631	1 626	2 345	393	1 204	13 403	23 025		1 058	4 004	117	291	9 481	37 975	51 378
	Construction	(3)																
	Trade	(4)	- 215	- 6 996	- 1 445	- 2 428	- 471	- 1 233	- 12 786	- 24 827		- 1 080	- 3 944	- 199	- 273	- 9 232	- 39 555	- 52 341
	Transport	(5)	- 27	- 1 321	- 191	- 135	- 31	- 65	- 1 771	- 347		- 21	- 146	- 2	- 27	- 487	- 1 030	- 2 800
	Communication	(6)	1	47	8	136	104	86	381	925		44	75		4	72	1 121	1 501
	Finance and business services	(7)	0	- 5	- 1	- 1	0	0	- 7	- 3		0	- 2	0	0	- 10	- 15	- 22
	Other services	(8)												85			85	85
	Total	(9)	0	0	0	0	0	0	0	0		0	0		0	0	0	0
Taxes less subsidies on products																		
PRODUCTS	Agriculture	(1)	0	- 38	0	1	0	3	- 34	327			- 3		0	- 10	313	279
	Manufacturing	(2)	80	888	194	1 133	411	1 485	4 191	14 888		374	1 016	137	7	379	16 800	20 992
	Construction	(3)	0	1	10	5	243	185	444	265			833				1 098	1 542
	Trade	(4)	3	21	4	24	17	40	109	468			2	7			477	586
	Transport	(5)	0	- 18	- 1	- 15	13	10	- 11	214		- 36				14	191	180
	Communication	(6)	0	6	1	30	253	155	446	2 984		10	104		0	15	3 112	3 558
	Finance and business services	(7)	9	91	21	171	733	750	1 775	2 171			918				3 090	4 865
	Other services	(8)	0	0	0	2	17	44	63	1 495		210		8			1 713	1 777
	Total	(9)	92	952	229	1 349	1 689	2 672	6 984	22 810		557	2 870	152	7	397	26 794	33 778

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7.27. Note that the use-side valuation matrices in Table 7.3 relate to the supply-side valuation matrices in Table 7.1 as follows:

- The sum of Columns (16) in Table 7.3 for "Wholesale trade margins" and "Retail trade margins" must be equal to "Trade margins" in the supply-side valuation matrix, namely Column (10) of Table 7.1.

- Column (16) of Table 7.3 for "Transport margins" must be equal to the "Transport margins" in the supply-side valuation matrix, namely Column (11) of Table 7.1.
- Column (16) of Table 7.3 for "Value added tax (VAT)" must be equal to the "Value added tax" in the supply-side valuation matrix, namely Column (12) of Table 7.1.
- Column (16) of Table 7.3 for "Taxes on products (excl. VAT)" must be equal to the "Taxes on products" in the supply-side valuation matrix, namely Column (13) of Table 7.1.
- Column (16) of Table 7.3 for "Subsidies" must be equal to the "Subsidies on products" in the supply-side valuation matrix, namely Column (14) of Table 7.1.

7.28. In general, the information needed to construct the trade and transport margins matrices of Table 7.3 is available only to a limited extent, and some balancing between the supply and use of trade margins and transport margins is necessary. In addition, depending on available data and whether a benchmark or a current SUT is being compiled, it must be assessed whether it is best to start out from the supply or the use side when estimating total trade margins and transport margins by products. In the cases when trade and transport margins are estimated first from the supply side, they will serve as a constraint when allocating the supply of trade margins and transport margins to the various use categories.

7.29. There is one type of tax on product, namely VAT, for which it is not possible to start with the supply-side estimates. In the VAT system according to the SNA, only non-deductible VAT is recorded as a tax on product, and there is no way that the actual VAT payers (VAT collectors) can have information about the final users and their ability to deduct VAT or not. The structure of VAT by products has therefore to be estimated from the use-side by identifying all user categories not exempted from the VAT system and to apply the appropriate effective tax rate to all their purchases of products. One challenging area of evolving development is the treatment of digital intermediation platforms in terms of trade and transport margins as well as the taxes (in particular, VAT) paid to foreign governments. This remains under discussion.

7.30. Once all the matrices in Table 7.1 are compiled, the next step is to deduct the trade margins, transport margins and taxes less subsidies on products from the Use Table at purchasers' prices to arrive to the Use Table at basic prices as shown in Table 7.4. Furthermore, it is necessary to reallocate the deducted trade margins and transport margins to the specific trade and transport service products distinguished in the product classification applied, and the taxes on products to a separate row. After these steps, the Use Table has been transformed into a valuation at basic prices as shown in Table 7.4.

7.31. It should be noted that all the entries from Row (1) to Row (9) in Table 7.4 are at basic prices. Row (10) of Table 7.4 contains the net taxes on products which bridge the total use at basic prices with the total use at purchasers' price which is shown in Row (11) of Table 7.4. This latter coincides with Row (9) of the Use table at purchasers' price in Table 7.2.

Table 7.4 Use Table at basic prices

			INDUSTRIES							FINAL USE								Total use at basic prices
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 545	5 964	13	287	29	38	8 877	2 042			170		- 32	996	3 176	12 052
PRODUCTS	Manufacturing	(2)	1 922	98 670	10 621	13 397	5 211	6 108	135 928	33 525		1 749	21 736	1 929	2 737	113 392	175 067	310 995
PRODUCTS	Construction	(3)	105	2 439	9 518	2 441	3 664	1 419	19 585	1 402			24 323		- 38	563	26 250	45 835
PRODUCTS	Trade	(4)	245	8 857	1 560	4 644	712	1 501	17 519	27 684			4 008	238		9 985	43 267	60 787
PRODUCTS	Transport	(5)	41	5 724	459	8 549	840	376	15 990	5 967		3 427				8 926	18 495	34 485
PRODUCTS	Communication	(6)	33	2 510	290	9 194	5 562	1 592	19 181	22 535		68	5 797		63	6 818	35 281	54 463
PRODUCTS	Finance and business services	(7)	448	13 492	4 716	20 189	28 433	8 384	75 662	36 669		1 006	10 254		- 177	11 156	58 907	134 569
PRODUCTS	Other services	(8)	8	381	59	1 169	398	1 750	3 765	13 429	5 416	53 163	113	14	1	567	72 702	76 467
PRODUCTS	Total at basic prices	(9)	5 348	138 038	27 236	59 870	44 849	21 167	296 507	143 252	5 416	60 492	66 548	2 182	2 852	152 403	433 145	729 653
PRODUCTS	Taxes less subsidies on products	(10)	92	952	229	1 349	1 689	2 672	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices before adjustments	(11)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
Adjustments	CIF/FOB adjustments on exports	(12)														- 97	- 97	- 97
Adjustments	Direct purchases abroad by residents	(13)								6 675							6 675	6 675
Adjustments	Purchases in the domestic territory by non-residents	(14)								- 12 945						12 945		
	Total at purchasers' prices	(15)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	466 517	770 009
GVA	Compensation of employees	(16)	551	30 679	10 239	37 906	22 997	41 971	144 343									
GVA	Other taxes less subsidies on production	(17)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
GVA	Consumption of fixed capital	(18)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
GVA	Net operating surplus/Net mixed income	(19)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
GVA	Gross operating surplus/Gross mixed income	(20)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
GVA	GVA	(21)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Total input at basic prices	(22)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

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C. Trade margins

7.32. This section deals with the compilation of the valuation matrix for trade margins. The amounts involved can vary significantly by type of product and can be of great magnitude in total. In most countries, it can vary between 10 and 25 per cent of total domestic supply of goods and services.

7.33. The data sources needed for compiling the trade margin estimates by product for the SUTs are special in the sense that they are not necessary when compiling the current National Accounts GVA by industry, and therefore they may not be readily available on an annual basis.

7.34. Whereas information on trade turnover and purchases of goods for resale by industry is usually included in the general business statistics or estimated in order to compile the annual GVA by industry, the situation is different for information on trade turnover and margins by product. These data are generally not as readily available for a number of reasons: most often they are collected with intervals of several years, if at all; or there may only exist information on trade margin ratios for a limited number of products available from government agencies dealing with price control or monopoly surveillance; or what can be derived from current price statistics by, for example, comparing wholesale prices collected for the wholesale price index (WPI) with the prices collected for the Consumer Price Index (CPI).

7.35. Especially for the purpose of compiling benchmark SUTs, it is therefore recommended to conduct a special survey that covers all trading activity (both as primary and secondary output) by industry and by product at a level sufficiently detailed to match the level and classification of products applied in the SUTs. Annex to Chapter 7 provides an example of a questionnaire used for a survey of this kind as well as a template for the optimal use of the collected data in compiling the SUTs trade margin matrices.

7.36. Even when less than ideal source data are available, it is still necessary to estimate the trade margin matrices. However, in these cases the results will become more dependent on the assumptions made to populate the trade margin columns in the Supply Table and the trade margin matrices in the Use Table. In principle, the same type of trade margin data table (shown in Table 7.5 and in the Annex in this Chapter) must be generated irrespective of the coverage or quality of primary source data on trade and trade margins.

1. Definition of trade margins

7.37. Even though wholesalers and retailers actually buy and sell goods, the goods purchased are not treated as part of their intermediate consumption as they are resold with only minimal processing such as grading, cleaning and packaging. Wholesalers and retailers are treated as supplying services. Their output is measured by the total value of the trade margins realized on the goods they purchase for resale and some non-margin trade services. In spite of this, actual trade turnover is an important supporting variable when compiling the trade margin matrices in the SUTs.

7.38. The 2008 SNA defines a trade margin as:

> "A **trade margin** is defined as the difference between the actual or imputed price realised on a good purchased for resale and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of." (2008 SNA, paragraph 6.146)

7.39. On valuation, it is further stated that:

> "Goods purchased for resale should be valued **excluding** any transport charges invoiced separately by the suppliers or paid to third parties by wholesalers or retailers: these transport services form part of the intermediate consumption of the wholesalers or retailers." (2008 SNA, paragraph 6.148)

7.40. This valuation principle implies that there cannot be any transport margins linked to purchases of goods for resale. This follows from the fact that, in the National Accounts definition of output from trade activity, the traded goods are not seen as actually flowing in and out of the trade activity. The trade activity only adds services to the goods that are seen as flowing directly from the producer or importer to the user. Therefore there is no flow to which a transport margin could be attached.

7.41. In practice, the output of wholesalers and retailers is derived as the difference between the trading sales and the costs of goods purchased for resale adjusted by changes in inventories (see 2008 SNA, paragraph 6.147):

Value of output	=	value of sales
	+	value of goods purchased for resale but used for intermediate consumption, compensation of employees, etc.
	-	value of goods purchased for resale
	+	value of additions to inventories of goods for resale
	-	value of goods withdrawn from inventories of goods for resale
	-	value of recurrent losses due to normal rates of wastage, theft or accidental damage.

7.42. In order to derive trade margins, either for trading activities of single goods, trading activities of a statistical unit industries or total economy, data on trading sales (trade turnover), data on goods purchased for resale without further processing, and data on inventories of goods for resale at the beginning and at the end of the period must be available. Usually business surveys or specialised trade surveys can collect and provide data at the level of trade industries. Trading is also an important secondary activity in many non-trade industries, and trading activities in the system are measured by trade margins, regardless of whether it is done by traders as their main activity or by other industries as part of their secondary outputs.

7.43. Even though distributive trade is defined as purchases of goods for resale without any transformation, certain operations usually associated with distribution are included in the definition such as the sorting, mixing, breaking bulk and re-packaging for distribution into smaller lots. Also included may be other services, if not separately invoiced, such as installation in situ.

7.44. Trade services should be separated at least into two main categories: **wholesale** and **retail**. Wholesale is the resale (sale without transformation) of new and used goods to retailers, industrial, commercial, institutional or professional users or to other wholesalers and export. Retailing is the resale (sale without transformation) of new and used goods, mainly to the general public for personal or household consumption or non-resident visitors or for a minor part to business (intermediate consumption and fixed capital formation). This separation is essential for estimating in a correct and transparent way, the trade channels and the cumulative trade margins for products passing through both the wholesale and the retail trade links.

7.45. The services provided by the trade industry include both margin and non-margin services. Margins services are those related to the trade activity of resale. Non-margin services are other services provided by trade establishments such as repair and installation services. However, some trade margins may best be estimated and treated as non-margin services, i.e. not be considered as calculated as a percentage of the basic value of the underlying goods. This is the case when the underlying goods do not appear in the system, for example: used household goods, in particular cars; when the value of the underlying goods makes up a very small and fluctuating share of the total selling price like scrap materials; and when the underlying goods by convention are not specified by type (as is the case for merchanting, where the goods involved are not covered by the merchandise trade statistics but only appear as a net item in the balance of payments – with acquisitions shown as negative exports, SNA 14.73 and 26.21). Note that merchanting, and thus trading output, also includes the case of the so-called factoryless goods production (FGP) where a principal has completely outsourced the transformation process but does not own the input materials (see paragraph 5.81 of the Guide to Measuring Global Production (UNECE, 2015), although in paragraphs 2.69-113, an alternative view that treats FGPs as manufacturers is explored). The treatment as non-margin services implies that this part of trading output will not be shown in the trade margin matrices. This will for the above-mentioned cases facilitate the use of the trade margin matrices in volume estimates and analytical uses of the resulting IOTs. With the CIF valuation of imports, there are no imports of trade margins.

7.46. Trade activity is classified in the industrial classification ISIC Rev. 4 under Division 45 "Wholesale and retail trade and repair of motor vehicles and motorcycles", Division 46 "Wholesale trade, except of motor vehicles and motorcycles" and Division 47 "Retail trade, except of motor vehicles and motorcycles". The following should be noted:

- Division 45 is a mixture of both wholesale and retail trade activities as well as of non-trade activities. In the context of SUTs and IOTs, Division 45 must be sub-divided into repair activities (Group 452), and trade activities (Groups 451, 453).

- Group 454 “Sale, maintenance and repair of motorcycles and related parts and accessories” has to be dealt with appropriately, depending on the significance of this activity in the country. This is a heterogeneous group and if the GVA contribution is significant, then the sale, maintenance and repair activities should be separated as the respective margin ratios are very different.
- Division 46 also covers wholesale on a fee or contract basis which is not part of the trade margin activity. It also covers some merchanting activity.
- Division 47 includes the resale (sale without transformation) of new and used goods mainly to the general public for personal or household consumption or utilization, by shops, department stores, stalls, mail-order houses, hawkers and peddlers, consumer cooperatives etc.

7.47. Trade services are classified in the CPC Ver. 2.1 in Division 61 (Wholesale trade services) and Division 62 (Retail trade services). It should be noted that even though many industries have output of trade services as either principal or secondary products, the product classification used in the system may distinguish only a few groups such as wholesale and retail trade services.

2. Compilation of trade margin matrices

7.48. The compilation of the trade margin matrices in the SUTs may in principle be started either from the **supply-side** or from the **use-side**. In general, especially when compiling a benchmark SUTs, the preferred approach is to first start with estimating trade margins in the supply-side resulting in data on the total amount of trade margins by products. These estimates will then represent the restrictions with which the use-side trade margin estimates have to comply.

7.49. Business surveys or special trade surveys usually provide data on total output of trade margins by industries (including sub-divisions of the trade industries) which then need to be transformed into margins by products if special surveys do not provide this information.

7.50. Starting the compilation of trade margins from the use-side means that estimates are made on the share of trade margins included in each element of the Use Table at purchasers’ prices. The effective trade margin associated with each cell depends both on the typical trade channels for this particular use and on the typical product margin ratios for those parts passing through the wholesale and retail links. Normally, such information cannot be gathered by asking purchasing enterprises/establishments and other users as they will only be aware of the last step in the distribution channel (where they have purchased the product) but clearly not on the previous steps. Even for the last step, they do not know the margin implicitly invoiced to them. Thus, plausible assumptions both on distributive channels and margin ratios have to be made and, for this purpose, it is useful to have the supply-side trade margin estimates at hand.

7.51. In the case of benchmarked estimates, it is necessary to calculate the full range of supply-side and use-side trade margin matrices by exploiting all available data sources and thus also to establish a basis for subsequent calculation, where the trade margin ratios of the previous years can be taken as the point of departure, and depending on available data, it may in this case be best to start from the use-side, as this represent the most detailed set of trade margin ratios.

7.52. The compilation of trade margins can be organized in three steps. The first two steps can be seen as dealing with estimating the supply-side trade margins by product, while the third step deals with the estimation of the use-side trade margin matrix. Box 7.1 gives a general summary of the three compilation steps for trade margins.

Box 7.1 Compilation process for trade margins

<table>
<tr><td rowspan="2">Supply-side trade margins</td><td>Step 1</td><td>Estimation of turnover and output (trade margins) by principal and secondary trade margin producers.</td><td>Absolute constraint for totals by producing industries
Output estimates entered into the domestic output part of the Supply Table</td></tr>
<tr><td>Step 2</td><td>(a) Estimation of trade turnover matrices (dimension: product by margin producing industry).
(b) Estimation of product specific trade margin ratios.
(c) Calculation of total wholesale and retail margins by product.
(d) Balance Step 2(c) against Step 1.</td><td>Relative constraints for margins by product.
Result entered into the trade margin columns of the Supply Table</td></tr>
<tr><td>Use-side trade margins</td><td>Step 3</td><td>The starting point is Step 2(d) and the Use Table, either balanced or unbalanced, and either at purchasers' prices or at basic prices.
Main objective:
If use table at purchasers' prices: To compile the full matrices for trade margins to derive basic price values in each cell, and the corresponding rows for the margin producing industries.
If use table preliminary estimated at basic prices: To compile the full matrices of trade margins in order to adjust the preliminary estimates of the rows for margin producing industries (often the case in an already established SUTs system)
Estimated trade margin matrices are eventually balanced against the constraint in Step 1 (absolute constraint) and in Step 2(d) (relative constraint)</td><td>Common problems:
– Question of distribution channels.
– No direct information of trade margin ratios by user category.
– Extensive use of assumptions necessary.</td></tr>
</table>

(a) Step 1

7.53. Step 1 of the compilation process for trade margins covers the compilation of trade services by industry that must already be part of the current annual National Accounts calculations of GVA by industry. The National Accounts estimates of output usually do not include a distinction between primary and secondary output. However, in the case of trade output, the situation is different as trade output must be derived separately as the difference between sales and purchase of goods for resale. The data needed to fill in the domestic production part of the Supply Table should therefore be readily available, and these calculations are not unique for the SUTs.

7.54. When compiling the SUTs, and in particular benchmark SUTs, there may be a need to take a closer look at existing calculations and to supplement them with more detail such as, for example, through the introduction of the distinction between wholesale and retail output, if it has not already been done.

7.55. Trading services are an important secondary output in many industries other than trade, such as manufacturing enterprises, barber shops, museums, hotels, recreational and sporting activities, etc. Therefore, as a first step, it should be assessed if current data fully cover all secondary output of trade activity, as some data sources such as industrial statistics may exclude trading, whereas data sources for service industries may not specify trade turnover separately, and some existing estimates may need improvements. Thus for certain industries only total sales without distinguishing between trade sales and other sales may be known. Estimates based on plausible assumptions should be made to achieve data on total trade services of the economy.

7.56. Trade turnover should be separated into wholesale trade turnover and retail sale trade turnover, and wholesale trade margins and retail trade margins be recorded as different products in the domestic output part of the Supply Table at basic prices. In business statistics, wholesale and retail trade turnover and margins are often available for the trade industries separately (ISIC Rev. 4 Divisions 45, 46 and 47). For industries with trade activity as a secondary activity this breakdown may not be available and, even in cases where trade turnover has been reported separately for wholesale and for retail sales, the value of goods purchased for resale may not thus be sub-divided. In this case, wholesale and retail trade margins cannot be derived directly but have to be estimated on plausible assumptions.

7.57. If no direct separate information on the type of trade (wholesale or retail) is available from surveys, the sub-division can be based on the kind of primary economic activity. Thus all ISIC Rev. 4 Division 46 can be assumed to carry out wholesale trade, and all ISIC Rev. 4 Division 47 retail trade, whereas ISIC Rev. 4 Division 45 has to be further broken down as indicated above. The sub-division of trade for secondary trade producers into wholesale and retail trade has in this case to be based on assumptions. For example, it can be assumed that trade turnover of restaurants and hotels, hairdressers, cinemas and theatres will probably be retail trade turnover, whereas trade activities of advertising agents will more likely be wholesale trade. Manufacturing industries will often trade in products similar to those they produce or in complementary products and such sales will usually be of a wholesale type, although some may be sold directly to consumers. Manufacturing industries may also be trading in similar imported goods, and such trade is again, likely to be classified as wholesale trade. There may also be industries where a grouping by size might be relevant for the correct identification of the type of trade activity performed, for example, the trade activity of small bakeries would normally be retail sale, whereas the trade activities of the larger ones would probably be wholesale trade.

7.58. For the purpose of the following calculation steps, these estimates should be done also at the most detailed level of classification of the trade industry available in source statistics. Although these more detailed estimates would not be shown in the Supply Table at basic prices, they will be very useful when estimating trade margins by products in the case where this information is not available from existing surveys.

7.59. In the discussion above, it has been assumed that secondary output of trade services remains in the industries of the secondary producers. However, as explained in Chapter 5, the SNA recommends to partition horizontally-integrated enterprises that have production in two or more Sections of the ISIC Rev. 4 (Sections are broad activity groups such as agriculture and fishing, mining, manufacturing, construction, trade, etc.) and create new establishments to be classified together with the primary producers of the secondary product if that has not already been done in basic statistics. Such reclassification of secondary output is called “redefinition” and is typically carried out for trade activities in many countries. A redefinition implies that there will be trade activity and output of trade margins from only Divisions 45-47 of ISIC Rev. 4. This will simplify significantly the calculations and will also facilitate the estimates of input structures and the calculations of Industry by Industry IOTs. However, the basic methodology outlined in this section and in the Annex to Chapter 7 will not be affected.

7.60. Step 1 results in an estimate of total output of trade services forming an **absolute constraint**. This value is then disaggregated by products in Step 2 as described below.

(b) Step 2

7.61. In Step 2, the **product dimension** is in focus, in particular in the allocation of total wholesale and retail trade margins to the products to which the margins apply.

7.62. The output of both wholesale and retail trade services must be first separated into output of margin activities (“trade margins”) and output of non-margin activities (“non-margin trade services”) such as trade services related to used goods, waste and scrap, and to merchanting. The output of non-margin trade services do not form part of the valuation matrices (see paragraph 7.45).

7.63. Table 7.5 illustrates how the trade data needed in the Supply Table are related to the survey data (or primary data obtained in other ways, eventually by relying on plausible estimates). The yellow shaded cells are data that will feed into the rows for wholesale and retail trade services in the domestic output part of the Supply Table. They are obtained as explained under Step 1 above. Step 2 deals with the problem of distributing the values in the yellow shaded cells to the various products and then the grey shaded column for the total trade margins will form the trade margin columns of the Supply Table (column (10) of Table 7.1). It is noted that the trade turnover data appear as supporting variables only; they are not moved forward to the Supply Table.

7.64. In the situation that data on margins by product is already available, either from current business surveys or from special surveys conducted in connection for the SUTs, the task is limited to aligning the survey results with the product classification used in the SUTs, and to grossing up the results to make them consistent with the output data for trade dealt with in Step 1 above.

7.65. In the case where no trade data by product are available, it is necessary to sub-divide the margin *trade turnover* by each industry into turnover and trade margins by the *products traded*. This should be done separately for wholesale trade turnover and retail trade turnover.

Table 7.5 Trade turnover and trade margins for wholesale and retail trade margins

Activity ISIC	Ec. Activity 1		Ec. Activity 2		. . .	Trade 45		Trade 46		Trade 47		. . .	Ec. Activity n		SUM	
	Trade turn-over	Trade margin	Trade turn-over	Trade margin	. . .	Trade turn-over	Trade margin	Trade turn-over	Trade margin	Trade turn-over	Trade margin	. . .	Trade turn-over	Trade margin	Trade turn-over	Trade margin
Product CPC	Indicate W or R		Indicate W or R		. . .	Indicate W or R		Wholesale (W)		Retail [R]		. . .	Indicate W or R			
1																
2																
:																
m																
Total Wholesale																
1																
2																
:																
m																
Total Retail																

7.66. The sub-division by products of trade turnover of each trade service producing industry will result in the two trade turnover matrices each with dimensions ‘products (traded) by producing industry (output)’: one matrix for wholesale trade turnover and one matrix for retail trade turnover. These matrices are presented together in Table 7.5. The availability of source data for this sub-division may vary a great deal across countries. Even in cases where no direct survey information is available, scattered information may be available including from administrative sources and related/older surveys. Although ad hoc information on specific units may not be representative for the total branch. In this case, it is of particular importance to utilise data from the most detailed level of **sub-divisions of the trade industry**, as these will indicate the types of products traded.

7.67. Even with the availability of data for sub-divisions of the trade industries, the estimation of trade turnover by products is not straightforward. This is the case, for example, of non-specialised trade divisions such as supermarkets and department stores where a wide range of goods are traded (even though, in some cases, it may be possible to get access to computerised cash transactions with detailed information about the goods sold and purchased data from businesses). It is generally easier to make estimates for specialised retail division as they are known from everyday life and more uniform. Estimating turnover by product for the wholesale divisions is more difficult because of the range of product mix, although there are branches with a clear concentration on one or a few product groups such as for example wholesale of motor vehicles and energy products.

7.68. For **trade as secondary activity** plausible assumptions must be made about the products traded. For example, for hairdresser trade in cosmetic articles, hotels trade in souvenirs, newspapers, journals, food and beverages, and museums trade in books, multimedia products, and so on, the share of each identified product group in turnover also has to be determined. In manufacturing, it can be difficult to estimate trade turnover structures by goods traded without any specific information as the specialization can be very high. Information could be obtained on ad hoc basis by asking selected units with significant trade turnovers. Making these estimates based on plausible assumptions at the **highest level of detail** may provide acceptable results for the SUTs aggregates, even if only rudimentary information is available.

7.69. Having compiled the two trade turnover matrices in Table 7.5, it is possible to check the wholesale and retail trade turnover against the supply of the goods (domestic production and imports) from the Supply Table. At this stage, the comparison cannot be done at completely comparable prices, as the supply will be at basic prices and the trade turnover will be inclusive of either wholesale or retail trade margins, or both, but such checks should ensure that the trade turnover estimates are plausible in relation to the supply of the goods. For instance, there should not be much retail trade turnover of intermediate and capital goods; wholesale trade turnover should normally not be much higher than domestic production plus imports (plus wholesale margins); retail trade turnover of consumer goods should not be much higher than household expenditure for these goods. However, there may be exceptions to these general rules for certain products, such as products that are traded twice within the same chain of distribution. For example, when one wholesaler imports a product or purchases it from many small producers (such as agriculture) and subsequently resells it to another wholesaler.

7.70. From the two trade turnover matrices, the trade margin matrices of the same dimensions must be derived. This is formally done by multiplying the trade turnover matrix by the assumed product margin ratios as described below.

7.71. The margin ratios are defined here as the share of a trade margin relative to the trade turnover. Margin ratios can be defined at the **level of industries** which would show the average margin obtained by margin producing industry (the necessary information is already available from the Step 1 calculations) or at the **level of products**, where information is usually less readily available, although some countries may conduct regular surveys on percentage trade margins by products, classified by CPC or COICOP. It must in general be assumed that margin ratios are closer connected with the products traded than with the industry carrying out the trading activity as either primary or secondary production.

7.72. It is obvious that even a single benchmark survey of product-specific trade margins would contribute greatly to the overall quality of the SUTs.

7.73. It is important to be aware of the basis for the calculation of percentage trade margins. When reported by enterprises, the trade margins will often appear as a percentage of the total selling price, including excise taxes and VAT, whereas the compiler of the SUTs will usually need the trade margin as either a percentage of the basic price (when estimating margins in the Supply Table) or a percentage of the purchasers' price excluding taxes on products (when estimating margins in the Use Table). The source data on percentage trade margins must therefore be adjusted to the appropriate basis before being applied in the system.

7.74. When specific survey information is missing, alternative sources for product specific margin ratios must be explored. One possible approach might be to compare the prices observed for the CPI and for the wholesale price index (WPI) for identical products. The same could be done by comparing PPIs with WPIs, which could provide proxies for wholesale margin ratios. In the case of regulated prices, the price levels in the different distribution channels may be available, and more generally price information available from the monopoly and price control agencies could be utilised. The margin ratios of specialised trade branches may be used as proxies for the related product margin ratios. Thus the margin ratio of the retail trade branch selling shoes could be taken as the typical retail margin for shoes. In practice, the usefulness of this approach would depend on the level of detail in the product classification applied, and the availability of data by detailed sub-branches of wholesale and retail activity, which would facilitate linking branches and products.

7.75. Having established a set of product-specific margin ratios, the multiplication of the trade turnover matrix could then be performed on the assumption that these product-specific margin ratios are valid in all industries trading in that product (primary and as secondary). Next the resulting wholesale and retail trade margins by producing industries must be compared with the total trade margins by industries determined in Step 1. The reasons for differences could be inaccuracies in the trade turnover matrices, in the sub-division between wholesale and retail margins, and in the assumed or derived product margin ratios. These differences must be eliminated either by proportional adjustments or, if appropriate, by more refined methods.

7.76. It should be noted that the challenges in determining trade margins are not only the often weak data sources but also related to the on-going changes in the structure of the trade industries, for example:

- changing forms of supply of trade services;
- concentration in retail trade branches;
- increase in the size of shops; and
- increasing importance of internet trade etc.

7.77. These developments also affect the validity of benchmark estimates that may, relatively quickly, become outdated.

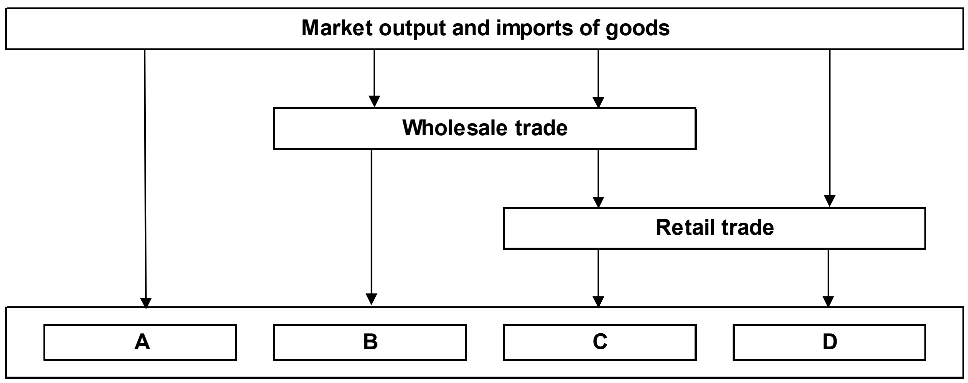
(c) Step 3

7.78. Step 3 relates to the calculation of the use-side trade margins matrices. In the previous steps, the question of trade channels has not been dealt with, as the data sources have been either survey data for the trading activities or estimates based on administrative or other indirect sources. However, when compiling the Use Table trade margin matrices, trade channels become important, as individual users may purchase their goods from different levels of the distribution system, or even directly from producers.

7.79. Direct data sources are more limited for the Use Table margins than for the Supply Table based margins. This is due to the fact that buyers of the goods do not know the share of the trade margins in the price they have paid. Sometimes they even do not know whether they have purchased the good from a trader or not. In cases that the goods have been purchased in a retail shop or from a wholesaler, the buyer will only know that the price paid includes some trade margin but not the full amount of the margin. This is because the distribution channels before the final seller are usually unknown to the buyer.

7.80. Figure 7.2 illustrates in a schematic way the possible distributions channels for goods from the producer of market output and imports of goods to the user. The distribution can go directly from the producer to the user (represented by box A); through wholesale trade (box B) in which case on wholesale margins are applicable; through wholesale and retail trade (box C) in which case both on wholesale and retail margins are applicable; or only though retail trade (box D) in which case only retail margins are applicable.

Figure 7.2 Alternative distribution channels of goods



Channel A: From the producer directly to the user (without margins)
Channel B: From the producer to the user through a wholesale trader (wholesale margins)
Channel C: From the producer to the user through a wholesale trader and a retail trader (wholesale and retail margins)
Channel D: From the producer to the user through a retail trader (retail margins)

7.81. The calculation of the Use Table trade margin matrices has therefore to be based on plausible assumptions and eventually balanced with the estimated total supply of the trade margins by products. In principle, the following types of information are necessary:

- for each single cell of the Use Table, the share of total purchases that has been channelled through trade activities (for all involved steps in the distributive channel); and
- the margin ratios to be applied for the products actually traded in the particular intermediate or final use part of the Use Table.

7.82. Usually specific knowledge about the distributive channels for the goods in the individual cells is missing. The same is the case for the possible variation of the actual margin ratio across users. Therefore plausible assumptions have to be made. Concerning the use of wholesale and retail trade channels, it can reasonably be assumed that:

- For intermediate consumption, mostly wholesale trade margins and in very few cases retail trade margins are relevant. Retail trade margins for intermediate consumption can be relevant, for example, when buying stationery, materials by handicrafts, smaller shops and small scale enterprises.
- For household final consumption expenditure, retail trade margins are mostly relevant with also some exceptions when consumers have access to wholesale channel directly and thus generating wholesale

trade margins or are able to buy directly from the producer of the good (for example, farmers, bakeries, tailors, etc.) thus not involving trading services at all.

- Wholesale services are also connected with household final consumption expenditure as some of the products bought in retail trade may have been delivered from wholesalers, and thus also contain wholesale trade margins.
- For gross fixed capital formation, the wholesale channel is the most important and, to a very small extent, also the retail sale channel, for example, valuables and smaller equipment.
- In changes in inventories, it may reasonably be assumed that only wholesale margins can be involved but not retail trade margins (although theoretically possible). Furthermore, wholesale trade margins can only be allocated to input stocks and trading stocks but not to output stocks, finished products and work-in-progress.
- For exports, it may reasonably be assumed that only wholesale margins may be involved (allowing for retail trade margins allocated to non-residents expenditure).

7.83. For much intermediate consumption, fixed capital information in equipment and machinery, and exports no trade margins may be involved at all, as especially bigger enterprises will deal directly with each other. Imported goods may be more likely to be bought via wholesales than goods from domestic producers, again depending on the size of the enterprises. Small enterprises will have a bigger tendency to buy certain goods via retail traders.

7.84. The allocation of the trade margins to the individual cells of the Use Table has to be done in a step-wise procedure. VAT and other net taxes on products must first be removed from the Use Table at purchasers' prices. The remaining value of the cells comprises only basic values and trade margins and is called the "residual" Use Table at purchasers' prices. It may be better to first estimate the retail trade margins for consumption of households and deduct those amounts in order to get all 'use-data' (including household final consumption expenditure) in a more uniform valuation including only wholesale trade margins, making the allocation of these wholesale trade margins easier and of slightly higher quality. Nonetheless, the retail margins and the wholesale margins are determined as follows:

- Based on the relationship between the total supply of each product and the trade turnover determined in Step 2, it is possible to estimate the average share of the total supply of each product passing through wholesale and retail trade links.
- At this stage, it is necessary to make assumptions about distributive pattern for each cell under the restriction that the total trade turnover (separately for wholesale and retail trade) is known from Step 2. In this way the absolute amount of each cell passing through either wholesale or retail trade is determined.
- If no specific information is available, it can be assumed that the average wholesale or retail trade margin ratio for the specific product (known from Table 7.5 in Step 2) should be applied to the share of the total value passing through this trade link as determined in (3).

7.85. When the two trade margin matrices have been compiled, they can be deducted from the "residual" Use Table at purchasers' prices to obtain the Use Table at basic prices.

7.86. The resulting Use Table and trade margin matrices should be checked for overall plausibility both regarding the relationship between allocated wholesale and retail trade margins and the relationship between the Use Table data at purchasers' prices and the allocated trade margins. In this process, the previously estimated trade margins by products of Step 2 may also be reallocated.

7.87. The procedures outlined in this section for estimating the trade margin matrices is one that typically has to be applied when estimating benchmark SUTs. As mentioned above, the approach may be somewhat different when compiling annual tables on a current basis, as it may be better in this case to start from the Use Table side, taking as the starting point the effective trade margin ratios (in principle the proportion passing through this trade channel multiplied by the actual trade margin ratio) of the previous year as this detailed set of trade margin ratios is less prone to aggregation errors than applying the average margin ratios by product that can be derived from the Supply Table.

7.88. The Annex to Chapter 7 contains a numerical example where the principles outlined in this section are illustrated in a complete template for deriving trade margin matrices, and in particular, clarifies the importance of the distinction between wholesale and retail trade margins in getting the correct results.

D. Transport margins

7.89. Transport margins are another valuation component relating to the delivery chain of the products from the producer to the final user. Transport margins represent freight transportation services of products when invoiced separately by the seller. Transport margins are transport charges paid separately by the purchaser to take delivery at the required time and place. They are included in the use of products at purchasers' prices but not in the basic price of a manufacturer's output or in the trade margins of wholesalers or retail traders.

7.90. Transport margins include in particular:

- Transport of goods arranged by the manufacturer, the wholesale or the retail trader in such a way that the purchaser has to pay separately for the transport costs even when the transport is done by the manufacturer, wholesale or retail trader himself.
- Transport of goods from the place where it is manufactured or sold to the place where the purchaser takes delivery of it in case the manufacturer or trader pays a third party for the transport, if this amount is invoiced separately to the purchaser.

7.91. This definition of transport margins implies that the transportation has to be arranged by the seller (producer or trader). This also implies that transportation arranged directly by the purchaser (and thus, of course, also directly paid for by the purchaser) is not included in the transport margins.

7.92. The existence of a transport margin is thus related to the way the transportation costs are paid. This implies that transport margins cannot be derived from the output of the respective transportation services but that information on the payments between the two related parties of the seller and the buyer is required.

7.93. Since transport margins only occur when transport services are separately invoiced, this has the important implication that no partitioning of transactions is necessary because the transport service is already treated as a separate product and necessarily known to the purchaser. (see 2008 SNA, paragraph 14.130)

7.94. Thus, from a statistical point of view, transport margins should therefore be much easier to deal with and to estimate than the trade margins because they could be surveyed directly, based on information available in the bookkeeping department of the purchaser and because it is not necessary to break down the purchasers' price based on assumptions. However, in reality, getting the data is challenging, for example, for large companies the bookkeeping department may be off-shore.

7.95. Based on the definition of transport margins, which is logically connected to the definitions of basic prices, purchasers' prices and trade margins, Box 7.2 provides examples of transportation costs which are not recorded as transport margins because they do not contribute to the valuation difference between basic prices and purchasers' prices.

7.96. The definitions of value concepts and the implied transport margins are treated in the 2008 SNA to reflect the way the transportation costs are treated in business accounts and thus in the source data. When the cost of transportation that is arranged by the **purchaser** is included in the price of the intermediate consumption or final use in the source data, it should be treated as transport margins but not when it is recorded as a separate cost item. Hence the recording of transportation costs in the source data will influence the actual delimitation of transport margins, particularly when "non SNA-compatible" source data are not being adapted (by the compiler of the National Accounts) to be in line with the SNA definition. However, such general adaptations of existing source data will in general not be feasible and it may even be questioned if such adaptations should be attempted at all. If not done, the concepts of basic value and transport margins would deviate somewhat from the recommended concepts but the overall properties of the system would not be compromised.

7.97. Contrary to the treatment of trade margins, imports of transport margins can exist. This happens when a foreign carrier transports freight into, within, or out of the domestic territory. This would be the case of road, sea (only inland waterways), and air (inland) transport. Pipelines within the domestic territory are normally run by a resident enterprise.

Box 7.2 Examples of transportation costs which do not form transport margins

Transport margins are not the same as actual transportation costs. Since these two concepts are often confused, examples of activities which are not recorded as transport margins because they do not contribute to the valuation difference between basic prices and purchasers' prices are listed below:

- If the manufacturer or trader transports the goods himself and does not invoice the transportation separately, these transportation costs will be included in the basic price of the manufacturers' output or traders' output. This transport represents an ancillary activity and the individual costs of transport will not be identifiable as transportation costs.
- If the manufacturer arranges for the goods to be transported by a third party without a separate invoice for the transport services, these transport costs will be included in the basic prices of the manufacturers' output. These transportation costs will be identifiable and recorded as part of the manufacturers' intermediate consumption.
- If wholesale and retail traders arrange for goods to be moved from where they take delivery of them to where another purchaser takes delivery, these costs will be included in the trade margin if no separate charge is made for transportation to the purchaser, where these costs will be part of the intermediate consumption of the wholesale trader and retail trader.
- If a household buys goods for final consumption purposes and arranges for transport by a third party, these transport costs are recorded as household final consumption expenditure on transport services and not included in transport margins.

- If a domestic carrier transports goods from Country A to Country B through the domestic territory (transit transport), this will also not be considered as a transport margin as it does not relate to goods that forms part of domestic supply and use, these transportation services will be recorded under exports of services.
- Transportation services of domestic carriers outside the domestic territory (merchanting) are not part of the transport margins but form exports of services.
- Freight transportation of used goods, scrap and waste, earth and similar freight connected with construction projects are also not part of transport margins as these goods are not considered as products. This also includes the transportation of goods in connection with removals.

7.98. According to the modes of transport (such as road, railway, water, air, and pipeline), several kinds of transport margins have to be distinguished provided they are classified as separately products in the system. In addition, the services of forwarding agencies also form part of the transport margins when paid separately by the buyer. Transport insurance services have to also be considered under the same terms as the general definition of transport margins.

7.99. Compared with trade margins, transport margins are of a much lower magnitude and, according to the restricted definition in the 2008 SNA compared to the 1968 SNA based system. However, the complexity of the transport margin is much bigger, not only because of the different kinds of transport margins but also because of the definition itself.

7.100. Furthermore, the data situation gives rise to numerous practical problems. The relationship between the supply of goods and the transport margins connected with them is looser than in the case of trade margins. Thus transport costs are usually not related to the value of the goods transported; much transportation is done as ancillary activity; and the way transportation costs are paid might differ from product to product and from transaction to transaction.

7.101. According to the 2008 SNA, total imports and exports of goods are to be valued FOB. However, for the purpose of compiling SUTs, total imports will be valued CIF and an appropriate adjustment item should serve for the transition between both valuation concepts. A CIF valuation means that transport costs up to the border of the importing country are included in the CIF based value.

7.102. Transport services between the border of the importing country and the domestic location of the buyer are thus to be considered as transport margins (if paid for by the buyer and separately invoiced by the seller). Analogously, transport services between the domestic location of the seller and the border in the case of exports are also to be considered as transport margins (if paid for by the buyer and separately invoiced by the seller). Transportation services delivered outside domestic territory by resident producers will never become transport margins but are exports of trade services. Non-resident carriers can also provide transportation services within domestic territory for resident or non-resident buyers.

1. Compilation of transport margin matrices

7.103. Before embarking on the task of estimating transport margins, the compiler should carefully study the instructions provided in the business questionnaires used to collect sales and purchases based data, and any other sources for these data. This should be done with a view to determine to what extent the collected data fulfils the conditions for the existence of transport margins, and, if that is the case, how exactly such transport margins relate to the SNA definition.

7.104. In particular, how the (non-margin) transport costs directly collected in the business surveys or available from other sources, have been defined should be examined, in order to clarify if such cost item could possibly include those transport costs that, according to the SNA definition, are to be considered as transport margins. Only after this examination, a decision can be made on the existence and/or the exact delimitation of the transport margins to be estimated.

7.105. Trade margins make up the bulk of total output of trade services (the exceptions being only the trade services on used goods, waste and scrap, and trade relating to goods in transit and merchanting), and practically all trading activity in the economy is covered by the total output of trade services identified in the system. The situation for transport margin activity is quite different. A significant part of all transport activity in an economy takes place as ancillary activity in non-transport industries and is therefore not identified in the system. The intermediate consumption related to the ancillary activity is lumped together with the intermediate consumption related to the principal and secondary activities of the industry. Only the transport services carried out by the transport industries and, if statistically identified, a very minor output of transport services as secondary output in non-transport industries is shown explicitly in the system.

7.106. If transport margins are estimated, it is therefore not possible to assess their importance relative to the total transport activity in the economy, and the estimated transport margins should not be mistaken for reflecting the actual physical freight transport activities carried out in the economy, comparable to what will usually be covered in specialised transport statistics. Within the SUTs, the only way to assess total freight transport activity, ancillary and marketed, is by means of the distribution of those inputs typically used for transportation such as fuel, auto repair, and current taxes on motor vehicles (other taxes on production). On the other hand, these inputs will often, and ideally, have been estimated based on a distribution of all motor vehicles by type and size to by industry.

7.107. The magnitude of the transport margins, and even of the total output of freight transport services, is usually relatively much smaller than the trade margins. In some cases, the imbalance between supply and use of a product might even be bigger than the transport margins of that specific product. Therefore, it is recommended to carefully review those products where important transportation services are involved such as, for example, agricultural and forestry products, energy products, iron and steel products and products related to construction. This situation will vary across countries.

7.108. If no secondary transport activity is shown in the Supply Table at basic prices, this means that the transport of goods is arranged by the manufacturer, the wholesale trader or the retail trader in such a way that the purchaser has to pay separately for the transport costs even when the transport is done by the seller will not be applicable.

7.109. As mentioned, transport margins could in principle be surveyed directly based on information available in the bookkeeping of the purchasers. In practice such information is, however, not being collected, as a relevant coverage would involve not only total transport margin paid by enterprises being surveyed but also their distribution by product and by kind of transportation. In addition, even if this information may exist, respondents may have to go back to the individual invoices and collate the data required in order to provide these data. Thus, even though it would be possible to establish such special surveys, for example related to compilation of benchmark SUTs, it is generally not conducted without incurring large burden on businesses.

When such information is available and sufficiently representative, then this is all that is needed to compile the transport margins of the system.

7.110. Box 7.3 provides four options to consider in the absence of any direct information on transport margins. The supporting argument for Option (4) is that the matrix of wholesale trade margins will anyway be based on inadequate information, and that it is not possible to ascertain whether the margin associated with a particular cell is the "pure" wholesale trade margin or if it also includes some transport margin. As trade margins will anyway be much higher (around 10-25 per cent) than any contribution from possible transport margins (around 0.5 per cent), the additional uncertainty introduced by choosing a joint wholesale and transport margin will be therefore rather limited. However, the input structure of wholesale trade will be somewhat distorted.

Box 7.3 Options to consider where no data exists on transport margins

In the absence of any direct information on transport margins, there are basically four ways to proceed:

Option 1: In complete absence of any information on transportation margins, decide that transport margins are insignificant the way output and intermediate consumption values are defined, and therefore need not be estimated at all.

Option 2: Concentrate on those products where important transportation services are involved. Such products are normally agricultural and forestry products, energy products, iron and steel products and products related to construction, and collect ad hoc information about transport arrangement from selected enterprises.

Option 3: Decide to establish a full matrix of transport margins based on general assumptions about total transport margins and their distribution by products and uses.

Option 4: Rerouting transport margins by product and by use through wholesale trade. This can be done by estimating for each type of transport output the share being transport margins, and record this as input into wholesale trade. Output of wholesale trade should be increased by the same amount. This "rerouting" via wholesale trade recognizes the existence of transport margins but their actual distribution is hidden in an untraceable way in the wholesale trade margin matrix.

Regarding Options (3) and (4), the total transport margins by type of transport output could be in principle determined residually as the difference between total supply and the identified uses of each type of transport service. This approach would, however, require a very high degree of confidence in the preliminary estimates of transport costs entered into the Use Table. As previously noted, transport margins are expected to make up only a very minor share of total transport services. This residual would be highly unreliable, and probably reflect the statistical uncertainty of the estimated output and use data than the actual level of any transport margins.

7.111. From the Supply Table basis alone, it is not possible to distinguish transport services paid for by the seller from those invoiced to the purchaser. Starting from the output of transport services (principal or secondary) in the industries, only total output can be calculated. From this total output, some non-margin services can be clearly deducted. These are the transport services related to transit transport, merchanting, and to used goods, waste and scrap. It would also be possible to deduct some statistically identified transport services paid for by the seller and not invoiced separately or directly paid for by the purchaser. However, this still could leave a residual that would be much higher than any reasonable estimate of total transport margins.

7.112. Transportation costs are usually surveyed in current business statistics, at least as a cost item. By definition, these transportation costs relate to the goods produced or traded. If the purchaser arranges the transport, these costs may be incorporated in intermediate consumption. Based on the structure of the output and the products traded, an estimate can be made on the structure of the products for which the transportation costs have been paid for. However it is implausible to assume that the transport costs are to some extent proportional to the value of the products produced or traded. Such assumptions and the subsequent estimates will be of limited use.

7.113. The various estimation steps to calculate the transport margins matrices should as far as possible be separated into the different modes of transport (for example, road, railway, water, air, pipeline, forwarding, and transport insurance); however, available data might not have such breakdowns and different estimation methods would need to be applied.

7.114. Due to the weak data availability, one may concentrate on the products with large transport margins involved and allocate margins to the remaining products according to some plausible assumptions. As only a part of all transport services are transport margins, it is difficult to check the resulting data on plausibility. Supply and use of transport margins should of course be equal but the estimation of the one side is not independent from the estimation of the other side.

7.115. For the forwarding agents' services, the same estimation problem exists as for the transportation itself. However, the forwarding agents' services are much more related to the transportation costs, and estimates could be based, if available at this stage, on the structure of the transportation margins. However, not all transportation is organised by forwarding agents. Forwarding agents are usually engaged in cross-border transportation rather than in domestic transportation. In evaluating the practical problems connected with the correct estimates of forwarding agents' margin matrices, one could consider treating these services as not being part of the transport margins.

7.116. Transport insurance services are usually a very small part of the transport margins. Here also, they may be more important for cross-border transportation than for domestic transportation. A key difference is that the insurance premiums depend on the value of the goods transported rather than on actual transport costs of the freight. Similarly to the forwarding agents' services, and in view of practical implementation and the usually small magnitude of such services, it could be decided to treat them also as ordinary services outside the margin system.

7.117. Having estimated the Use Table based transport margin matrices, whenever relevant, these matrices have to be deducted from the Use Table at purchasers' prices, and the total transportation margins by intermediate and final uses are allocated to the transport services products of the applied product classification.

E. Taxes on products and subsidies on products

7.118. Taxes on products and subsidies on products are the other major valuation component in addition to the trade and transport margins. Compared with the margins matrices, the elaboration of the matrices of taxes on products and subsidies on products is less complicated because the data situation is usually more favourable and the delimitation and calculation of taxes and subsidies is an integral part of the regular compilation of National Accounts and not just an aspect of the SUTs. Thus the main task with regard to taxes on products and subsidies on products when compiling SUTs is to establish the relationship between the different kinds of taxes and subsidies and the product flows.

7.119. The matrices for taxes on products and subsidies on products is usually derived by separate calculations for each of those taxes and subsidies and related to the intermediate use and final use parts of the Use Table.

Contrary to the trade and transport margins, no specific information on distribution channels or transport deliveries is needed here; only the relations between the product classification and the individual taxes and subsidies are needed.

7.120. A **tax on a product** is a tax that is payable per unit of some good or service. The tax may be a specific amount of money per unit of quantity of a good or service (the quantity units being measured either in terms of discrete units or continuous physical variables such as volume, weight, strength, distance, time, etc.), or it may be calculated ad valorem as a specified percentage of the price per unit or value of the goods or services transacted. A tax on a product usually becomes payable when it is produced, sold or imported, but it may also become payable in other circumstances, such as when a good is exported, leased, transferred, delivered, or used for own consumption or own capital formation. An enterprise may or may not itemise the amount of a tax on a product separately on the invoice or bill that it charges its customers. (2008 SNA, paragraph 7.88)

7.121. **VAT** is a special type of tax on products collected in stages by enterprises but ultimately charged in full to the final purchasers. It is described as a "deductible" tax because producers are not usually required to pay to the government the full amount of the tax they invoice to their customers, being permitted to deduct the amount of tax they have been invoiced on their own purchases of goods or services intended for intermediate consumption or fixed capital formation. VAT is usually calculated on the price of the good or service including any other tax on the product. VAT is also payable on imports of goods or services in addition to any import duties or other taxes on the imports. (2008 SNA, paragraph 7.89). General sales and turnover taxes give rise to many of the same compilation problems as VAT.

7.122. A **subsidy on a product** is a subsidy payable per unit of a good or service. The subsidy may be a specific amount of money per unit of quantity of a good or service, or it may be calculated ad valorem as a specified percentage of the price per unit. A subsidy may also be calculated as the difference between a specified target price and the market price actually paid by a buyer. A subsidy on a product usually becomes payable when the good or service is produced, sold or imported, but it may also be payable in other circumstances such as when a good is transferred, leased, delivered or used for own consumption or own capital formation. (2008 SNA, paragraph 7.100).

7.123. Three main categories of taxes on products are distinguished:

- VAT type taxes;
- taxes and duties on imports excluding VAT; and
- taxes on products, except VAT and import taxes.

7.124. Similarly, there are three main categories of subsidies on product:

- import subsidies;
- export subsidies; and
- other subsidies on products.

7.125. For all of these different types of taxes on products and subsidies on products, the 2008 SNA gives further definitions and lists typical examples. It should be noted that profits of fiscal monopolies which are transferred to the state are treated as taxes on products, and that losses of government trading organizations and subsidies to public corporations and quasi-corporations may have to be treated as subsidies on products.

7.126. Taxes on products should be recorded on an accrual basis that is when the activities, transactions or other events occur creating the liabilities to pay taxes. The amounts to be recorded in the system are determined by the amounts due for payment only when evidenced by tax assessments, declarations or other instruments which create liabilities in the form of clear obligations on the part of taxpayers. The system does not impute missing taxes not evidenced by tax assessments.

7.127. Subsidies on products are recorded when the transaction or the event (production, sale, import, etc.) which gives rise to the subsidy occurs.

7.128. The recording in the SNA of transactions related to taxes on products and subsidies on products does not mirror the way in which those involved view them. The system contains no transactions between economic units that are the actual payers (collectors) of taxes on product or the actual receivers of the subsidies on products and government. In the SNA, taxes on products and subsidies on products are recorded only at the level of the total economy and are not payable out of GVA of domestic producers. They are also not split by institutional sector.

7.129. In the context of SUTs, this has the important implication that it is never necessary to consider the actual payment flows related to these taxes and subsidies but only to identify the products to which they relate. It is therefore also irrelevant at which stage in the turnover sequence (producer, wholesaler or retailer) the tax is actually being collected or the subsidy paid out.

1. Compilation of taxes on products and subsidies on products matrices

7.130. Generally, the compilation of the taxes on products and subsidies on products matrices consists in three main steps. The first compilation step is the allocation of taxes and subsidies on products by the products of the supply table which corresponds to Columns (12), (13) and (14) of Table 7.1. The second compilation step is to allocate taxes and subsidies on products to the relevant entries of the Use Table as shown in Table 7.3. The third compilation step covers the specific task relating to VAT in order to calculate non-deductible VAT.

7.131. The allocation of the taxes on products and subsidies on products would be easier if it SUTs would be compiled at a level of product detail where a one-to-one relation between the product classification item and the specific tax and subsidy given. Furthermore, in cases that the tax or subsidy is linked to the physical quantities, such additional information might be necessary.

7.132. In the first compilation step, the amounts of the different and specific taxes and subsidies - usually taken directly from the respective government revenue accounts - are allocated to specific products in the SUTs. If these data are not already on an accruals basis, then they must be adjusted from a cash basis to an accruals basis, which can often be done by summary time-adjustments. No further compilation steps would be needed to arrive at the required column of taxes on products (exclusive of VAT) less subsidies on products for the Supply Table at purchasers' prices, Column (13) and (14) of Table 7.1. The allocation of non-deductible VAT depends upon the user, and in general, can only be derived from the basis of the Use Table, and is covered later in this section.

7.133. The second compilation step refers to the allocation of taxes and subsidies on products to the entries of the Use Table (intermediate use and final uses) at purchasers' prices and to the separation of "other taxes on products" and "subsidies on products" as in Table 7.3. For those product categories for which the tax or subsidy have been allocated, the share of the tax or subsidy component in the purchasers' price has to be calculated. This step needs to be based on the appropriate taxation basis according to tax legislation, and Table 7.3 is the result of the appropriate calculations for each single kind of taxes on products and subsidies on products.

7.134. In order to adequately allocate the taxes and subsidies to the Use Table elements, not only the appropriate tax rates have to be explored but also the share of the use flows at which the tax rate is to be applied. A certain product classification category might not only include flows that are taxed but also other types of products not taxed, and/or certain products may be free of taxes for certain users. Thus, an effective rate may need to be estimated, for example, the mineral oil tax may not only have different tax rates for the different mineral oil products but also some of them might have a tax rate of zero (for example, aviation fuel) and some users may be exempt of tax like the agriculture industry. As mentioned, this problem may be alleviated by having a sufficiently detailed product classification.

7.135. There may be cases where no rates or limited data are available to allocate taxes and subsidies to the Use Table element. In these cases, a pro rata approach may need to be applied, for example, the total value of tobacco excise duty received by government may need to be prorated against all industries' purchases of tobacco except the principal industry and including components of final uses. This implicitly assumes all purchasers of tobacco pay the same proportion of duty in relation to the value of their purchase. This is clearly a sub-optimal approach but achieves an allocation constrained to the corresponding total value in the Supply Table at purchasers' prices.

7.136. Usually the taxes on products and subsidies on products are restricted to only a small group of products, and furthermore, quite a few taxes on products cover the bulk of them. This is even more prevalent with subsidies on products.

7.137. The third compilation step covers a specific tax on product, VAT, which requires separate handling. According to 2008 SNA, VAT is to be recorded net in the sense that the:

- output of goods and services and imports are valued excluding invoiced VAT, and
- purchases of goods and services are recorded inclusive of non-deductible VAT.

7.138. VAT is recorded as being borne by the purchasers, not the sellers, and then, only by those purchasers who are not able to deduct VAT. This applies to both intermediate consumption and GCF.

7.139. Therefore the overwhelming part of non-deductible VAT will be recorded as being levied on final uses, mainly on household final consumption expenditures. A small part of VAT, however, is levied on enterprises and institutions that are exempt from VAT.

7.140. According to the definition of purchasers' prices, only the non-deductible part of VAT is included in the purchasers' prices. Thus, the rows (products) in the Use Table at purchasers' prices include non-deductible VAT. In order to balance supply and use for each product, the non-deductible VAT by products has to be estimated and either included in Column (13) of Table 7.1 or deducted from the Use Table.

7.141. In general, VAT exemptions are related to products or activities. If an industry has only exempted activities there is no problem. In the case of an industry has exempted and non-exempted activities, additional assumptions on the estimation of non-deductible VAT are necessary. For example, apply the ratio of exempted activities and total activities to intermediate consumption in the estimation of VAT. The exemptions may differ across countries and dependent of the respective countries' taxation policies. For estimation of VAT by type of product, and by type of use, details should be sought from the relevant tax authorities and should be reviewed annually.

7.142. In order to calculate non-deductible VAT, it is necessary to identify those industries and final users that are exempted from VAT, and therefore not allowed to deduct VAT from their purchases, and to relate the VAT rates (explicit rate or an effective rate depending upon the product mix) to the product classification used. Both steps need to be based on the actual VAT legislation. This calculation will be further complicated where there is more than one VAT rate in operation, as some product items in the product classification applied might be mixed with regard to the VAT tax rates. In this case, additional breakdowns of those product groups would be desirable or an effective rate using a weighting of lower level product detail and VAT rates calculated.

7.143. Certain part of an industry might be VAT exempt and appropriate sub-divisions might be helpful. It could also be the case that certain VAT exempt industries are normal VAT payers for their secondary outputs. The VAT legislation may also have specific rules for very small enterprises that have to be considered, for example, thresholds for being registered in the VAT system. It is important to note, for VAT exempt industries, non-deductible VAT has to be calculated both for intermediate consumption as well as for GCF.

7.144. Examples of exempt-type industries, dependent upon individual countries' tax legislation, tend to cover industries like postal services, newspapers, dwellings (but not the intermediate consumption part), banking, insurance, some business services, education services and health services. Also, small producers below the VAT threshold may also be exempt.

7.145. Total calculated non-deductible VAT derived by using the official tax rates and the purchasers' values of the relevant cells in the Use Table will generate a theoretical VAT estimate, which should exceed VAT revenue (on accrual basis) received by government. This is because there will always be some degree of missing VAT due to evasion, cash transactions and fraud involving products that are (based on other statistical sources) included in SUTs. Using the official VAT rates may lead to an over-estimation of theoretical VAT, for example, the tax-law allows reductions for losses on debtors or in countries where there are high thresholds for registration for VAT. It can also be appropriate to lower the rate if local tax authorities are known to be inefficient.

7.146. In the balancing process of the VAT vector/matrices, the theoretical VAT must be adjusted to the revenue received (due to be paid) by government. This adjustment process should be based on information from the tax authorities such as industries / products where VAT is or is not likely to be paid, for example, general government is likely to be fully compliant whereas households less so.

7.147. It is also important in producing SUTs, that the rates are reviewed each year to allow for changes in VAT rates, schemes and legislation. For example, if the effective VAT rate on a product changes in mid-year, appropriate weighted estimate for the period will need to be established.

Annex A to Chapter 7. Example for deriving trade margins in Supply and Use Tables based on survey data

A7.1 This Annex provides an illustrative example on how to calculate trade margins matrices using survey data. This example builds upon the availability of survey data obtained, for example, through the questionnaire shown in Figure A7.1 which is used in the Statistical Office of the Republic of Serbia. Similar information can be extracted by other forms of questionnaires.

Figure A7.1 Extract of questionnaire

No.	Code	Product description	Sales of goods produced by the enterprise (group of accounts 61)	Closing stock of products and work in progress (groups of accounts 10 and 11)	Sales of merchandise (group of account 60)	Trade margin amount or rate %	Closing stocks of goods for resale (group of accounts 13
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1072	14.3	Outerwear, knitted or crocheted; socks, sweaters, vest					
1073	15.1	Tanned or dressed leather; luggage, handbags, saddlery and harness; dressed and dyed fur					
1074	15.2	Footwear					
		Wood and products of wood and cork, articles of straw and plaiting					
1075	16.1	Cut and treated wood for further processing					
1076	16.2	Wood and products of wood and cork, except furniture (see 1147); articles of straw and plainting					
		Paper and paper products					
1077	17.1	Pulp, paper and cardboard for further industrial processing and printing					
1078	17.2	Articles of paper and paperboard for industrial use - boxes, containers and packing material					
1079	17.2	Articles of paper and paperboard for personal use -paper towels, napkins, toilet paper, cleaning items and deletion of the pulp and paper					
1080	17.2	Paper stationary and articles of paper and paperboards (notebooks, binders, forms etc..)					
		Coke and refined petroleum products - manufacturing (columns 4-5; trade and wholesale (columns 6-8)					

Source: Structure of income and expenditure of economic subjects in the republic of Serbia 2011. Statistical office of the Republic of Serbia, 2013. http://webrzs.stat.gov.rs/WebSite/Public/PageView.aspx?pKey=63

(Data were collected for about 250 goods and 50 services according to the Classification of Products by Activity (CPA) used in the EU, varying from 2 to 4 digit groups. The CPA is consistent with the CPC. The same questionnaire was used for all non-financial market enterprises).

A7.2 The objective of the calculation is to populate Table A7.1 with available data in order to obtain the trade margin matrices. If the available data sources are less complete, the results are of course more dependent on the assumptions used to populate the trade margin columns (in the Supply Table) and the trade margin matrices (underpinning the Use Table). Irrespective of the coverage or quality of source data on trade and trade margins, it is important to generate Table A7.1.

A7.3 The data collected from the above questionnaire covers:

- For all economic activities, trade turnover and either purchase of goods for resale or trade margins (either absolute or as a percentage of either purchasing or selling price) by type of product.
- The product specification is at least as detailed as the product classification applied in the SUTs, and is either using the same classification or a version that is easily transformed into the SUTs product classification.
- For each product, data are sought on either opening or closing stocks of merchandise to facilitate the calculation of changes in inventories of merchandise needed in case the total trade margin is derived from the difference between sales and purchases.
- Surveys usually include total coverage for enterprises above a certain threshold (based on either turnover or employment) and samples for the smaller enterprises. It is assumed that the survey results have been grossed up to cover the whole population.

Based on this information it is possible to compile Table A7.1.

A7.4 As shown in Table A7.1, the vast majority of trade turnover and output of trade margins (trade services) originates from the three trade activities (ISIC Rev. 4 Divisions 45-47) whereas many other industries generate relative small amounts of trade output as their secondary production. In Table A7.1 estimates of grossed up trade turnover and trade margins are both shown as this information is needed later in the compilation process.

Table A7.1 Trade data from survey: Trade margins identified separately for wholesale and retail trade margins

	Ec. Activity 1		Ec. Activity 2		. . .	Trade 45		Trade 46		Trade 47		. . .	Ec. Activity n		SUM: All W		SUM: All R	
	Trade turn-over	Trade margin	Trade turn-over	Trade margin	. . .	Trade turn-over	Trade margin	Trade turn-over	Trade margin	Trade turn-over	Trade margin	. . .	Trade turn-over	Trade margin	Trade turn-over	Trade margin	Trade turn-over	Trade margin
	Indicate W or R		Indicate W or R		. . .	Indicate W or R		Wholesale (W)		Retail [R]		. . .	Indicate W or R		W		R	
Product: CPC																		
1	10	1	15	2		0	0	750	90	950	230		10	3	800	100	1 000	250
2	0	0	10	4		0	0	1 000	100	700	300		20	8	1 100	100	800	400
:																		
m																		
Total W		5		200			1 000		9 000		0			0		11 000		
Total R		0		50			2 000		0		13 000			25				17 000

A7.5 At this stage, it is important to introduce the **distinction between wholesale and retail trade margins**. In this example, it is assumed that this distinction is not made directly in the survey results (although it can be established from survey returns). It is therefore necessary to make decisions on the type of margin associated with the various combinations of producing economic activities and products.

A7.6 Firstly, it can be reasonably assumed that ISIC Rev. 4 Division 46, wholesale, produces mainly wholesale trade margins, and similarly that ISIC Rev. 4 Division 47, retail trade, produces mainly retail margins, whereas ISIC Rev. 4 Division 45 produces a mix of margins, which must be decided based on the individual products.

A7.7 For trade carried out as secondary activity, it can be assumed, for example, that trade turnover of restaurants and hotels is probably retail trade turnover, the same with trade turnover of suppliers like hairdressers, cinemas and theatres. On the other hand, trade activities of advertising agents are more likely to be wholesale trade. Manufacturing industries are often trade in products similar to those they produce or in complementary products and the majority of such trade sales are usually of the wholesale type, although some may be sold direct to consumers. These industries may also be trading in similar imported goods and such trade is again likely to be classified as wholesale trade.

A7.8 There will be some products where a trade margin may not be applicable and there may be additional survey detail collected enabling the specific nature of these decisions to be improved.

A7.9 Once these decisions have been made, the row and column totals for wholesale margins and retail trade margins can be calculated, and for the row totals also the turnover by product broken down by wholesale and retail turnover. Table A7.1 illustrates how the results of these decisions are fitted into the system. It should also be noted that at this stage only absolute and not percentage margins are being processed.

A7.10 As explained in Chapter 7, the source data for trade activity and trade margins may in practice be available in alternative ways and with a varying degree of detail. Therefore different assumptions may be needed to establish the dataset shown in Table A7.1 which is essential for deriving the trade margins needed in both the Supply Table and the Use Table.

The Supply Table

A7.11 The trade activity and the trade margin entries needed in the Supply Table consist of rows for output of margin activities by economic activity in the "domestic output at basic prices" part of the Supply Table, and of the columns for trade margins needed to transform the values by product from basic prices to purchasers' prices.

A7.12 It will become clearer throughout this process, and beyond, that it is essential to retain the distinction between wholesale trade margins and retail trade margins derived in connection with TableA7.1.

A7.13 Table A7.1 resembles the format (product by industry) of the Supply Table. All necessary information on the output of trade services and trade margins from Table A7.1 can be transferred in Table A7.2.

A7.14 As explained in Chapter 5, many countries may choose to "redefine" secondary output of trade services in the Supply Table so that secondary output is classified together with the output of the primary producers. Such a redefinition would imply that there will be trade activity and output of trade margins services only from ISIC Rev. 4 Divisions 45-47. In this example it is assumed that redefinition has taken place. This simplifies all the calculations in this example and facilitates the estimation of the input structures and the calculations of IOTs. However, the basic methodology outlines in this Annex will not be affected.

A7.15 It should be noted that the output of trade products may also contain some non-margin items (for example, commissions, fees, margins on second-hand sales, etc.) so that total supply from trade may still be positive after deduction of trade margins in the trade margin columns – this reflects actual output produced.

Table A7.2 Supply Table

		Ec. Activity 1	Ec. Activity 2	. . .	Trade 45	Trade 46	Trade 47	. . .	Ec. Activity n	Output at basic prices	Imports	Supply at basic prices	Wholesale trade margins	Retail trade margins	VAT	Taxes on products	Subsidies on products	Supply at purchasers' price
PRODUCTS	1											1 000	100	250	150	20		1 520
	2											2 000	100	400	200		- 10	2 690
	:																	
	Wholesale	5	200		1 000	9 000			0	11 000			- 11 000					0
	Retail	0	50		2 000		13 000		25	17 000				- 17 000				0
	:																	
	m																	
	Total												0	0				

A7.16 Before compiling the trade margin matrices associated with the Use Table, it is useful to derive a number of memo proportions from Table A7.1 and Table A7.2, which are shown in Table A7.3.

Table A7.3 MEMO table: Distribution channels and percentage trade margins

		Total supply at purchasers' prices made comparable to trade survey turnover (from **Table A7.2**)		Survey turnover, Grossed up (from **Table A7.1**)		Average percentage of supply passing through W and R trade channels		Absolute trade margins (from **Table A7.1**)		Average percentage trade margin for **traded goods** out of comparable prices	
		Basic value plus wholesale margins	Basic value plus wholesale and retail margins	Trade turnover Whole-sale	Trade turnover Retail	Whole-sale	Retail	Whole-sale	Retail	Whole-sale	Retail
PRODUCTS	1	1 100	1 350	800	1 000	72.7	74.1	100	250	12.5	25.0
	2	2 100	2 500	1 100	800	52.4	32.0	100	400	9.1	50.0
	:										
	Wholesale										
	Retail										
	:										
	m										
	Total										

A7.17 The question of trade channels (i.e. how big a share of the supply of a given product passes through the wholesale and/or retail channels) is central when compiling the Use Table trade margin matrices as shown in Figure 7.2. Fortunately there is enough combined information in Table A7.1 and Table A7.2 to address this issue.

A7.18 To calculate these shares, the total supply in the Supply Table must be made comparable to the turnover concept used for the survey data (assumed to be turnover exclusive of VAT and net of taxes on products). The Supply Table value concept comparable for the wholesale trade turnover is basic value plus wholesale trade margin (1100 for product 1). For retail trade turnover, the comparable concept is basic value plus both wholesale and retail trade margins (1350 for product 1).

A7.19 The average percentages of supply passing through each of wholesale and retail trade channels can now be calculated as shown in Table A7.3. For product 1, the shares are 72.7 (800/1100) and 74.1 (1000/1350) respectively. It is further possible to calculate the average percentage trade margin for actual traded goods out of comparable purchasers' prices. For product 1, the percentage trade margins are 12.5 (100/800) and 25.0 (250/1000) respectively.

A7.20 It should be noted, that the percentage trade margins are calculated as percentage of sales prices, as required for the estimates in the Use Table (and not the usually applied survey percentages out of the traders buying price). It should be noted that the VAT column does not need to be completed to calculate these memo items.

The Use Table

A7.21 The Use Table is initially valued at purchasers' prices and this table is the starting point for determining the valuation matrices that will permit the gradual transition of the Use Table from purchasers' prices to basic prices.

A7.22 The first step is to estimate the VAT matrix, and subsequently deduct it from the Use Table at purchasers' prices. In the next step, the matrix for other taxes on products must be determined and deducted, and the matrix for subsidies on products determined and added.

A7.23 The elements in the "residual" Supply Table resulting from these procedures will consist of only basic values and trade margins as illustrated in Table A7.4, and the task is now to separate each element into its basic value and the possible wholesale and retail trade margins. In order to illustrate the restrictions and sum conditions, it is assumed that only those economic activities specified (1, 2 and n) have intermediate consumption.

Table A7.4 The Use Table after removal of net taxes on products

		Econ. Activity 1	Econ. Activity 2	. . .	Econ. Activity n	Total intermediate consumption	Final consumption expenditure of households	Final consumption expenditure of general government	Gross fixed capital formation	Changes in inventories	Exports	Total use at purchasers' prices
PRODUCTS	1	100	50		150	300	700	50	150	50	100	1 350
	2											
	:											
	Wholesale											
	Retail											
	:											
	m											
	Total											

A7.24 The Product by Product procedure utilises the information in Table A7.3 as illustrated in Table A7.5, Table A7.6 and Table A7.7. If a product passes through both a wholesale channel and a retail channel, the retail trade margin comes on the top of the wholesale trade margin, corresponding to the trade margin percentages calculated in Table A7.3. Therefore, first the retail trade margins must be estimated and then the wholesale trade margins.

Table A7.5 Product 1: Retail margins

	Econ. Activity 1	Econ. Activity 2	. . .	Econ. Activity n	Total intermediate consumption	Final consumption expenditure of households	Final consumption expenditure of general government	Gross fixed capital formation	Changes in inventories	Exports	Total use at purchasers' prices
1. Starting row (from **Table A7.4**)	100	50		150	300	700	50	150	50	100	1 350
2. Selected values with retail margin	50			150	200	700		100			1 000
3. Retail margin distributed	13	0		38	50	175	0	25	0	0	250
4. Average percentage retail margin	12.5			25.0		25.0	0.0	16.7	0.0	0.0	18.5

A7.25 The estimates of the retail trade margins are illustrated for product 1 in Table A7.5. From Table A7.3, it is known that 1,000 of the 1,350 passes through the retail trade, and the total retail trade margin on this product is 250. The knowledge of these totals provides a good starting position but it is still not known to which of the individual uses (or part thereof) the retail turnover is linked, and therefore it is necessary to decide (make assumptions on) on the figures to be entered in Row (2) - based on which specific knowledge may be at hand, and on common sense, to comply with the restriction that their sum must be 1000. For example, final consumption expenditure of households is usually assumed to include a high share of the “available” retail trade margins, whereas intermediate consumption and Gross capital formation may have very little retail margin, and exports none at all, as non-resident expenditure is a summary adjustment item, and the related margins will be included in the domestic consumption concept.

A7.26 When Row (2) in Table A7.5 has been determined, the distribution of the retail trade margin can be determined either by distributing the 250 proportionally to the values in Row (2), or by applying the percentage retail trade margin of 25 per cent from Table A7.3 to the values in Row (2). In Row (3), the effective percentage retail trade margins relative to the elements of the Use Table are calculated. These are the percentages that will be used to recalculate the retail trade margin table after changes made to the original data during the balancing.

Table A7.6 Product 1: Wholesale margins

	Econ. Activity 1	Econ. Activity 2	. . .	Econ. Activity n	Total intermediate consumption	Final consumption expenditure of households	Final consumption expenditure of general government	Gross fixed capital formation	Changes in inventories	Exports	Total use at purchasers' prices
1. **Table A7.4** Row (1) minus Row (3)	87.5	50.0		112.5	250.0	525.0	50.0	125.0	50.0	100.0	1 100.0
2. Values with wholesale margin	50.0			100.0	150.0	500.0		100.0		50.0	800.0
3. Wholesale margin distributed	6.3	0.0		12.5	18.8	62.5	0.0	12.5	0.0	6.3	100.0
4. Average percentage wholesale margin	7.1	0.0		11.1		11.9	0.0	10.0	0.0	6.3	9.1

A7.27 A similar procedure is used to determine the distribution of wholesale trade margins in Table A7.6. The first row in this table is the first row in Table A7.5 minus the estimated retail trade margins. When the estimated wholesale trade margins are deducted from Row (1) in Table A7.6, the row at basic prices in Table A7.7 below is obtained, and thus the desired Use Table at basis prices has been derived. Note, in the Use Table at basic prices, the rows for wholesale and retail “products” will be made up of the column totals of the two trade margin matrices, and in addition, they will include any non-margin trade output.

Table A7.7 Product 1: Row in Use Table at basic prices

	Econ. Activity 1	Econ. Activity 2	. . .	Econ. Activity n	Total intermediate consumption	Final consumption expenditure of households	Final consumption expenditure of general government	Gross fixed capital formation	Changes in inventories	Exports	Total use at purchasers' prices
Product 1 at basic prices	81.3	50.0		100.0	231.3	462.5	50.0	112.5	50.0	93.8	1 000.0

A7.28 Following the outline of these procedures, it is clear why it is essential to distinguish between wholesale and retail trade margins. If this is not done, in practice it will not be possible to manage the problem of successive trade channels. Thus the cumulative trade margin on household consumption of (175+62.5)/463 = 51 per cent out of the basic value total could not have been derived directly from the survey results if just aggregated.

Chapter 8. Compiling the Imports Use Table and Domestic Use Table

A. Introduction

8.1. This Chapter describes the disaggregation of the Use Table into the Imports Use Table and the Domestic Use Table. The first table, the Imports Use Table, contains information on the use, in the national economy, of imported products (by product) for intermediate consumption and final uses. The second table, the Domestic Use Table, provides information on the use of domestically produced products (by product) for intermediate consumption and final use. The compilation of these two tables mainly consists in the estimation of the Imports Use Table since the Domestic Use Table is obtained by subtracting the Imports Use Table from the Use Table. This Chapter therefore focuses mainly on the compilation of the Imports Use Table.

8.2. The compilation of an Imports Use Table is embedded in the System of National Accounts and it is important to balance supply and use of products for the domestic economy, to accurately deflate components of GDP by linking imported intermediate products with appropriate import price deflators, and to ascertain the correct distribution of the changes in the volume of GVA by industry and industry contributions of GDP growth.

8.3. Historically the compilation of the Imports Use Table was mainly considered as an intermediate step towards the compilation of IOTs (though not an essential step). However the Imports Use Table is becoming increasingly important in its own right for analytical purposes. With the globalization of economic activities, exports and imports are growing more rapidly than GDP and the GVA chains in production are becoming more complex and more international. Therefore, it is very important for the National Accounts to provide sectored disaggregation of macroeconomic data for both domestic production and imports.

8.4. Over time, many domestic economies have seen significant changes in the import share of domestic supply that can be attributed to changes in international trade, and in particular, trade in goods for processing and other intermediate materials inputs. In addition, many multi-national enterprises, and previously large domestic businesses, have shifted their production processes around the world, utilising lower costs of production and thereby increasing their competitiveness and profitability.

8.5. The set of SUTs at basic prices - both in current prices and in volume terms - that should be compiled includes the following tables:

- Supply and Use Table at basic prices;
- Domestic Use Table at basic prices; and
- Imports Use Table at basic prices.

8.6. Since direct information for compiling the Use Table for imported products is generally rare and available only in exceptional cases, the recommendation is to work on a highly detailed level of product group (implying rectangular SUTs with a detailed product specification). A detailed level helps identify the likely users of a specific imported product.

8.7. Chapter 5 provides a detailed description of the concepts and definition of imports of goods and services, where emphasis is placed on the imports by products as part of total supply of products. In the Supply Table, imports are only shown as a vector of products covering goods and services. However, in practice, it may be desirable to sub-divide the import vector by regions to separately identify imports within and outside of particular regions. Furthermore, the import vector could show separate columns, for example showing goods and services separately. Further elaborations that are very useful for the analysis of GVCs and globalization: splitting residents expenditure abroad into individual products; separately identifying the transportation and insurance margins included in CIF estimates of goods; and separately identifying imports of manufacturing services provided under goods for processing arrangements (with ideally complementary information showing the underlying value of goods processed).

8.8. This Chapter focuses on the compilation of the Imports Use Table. In particular, Section B describes the structure of the Imports Use Table, provides a numerical example and describes how to obtain the Domestic Use Table. Section C focuses on the compilation of the Imports Use Table and potential issues that arise during the compilation process.

B. Structure of the Imports Use Table and Domestic Use Table

8.9. Imports consist of purchases of goods and services by residents from non-resident producers/suppliers. In the SNA, total imports are valued FOB. However, data on detailed flows of imports by product from foreign trade statistics are usually valued on a CIF basis. To reconcile the different valuations used for total imports and the product components of imports, a global CIF/FOB adjustment on imports is required, and it needs to be allocated by the type of goods involved. More details on the CIF/FOB adjustment are covered in Chapter 5.

8.10. The supply of imports shown in the Supply Table has to be allocated in the Imports Use Table to the different use categories of intermediate uses and final uses. The general structure of the Imports Use Table is shown in Table 8.1. The Table shows the total use of imported products, goods and services, by products and by industries and by final use categories. In the columns, the table has the same format as the use table. It distinguishes two main sub-matrices, one for the intermediate use and one for the final uses of products. The total use of imports must be equal to the total supply of imports of the Supply Table. This equality is given for each of the products distinguished in the SUTs. Table 8.2 shows a numerical example of the Imports Use Table as part of the SUTs system.

Table 8.1 Structure of the Imports Use Table

<table>
<tr><th rowspan="2">Industries
Products</th><th colspan="5">Industries</th><th colspan="4">Final uses</th><th rowspan="2">Total use at basic prices</th></tr>
<tr><th>Agriculture</th><th>Manufacturing</th><th>…</th><th>Services</th><th>Total</th><th>Final Consumption</th><th>Gross capital formation</th><th>Exports</th><th>Total</th></tr>
<tr><td>Agriculture
Manufacturing
…
…
Other Services</td><td colspan="4">Imported products for intermediate consumption at CIF values</td><td>Total imported products for intermediate consumption</td><td colspan="3">Imported products for final uses at CIF values</td><td>Total imported products for final uses</td><td>Imported total use</td></tr>
<tr><td>Total</td><td colspan="5">Intermediate consumption by Industry</td><td colspan="4">Total final uses by category</td><td></td></tr>
</table>

Table 8.2 Numerical example of the Imports Use Table

Million euro

		INDUSTRIES							FINAL USE								
		Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at basic prices
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture (1)	191	1 680	5	170	14	17	2 077	1 079			47		9	58	1 194	3 271
	Manufacturing (2)	706	55 898	4 365	5 621	1 126	2 985	70 702	20 894		1 422	12 310	807	1 344	17 112	53 888	124 590
	Construction (3)		255	197	68	38	5	563									563
	Trade (4)		257	0	274	30	39	600									600
	Transport (5)	10	1 300	95	2 181	265	75	3 926	139		9	59	1	6	4 011	4 223	8 150
	Communication (6)	4	860	65	2 449	1 267	248	4 893	447		17	686		22	169	1 342	6 234
	Finance and business service (7)	8	1 786	106	1 566	2 654	322	6 443	145			473				618	7 061
	Other services (8)		14	1	110	23	127	275	384		47		118			549	824
	Total (9)	919	62 051	4 834	12 439	5 417	3 819	89 479	23 087	0	1 495	13 575	926	1 381	21 350	61 814	151 293

Austria 2011

8.11. Once the Imports Use Table is compiled, the Domestic Use Table is obtained by deducting the Imports Use Table from the Use Table. As shown in Table 8.3, the structure and size of the Domestic Use Table is the same as the Use Table except there is an additional row in the primary inputs section to reflect the sum of the columns in the Imports Use Table. The body of the Domestic Use Table does not include direct or indirect imports of goods and services. Some countries compile and reconcile both the Imports Use Table and Domestic Use Table concurrently, instead of compiling the Use Table first, and then compiling the Imports Use Table and Domestic Use Table. For example, where there may be very good quality data on both imports and domestic use, separately available.

8.12. Table 8.4 provides a numerical example of the Domestic Use Table.

Table 8.3 Structure of the Domestic Use Table

Industries / Products	Industries					Final uses				Total use at basic prices
	Agriculture	Manufacturing	…	Services	Total	Final Consumption	Gross capital formation	Exports	Total	
Agriculture Manufacturing … Other Services	Domestic products for intermediate consumption at basic prices					Domestic products for final uses at basic prices				Total use by product
Total at basic prices	Domestic intermediate inputs at basic prices					Final uses at basic prices				
Use of Imported products, CIF	Total imported products for intermediate consumption					Total imported products for final uses				
Taxes less subsidies on products	Net taxes on products for intemediate consumption					Net taxes on products for final use				
Adjustments						Adjustments on final uses				
Total at purchasers' prices	Intermediate inputs at purchasers' prices					Final uses at purchasers' prices				
Compensation of employees Other net taxes on production Consumption of fixed capital Net operating surplus/net mixed income	Value added by component and by industry									
Value added at basic prices	Total value added by industry									
Total Inputs at basic prices	Total input by industry									

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Table 8.4 Numerical example of a Domestic Use Table

Million euro

			INDUSTIES							FINAL USE								
										Final consumption expenditure								
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at basic prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 354	4 284	8	117	15	21	6 800	963			123		- 42	938	1 982	8 782
	Manufacturing	(2)	1 216	42 772	6 256	7 776	4 085	3 123	65 227	12 631		327	9 426	1 122	1 393	96 280	121 178	186 405
	Construction	(3)	105	2 184	9 321	2 373	3 625	1 414	19 021	1 402			24 323		- 38	563	26 250	45 272
	Trade	(4)	245	8 601	1 560	4 370	682	1 462	16 919	27 684		1 080	4 008	238	273	9 985	43 267	60 187
	Transport	(5)	31	4 424	364	6 368	575	301	12 063	5 828		3 418	87	2	21	4 916	14 271	26 335
	Communication	(6)	29	1 651	226	6 745	4 295	1 343	14 289	22 088		51	5 111		40	6 649	33 940	48 228
	Finance and business services	(7)	439	11 706	4 611	18 623	25 779	8 062	69 219	36 524		1 006	9 781	0	- 177	11 156	58 289	127 508
	Other services	(8)	8	367	58	1 060	375	1 622	3 490	13 045	5 416	53 116	113	- 105	1	567	72 153	75 643
	Total at basic prices	(9)	4 429	75 987	22 402	47 431	39 431	17 348	207 028	120 165	5 416	58 997	52 973	1 257	1 471	131 053	371 332	578 360
	Imports	(10)	919	62 051	4 834	12 439	5 417	3 819	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293
	Taxes less subsidies on products	(11)	92	952	229	1 349	1 689	2 672	6 984	22 810		557	2 870	152	7	397	26 794	33 778
Adjustments	Total at purchasers' prices	(12)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
	CIF/FOB adjustments on exports	(13)														- 97	- 97	- 97
	Direct purchases abroad by residents	(14)								6 675							6 675	6 675
	Purchases on the domestic territory by non-residents	(15)								- 12 945						12 945		
	Total at purchasers' prices	(16)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	466 517	770 009
GVA	Compensation of employees	(17)	551	30 679	10 239	37 906	22 997	41 971	144 343									
	Other taxes less subsidies on production	(18)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
	Consumption of fixed capital	(19)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
	Net operating surplus/net mixed income	(20)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
	Gross operating surplus/gross mixed income	(21)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
	GVA	(22)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Total input at basic prices	(23)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

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(a) Input Table for Imports

8.13. Table 8.5 shows a numerical example of an input table for imports of goods and services at basic prices. This table is either a Product by Product Table or Industry by Industry Table but is not an IOT as imports form an input, and not an output.

8.14. It should be noted, that the sub-matrices for final uses and the row totals for products are the same in the Imports Use Table and the IOT table of imports. An Input Table for Imports, as mentioned, can also be a step in order to compile IOTs but not a necessary step. This is covered in more detail in Chapter 12 (Box 12.3) on the transformation of SUTs into IOTs, where the "transformed" Imports Use Table can be applied in two different ways.

8.15. The only difference from the Imports Use Table in Table 8.2 is that Table 8.5 shows the intermediate use of the imports in a Product by Product format (or could be an Industry by Industry format). The final use part is unchanged. Chapter 12 provides more details on how the Imports Use Table, and in turn the Input Table for Imports, can be used to produce IOTs, where for imports of goods and services, this is only an input table.

Table 8.5 Example of an Input Table for Imports at basic prices

Million euro

		PRODUCTS							FINAL USE								
									Final consumption expenditure								
		Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at basic prices
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture (1)	176	1 722	3	148	14	15	2 077	1 079			47		9	58	1 194	3 271
	Manufacturing (2)	618	55 846	4 392	5 506	1 398	2 941	70 702	20 894		1 422	12 310	807	1 344	17 112	53 888	124 590
	Construction (3)		265	204	47	44	4	563									563
	Trade, transport and communication (4)	9	2 095	150	5 150	1 678	337	9 419	586		26	745	1	28	4 179	5 565	14 984
	Finance and business services (5)	7	1 531	97	1 527	2 974	308	6 443	145			473				618	7 061
	Other services (6)		10	0	108	29	127	275	384		47		118			549	824
	Total (7)	811	61 469	4 846	12 485	6 136	3 731	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293

Austria 2011

(b) Input-Output Table for domestic output at basic prices

8.16. If the Imports Use Table is subtracted from the Use Table at purchasers' prices, the corresponding Domestic Use Table can be derived which shows only consumption of domestic produced output. However, a further step is to subtract and reallocate the trade and transport margins and to deduct the taxes less subsidies on products in order to achieve the SUTs at basic prices.

8.17. Table 8.6 shows the IOT for domestic output and is the basis for I-O analyses. It should be noted that in this table the use of imported goods and services is only shown in an aggregated form in one row. More detail on the transformation of SUTs into IOTs is covered in Chapter 12.

Table 8.6 Input-output table for domestic output at basic prices

Million euro

		PRODUCTS							FINAL USE								
									Final consumption expenditure								
		Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Output at basic prices
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture (1)	2 316	4 344	4	101	15	19	6 800	963			123		- 42	938	1 982	8 782
	Manufacturing (2)	1 091	42 919	6 362	7 534	4 369	2 951	65 227	12 631		327	9 426	1 122	1 393	96 280	121 178	186 405
	Construction (3)	73	1 883	9 927	1 969	3 890	1 279	19 021	1 402			24 323		- 38	563	26 250	45 272
	Trade, transport and communication (4)	239	13 805	2 109	18 364	5 909	2 846	43 272	55 600		4 549	9 207	239	334	21 550	91 479	134 750
	Finance and business services (5)	370	9 320	4 530	17 653	29 781	7 564	69 219	36 524		1 006	9 781	0	- 177	11 156	58 289	127 508
	Other services (6)	6	286	51	1 066	453	1 629	3 490	13 045	5 416	53 116	113	- 105	1	567	72 153	75 643
	Total (7)	4 094	72 557	22 984	46 687	44 418	16 288	207 028	120 165	5 416	58 997	52 973	1 257	1 471	131 053	371 332	578 360
	Imports (8)	811	61 469	4 846	12 485	6 136	3 731	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293
	Taxes less subsidies on products (9)	78	862	226	1 333	1 839	2 646	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices (10)	4 983	134 889	28 056	60 506	52 393	22 665	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
GVA	Compensation of employees (11)	411	25 857	10 216	38 422	28 962	40 475	144 343									
	Other taxes less subsidies on produ (12)	- 1 446	717	545	1 762	2 267	1 014	4 858									
	Consumption of fixed capital (13)	1 620	11 519	1 422	10 172	21 759	6 977	53 469									
	Net operating surplus/net mixed income (14)	3 214	13 423	5 032	23 889	22 127	4 512	72 198									
	Gross operating surplus/gross mixed income (15)	4 834	24 942	6 455	34 061	43 886	11 489	125 667									
	GVA (16)	3 799	51 516	17 216	74 245	75 115	52 978	274 868									
	Total input at basic prices (17)	8 782	186 405	45 272	134 750	127 508	75 643	578 360									

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8.18. It should be noted that Table 8.6 do not contain any of the adjustment rows shown in Table 8.4. The adjustment items being:

- CIF/FOB adjustments on exports (recorded as part of imports);
- Direct purchases abroad by residents (recorded as part of exports); and
- Purchases on the domestic territory by non-residents (recorded as part of exports).

8.19. In this form, i.e. Table 8.6, the IOTs always show the correct GDP, however, the totals for HHFCe, exports and imports in the IOTs differ from the totals in the SUTs. Given that all the omitted adjustments items relate to final uses, GDP calculated from the expenditure side (308,647) is still correct and identical to the results shown in connection with Box 2.10. It is always possible to include the corresponding adjustments items in the final IOTs to arrive at the correct totals for HHFCe, exports and imports as illustrated in Table 8.7, which is consistent with Table 8.2, Table 8.4 and Table 8.6.

8.20. Ideally, the adjustment items should be included in the IOTs for reasons of consistency with the National Accounts framework, the SUTs, and for complete coverage of the economy in analytical uses, as illustrated by Table 8.7 (which also shows a net export presentation to help illustrate the point - this presentation is covered in more detail in Chapter 12). However, different practices regarding these adjustment items have developed across countries and international organizations. Thus the Austrian IOTs shown here replicate the tables contained in the Eurostat database. On the other hand, the IOTs in the OECD I-O Database include all adjustment items to be fully consistent with National Accounts data.

8.21. Whereas the problem of how to deal with the adjustment items necessarily arises when compiling empirical IOTs adjustment rows. For the ease of exposition and not to overload the presentation of the SUTs and IOTs, these additional rows are not included in the numerical examples in this Handbook. Their absence does not imply that they have been distributed by products and thus included in the “upper” part of the SUTs and IOTs, which for example, some analytical users of IOTs would sometimes prefer.

Table 8.7 Input-output table for domestic output at basic prices, net exports with adjustment items

Million euro

			INDUSTRIES							FINAL USE										
			Agricul-ture	Manu-facturing	Construc-tion	Trade, transport and commu-nication	Finance and busi-ness services	Other services	Total	Total consumption expenditure: House-holds	NPISH	General govern-ment	Gross fixed capital formation	Changes in valu-ables	Changes in inven-tories	Exports	Less imports	Total	Total output at basic prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
PRODUCTS	Agriculture	(1)	2 492	6 065	8	248	29	34	8 877	2 042			170		- 32	996	- 3 271	- 95	8 782
	Manufacturing	(2)	1 708	98 765	10 754	13 040	5 768	5 893	135 928	33 525		1 749	21 736	1 929	2 737	113 392	- 124 590	50 477	186 405
	Construction	(3)	73	2 148	10 131	2 016	3 934	1 282	19 585	1 402			24 323		- 38	563	- 563	25 687	45 272
	Trade, transport and communication	(4)	248	15 900	2 258	23 514	7 586	3 183	52 690	56 185		4 575	9 951	240	363	25 729	- 14 984	82 060	134 750
	Finance and business services	(5)	377	10 851	4 627	19 180	32 755	7 872	75 662	36 669		1 006	10 254		- 177	11 156	- 7 061	51 846	127 508
	Other services	(6)	6	297	51	1 174	482	1 756	3 765	13 429	5 416	53 163	113	14	1	567	- 824	71 878	75 643
	Total at basic prices	(7)	4 905	134 027	27 830	59 173	50 554	20 019	296 507	143 252	5 416	60 492	66 548	2 182	2 852	152 403	- 151 293	281 852	578 360
	Taxes less subsidies on products	(8)	78	862	226	1 333	1 839	2 646	6 984	22 810		557	2 870	152	7	397		26 794	33 778
	Total at purchasers' prices	(9)	4 983	134 889	28 056	60 506	52 393	22 665	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	- 151 293	308 647	612 138
ADJUSTMENTS	CIF/FOB adjustments	(10)														- 97	97		
	Direct purchases abroad by residents	(11)								6 675							- 6 675		
	Purchases on the domestic territory by non-residents	(12)								- 12 945						12 945			
	Total	(13)	4 983	134 889	28 056	60 506	52 393	22 665	303 492	159 792	5 416	61 050	69 418	2 335	2 859	165 648	- 157 871	308 647	612 138
VALUE ADDED	Compensation of employees	(14)	411	25 857	10 216	38 422	28 962	40 475	144 343										
	Other taxes on production	(15)	- 1 446	717	545	1 762	2 267	1 014	4 858										
	Consumption of fixed capital	(16)	1 620	11 519	1 422	10 172	21 759	6 977	53 469										
	Net operating surplus	(17)	3 214	13 423	5 032	23 889	22 127	4 512	72 198										
	Gross operating surplus	(18)	4 834	24 942	6 455	34 061	43 886	11 489	125 667										
	GVA	(19)	3 799	51 516	17 216	74 245	75 115	52 978	274 868										
	Total input at basic prices	(20)	8 782	186 405	45 272	134 750	127 508	75 643	578 360										

C. Compilation of the Imports Use Table

8.22. The compilation of the Imports Use Table may be challenging because direct information for the estimates of imported products by industry and by final use may not be available or only available in limited cases. As a result, direct information has to be supplemented by reasonable assumptions and indirect techniques. As noted earlier, in a large rectangular SUTs system many homogenous products can be identified which have to be imported from abroad. Thus, the allocation of goods and services in the use table for domestic output and the use table for imports is easier if a large rectangular SUTs system is available. The two main approaches to the compilation of Imports Use tables are presented below: the first is based on the availability of directly collected data and the second on assumption on the imports.

1. Using directly collected data

8.23. There are two major sources for direct information for the Imports Use Table:

- Business surveys which could be developed further, for example, for each industry, more product detail of imports of goods and services by type of product as well more information on imports of services.
- Trade surveys which provide extensive details of imports of goods. Traditionally the Customs Department collects foreign trade statistics.

8.24. The micro-data linking of units' data from trade and business registers provides another source also ensuring some degree of coherence between the two sources.

8.25. Business surveys (annual or for benchmarked years) generally collect details such as sales by type of product and purchases by type of product. These surveys could be expanded to include additional questions useful for the Imports Use Table, such as the value of purchases of imports of goods and the value of purchases of imports of services.

8.26. For certain industries, it is important to ask specific questions on imports of goods and services for some specific products. For example, for the sugar refining industry it may be important to have information on the purchases of sugar beet separate from sugar cane. The economy may not have any, or little, domestic production of one or both of these products and would have to rely on imports, which at the 2-digit level would appear in the same product classification. This approach of asking for specific details may apply also to other products such as, for example, tobacco and tobacco leaf.

8.27. This use of the business survey data would help to provide an industry total of direct imports. These values could then be developed and matched with imports of goods from the trade data suppliers by product to help develop the body of the Imports Use Table in terms of intermediate use. This works for direct imports but less so for indirect imports, such as imports sold to manufacturers via resident distributors such as wholesalers. However, imports by retailers could be assumed in the main for final use categories. Again, this would need scrutiny, for example small items (not purchased in bulk) like stationary, may be purchased by businesses from retailers. For imports of services, indirect imports should not be an issue because by their nature services cannot be resold, i.e. they are used only once.

8.28. International trade surveys provide a lot of the detail by product. However, further work is often required to identify the importing industry or industries. For imports of goods, for example, very detailed international trade data from the HS can be more easily used to link imports to specific products that are used by industries as intermediate consumption and those products that are components of specific categories of final use. These data could be developed with the data collectors to identify the industry to which the importer is classified and the value of imports by product.

8.29. In terms of imports of services - a product by industry matrix should be generated for each of the 12 components forming trade in services (applicable to both imports and exports), see Box 8.1, which would also highlight various improvements required to imports of services in the balance of payments. For business services, a separate matrix can be generated using imports of services data from business surveys providing details for other variables such as sales and purchases.

8.30. There are various existing sources of data used for imports of services by product, examples include:

- International trade in services – which collects data from businesses covering their imports and exports of services by product. This is a statistical survey which has advantages over administrative data.
- International passenger survey – which collects expenditure data by product by travellers, at the point of entering or exiting the resident economy (for example, airports and ports). There is a need to separate the expenditure by business travellers (recorded as intermediate consumption) and expenditure by households (recorded as Households final consumption expenditures).
- Specific sources capturing imports of services such as shipping, air transport, financial services, etc.
- Development of non-traditional survey-type sources such as credit card data and international micro-data sharing, for example between NSOs.

8.31. However, for some of the standard services components, there are specific issues which need careful handling, for example, disbursements, freight costs, royalties, etc.

Box 8.1 Standard services components of BPM 6

1	Manufacturing services on physical inputs owned by others.
2	Maintenance and repair services not included elsewhere (n.i.e.).
3	Transport.
4	Travel.
5	Construction.
6	Insurance and pension services.
7	Financial services.
8	Charges for the use of intellectual property not included elsewhere (n.i.e.).
9	Telecommunications, computer, and information services.
10	Other business services.
11	Personal, cultural, and recreational services.
12	Government goods and services n.i.e.

Source: United Nations *et al.* (2010)

2. An alternative approach

8.32. As noted, there may be a lack of source data (unless surveys are designed to collect detail data and flows from the trade industry) to estimate "indirect" import use, that is the ultimate destination of the use of imported goods, and not say, the wholesaler acting as an intermediary. This situation will often require strong assumptions and indirect techniques to allocate the use of imports by product for each industry and by category of final use by product.

8.33. A widely used assumption to estimate import use by product across using industries and categories of final uses is to apply the so-called import proportionality or comparability assumption. This assumes that imports are used in the same proportion across all industries intermediate inputs and final uses (except exports and allowing for imports for re-exports). This is often a two-step procedure in which the ratio of imports to domestic supply is first calculated and is then applied to each product that is used by industries as intermediate inputs to production and by categories of final uses (except exports). For example, if imports of semi-conductors represent 50 per cent of the domestic supply of semi-conductors, then it is assumed that each industry that purchases semi-conductors purchases 50 per cent from foreign sources. This procedure results in the same distribution of imported products across a given row in the Use Table, thus providing another reason to work at the most detailed level of products available within the SUTs system, where there are likely fewer users of very specific products. Thus this procedure works much better with many products (for example, 10,000) as opposed to, say, less than 100 products. With the foreign trade data, there tends to be much more data available by products relative to other data sources. The procedure should, preferably, be applied at basic prices.

8.34. Certain products can be very straightforward to allocate. For example, there are very few users of imports of crude oil in the domestic economy, whereas imports of food are used by many industries and households, or refrigerators could be used by households or in gross fixed capital formation. Nevertheless, the main task remains, and that is to attribute allocation ratios and percentages for each category of imported products across using industries and categories of final uses.

8.35. For this procedure, the Classification by Broad Economic Categories (BEC) can also be utilised or a national variant of BEC when using the import proportionality assumption. The BEC allocates imports of goods into categories of intermediate goods, consumer goods and capital goods. The elements of BEC are the sub-classes of the Standard International Trade Classification (SITC) which are defined in terms of the HS. However, the categories distinguished are only of broad use, and are of less help for the intermediate uses by specific industry. Nonetheless, the BEC would help achieve a certain categorization of the products for the Imports Use Table.

8.36. It is worth noting that it is time and resource consuming, especially for the first time, to attribute allocation ratios and percentages for each category of imported products, on which the allocation of the imports to the assumed user.

8.37. In defining the allocation percentages, there is a need to also consider that, due to secondary output, products are also used in industries where they might not be typical inputs into that industry. This may have already been addressed in the Use Table.

8.38. It is important that the import proportionality assumption or related ratio procedures be used only after direct information of imports use has been compiled. Lastly, once the proportionality assumptions have been applied, it is essential to evaluate the generalised results for reasonableness, and adjust these percentages based on the understanding of how the specific economy operates with regard to production chains and purchases of products by final use.

8.39. The product imbalances, and the balancing process, can often be used to correct for implausible results from an initial allocation based on proportions.

8.40. Although the proportionality approach is not time consuming, the allocation percentages can generally also be applied for other years without any large changes. Usually a great share of total imports will fall under quite a few specific product classifications (for example, manufacturing products purchased by manufacturing industries) and efforts should be concentrated on those as they determine the quality of the resulting Imports Use Table to a large extent, and thus the accuracy of GDP in volume terms and the distribution of GVA by industry.

8.41. A difficult category of final use with respect to the allocation of imports of goods is changes in inventories. Firstly, it is often assumed that the import share of semi-finished and finished products is zero. Secondly, changes in inventories is a balancing item between the inventories at the end of the period minus the inventories at the beginning of the period without knowing the inflows and outflows over the period, therefore the sign of the estimate can be positive or negative, with the latter case, this needs to be handled with caution otherwise this could lead to implausible values.

8.42. However, inventories of finished goods should be treated separately from imports of finished goods for resale without further processing. The latter are goods likely to be held mainly by distributors.

8.43. Lastly, in the process of balancing it must be expected that the procedure may need to be repeated in order to achieve plausible results. As noted, the allocation shares might need to be corrected based on implausible results, which can include negative use elements. Naturally, the allocation of imports to a use element with a zero entry is not permissible and may indicate a wider problem with the level of aggregation.

D. Specific issues in the compilation of Imports Use Table

8.44. There are specific issues that need careful consideration when compiling Imports Use Table. They include the recording of goods sent abroad for processing, investment goods repaired abroad, imports for re-exports, and direct expenditures by residents abroad. These specific issues are briefly discussed in this section.

8.45. Other issues include: Arrangements within MNEs including transfer pricing; contract manufacturing and manufacturers; factoryless goods production and processors; Foreign Direct Investment (FDI) relationships; intellectual property products (IPPs) - ownership and cross border use; international labour movement and remittances; Internet trading; limitations of national data collections; merchanting of goods and services; ownership of property abroad; special purpose entities (SPEs); and toll processing and processors. The UNECE Guide to Measuring Global Production (2015) provides much more detail on how handle these types of issues.

1. Goods sent abroad for processing

8.46. Sending materials or partly-finished goods to another affiliate or non-affiliate enterprise for processing is an established practice which has become more common with low transport costs, specialization among enterprises and the emergence of new production sources. The enterprise processing the items may be resident in the same country as its client or it may be abroad.

8.47. The procedure of sending material for processing is called "goods sent abroad for processing". This practice is very common in industries such as wearing apparel (clothing); chemicals and manufacturing of electronic and metal goods. One variant of particular interest for the National Accounts and Balance of Payments is goods sent abroad for processing, where the unit in country A (the principal) makes a contract with the unit in country B (the contractor) under which B transforms in a substantive way raw materials or semi-processed goods sent by country A. The principal maintains legal ownership of the raw materials and semi-processed goods throughout as well as of the processed goods. The principal pays the contractor a fee for the processing.

8.48. How to record the goods sent abroad for processing in National Accounts, including SUTs and Balance of Payments, has been the subject of extensive discussions in connection with successive versions of the SNA and the BPM. The central question has been whether to impute a value of the goods when sent abroad for processing and subsequently for the processed goods when returned to the legal owner, in this approach, impute transactions even though no change of ownership has taken place (the gross principle) or just record the processing fee as a separate service delivered from the processor to the principal (the net principle).

8.49. In the following sections, the different implications of applying either the gross or the net method are illustrated by numerical examples, both for goods sent for domestic processing and for goods sent for international processing. With this background, the international recommendations as established by the 2008 SNA and the BPM 6 are explained, also including possibilities to deviate from them to reinforce desirable SUTs properties. Eurostat Manual on Goods Sent Abroad for Processing (Eurostat, 2014b) provides further detail. Finally, related measurement problems in current economic statistics are also considered.

(a) Domestic processing

8.50. In the example in Table 8.8, a principal unit classified in Industry 1 sends semi-processed goods (Product A) for further processing to a contractor unit classified in Industry 2. The contractor does not pay for the material received from the principal unit. The value of the goods sent for processing is 100. The value of the goods after processing, assumed to be finished goods requiring no further processing (Product B) is estimated at 180. Processing fees in this example are for simplicity set at 80. In this example, Industry 1 and Industry 2 could also be interpreted as two units belonging to the same industry but for the clearness of the exposition a two-industry case is chosen.

Table 8.8 Processing within the country

Gross recording

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Product A	100				100	
Product B		180				
Processing fees						
Other intermediate consumption				70	30	
GVA				30	50	
Total output	100	180	0	100	180	0

Note: Industry 1 is the principal and Industry 2 is the contractor.

Net recording

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Prod A						
Prod B	180					
Processing fees		80		80		
Other intermediate consumption				70	30	
GVA				30	50	
Total output	180	80	0	180	80	0

8.51. Under the gross treatment transactions of the values of 100 and 180 are imputed, the 100 being output of Industry 1, and the 180 being output of Industry 2. As the 180 is assumed to consist of finished goods, they are not "returned" to the owner industry but enter the product balance as an output of Product B from Industry 2, even though this industry is not the legal owner. From the point of view of Industry 1, it would be goods for resale which are therefore not recorded as a flow from Industry 1 in the system, except if held in inventories at the end of the period. The processing fees do not appear separately as they are included in the output of Product B.

8.52. Under the net treatment, the processing fee of 80 is the (only) output of Industry 2 and it is used as intermediate consumption by Industry 1. The processing fee will be classified as a service and not a good. The output of Industry 1 will be 180. As processing fees can usually be found in current industrial statistics, then there are no imputations associated with implementing the net treatment.

8.53. It is noted that the GVA in the two industries (30 and 50 respectively) are identical for the two alternative treatments but the input structures are quite different. For Industry 1, the gross treatment results in a much higher GVA share in output than the net treatment, and vice versa for Industry 2.

(b) International processing

8.54. In Table 8.9, the gross and net treatments are illustrated for goods sent abroad for processing. Basically the numerical example is identical to the one for domestic processing, except that now it is assumed that the principal is a resident of Country I, and the processor a resident of Country II, and also the two-country case involves exports and imports transactions, either actual or imputed.

Table 8.9 Goods sent abroad for processing

Gross recording (1993 SNA)

Principal (Country I)

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Product A	100					100
Product B			180			
Processing fees						
Other intermediate consumption				70		
GVA				30		
Total output	100	0	180	100	0	100

Contractor (Country II)

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Product A			100		100	
Product B		180				180
Processing fees						
Other intermediate consumption					30	
GVA					50	
Total output	0	180	100	0	180	180

Net recording (2008 SNA)

Principal (Country I)

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Product A						
Product B	180					
Processing fees			80	80		
Other intermediate consumption				70		
GVA				30		
Total output	180	0	80	180	0	0

Contractor (Country II)

	Supply Table			Use Table		
	Industry 1	Industry 2	Imports	Industry 1	Industry 2	Exports
Product A						
Product B						
Processing fees		80				80
Other intermediate consumption					30	
GVA					50	
Total output	0	80	0	0	80	80

8.55. Under the gross treatment, the 100 output of semi-processed goods (Product A) from Industry 1 in Country I is exports of goods from Country I and imports of goods into Country II, where it is used as intermediate consumption in Industry 2. The output of 180 from Industry 2 (Product B) in Country II is exported to Country I. As the 180 is assumed to consist of finished goods, they are not "returned" to the owner industry but enter the balance of Product B in Country I as imports of goods. As there is no change of ownership related to the 100, and the 180, the values of these transactions must be imputed, but as later noted these cross-border movements of goods will usually be included in and valued for the external merchandise trade statistics.

8.56. Under the net treatment the semi-processed goods (Product A) disappear, and the processed goods (Product B) will appear as produced in Country I, as actual output from Industry 1. Only processing fees will appear in international trade, under services. As international processing fees are usually covered both by current industrial statistics and by statistics on international trade in services, there are no imputations associated with the implementation of the net treatment of goods sent abroad for processing.

8.57. As for domestic processing, the GVA remains the same for the two approaches but the input structure is significantly different.

8.58. It should be noted that these numerical examples are highly stylised to stress the main characteristics of the gross and net treatments. In practice, the difference between the value of the finished goods and the semi-processed goods may not be equal to the processing fee paid either because the prices have changed over the processing period or because part of the increase in the value of the finished goods reflects the embodiment of intellectual property or trademarks owned by the principal. It may also be that the processed goods require further processing by the principal in which case an additional entry of intermediate consumption (180 in the example following the gross treatment) would be necessary, and output increased accordingly. It should be noted that these issues will only arise under the gross treatment. The net treatment automatically resolves them.

8.59. In practice, the situation can be much more complicated and provide a significant measurement challenge. For example, goods are often not really 'sent abroad', for example, they can be purchased abroad. On the other hand, goods do not necessarily return after processing, for example, they can be shipped immediately to a third country for final use.

(c) The treatment in 2008 SNA and BPM 6

8.60. The treatment of goods sent for processing based on the 1993 SNA and the BPM 5 was quite complex but the main recommendations were that domestic processing should be based on the net treatment (except when transactions take place between two establishments belonging to the same enterprise, in which case the gross treatment should be used), and that international processing should be based on the gross principle. It was mentioned that this treatment of goods for processing in the 1993 SNA was to facilitate input-output analysis.

8.61. The question raised leading up to the discussion of 2008 SNA was whether there was still a valid reason to record goods for international processing on a gross basis or if the advent of globalization and the increasing amount of goods processed abroad suggest a change in practice would be appropriate. In response to this discussion, the recommended treatment of goods for processing was changed in the 2008 SNA and the BPM 6, where the change in economic ownership principle was given priority to the actual movements of goods and physical technology so that all goods sent for processing (both domestically and internationally) should be treated according to the net principle. This much simplified recommendation is, at the same time, more in line with company accounts and principally avoids imputations but may still require adjustments to ensure the domestic activity is consistent with that recorded in the imports and exports data.

8.62. The new treatment of goods for processing potentially leads to larger variation in I-O coefficients and it is important to put this change into perspective. In the 1993 SNA, the net treatment was already applied if the goods were sent for processing to a non-affiliated domestic processor. Moreover, input structures change for a number of reasons, for example, because of changes in product mix, more or less use of semi-finished products, changes in capital and labour intensities, and outsourcing of services. The goods sent abroad for processing change merely adds to the other changes in the 2008 SNA, which in turn change the I-O coefficients.

8.63. The effects on the input structure of the alternative treatments of goods sent for processing are illustrated in Table 8.10 for Industry 1. The input structures when using the gross or net treatment are taken from Table 8.8. To get an idea of what the input structure would have looked like if no goods had been sent for processing, the processing fee has been decomposed into “other intermediates” and “GVA”, using the input structure of Industry 2, and the components added to “net treatment” column to obtain the result in last column. When looking at the GVA/Output ratios of the three input structures, they are obviously quite different. From an “I-O technology” point of view, the structure in the last column would be preferred as neither of the first two columns would be a good approximation. In practice, when following the 2008 SNA, the input structure of an industry sending goods for processing would probably represent a weighted average of the structures in the second and the last column, as the industry will probably also have some primary output that has not been sent for processing. When the share of goods sent for processing changes, the overall input structure of the industry will change even though no technological change has taken place.

Table 8.10 Industry 1 – Alternative input structures

	Gross treatment	Net treatment	Processing fee breakdown	Structure when no processing
Processing fees		80	-80	
Other intermediates	70	70	30	100
GVA	30	30	50	80
Output	100	180		180
GVA/Output	0.30	0.17		0.44

8.64. As already emphasized, Table 8.10 provides a stylized example. There are various business activity models, and mixed models, not just within an industry but within an individual business – with the impact of globalisation, this is becoming more prevalent. For example, the same oil company can cover the following three activities:

- extract the crude oil, refine it and then sell the refined petroleum. This activity has the full input structure as indicated in the final column of Table 8.10.
- extract the crude oil, sell the crude oil for processing to another company and then purchase the refined petroleum from that company for re-sale without any further processing. Note, in this case, there is a change in economic ownership and the oil company undertakes no refining.
- extract the crude oil, pay another company a processing fee for refining the crude oil (note, no change of economic ownership), and then sell the refined petroleum. Again, the oil company undertakes no refining. This activity is indicated in the second column of Table 8.10.

8.65. If the three activities are separable, then they would reflect different input structures. However, this illustrates that an individual company, and an industry, can reflect a mix of activities and input structures from both the point of view of the outsourcing industry and the point of view of the processing industry. This makes the data collection, measurement and interpretation of the industry input structures much harder.

8.66. In 2008 SNA (paragraphs 28.18 and 28.19), there are two ways to proceed that would retain the "technical" interpretation:

- Option 1: Split the economic activity into two: one processing on own account, and one for goods sent for processing.
- Option 2: use the gross recording approach.

8.67. It should be emphasized that it is option 1 that is the recommendation of the 2008 SNA and, for goods sent abroad for processing, BPM 6. Option 2 is shown as a supplementary presentation that may be adopted for reasons of continuity with past practices. Option 1 more accurately reflects the economic processes taking place while option 2 focuses on the physical transformation process. (2008 SNA, paragraph 28.20). However, the idea – when seen in the perspective of a published IOT – is rather theoretical, as it would in very exceptional cases be realistic to have the tables to include such "dual" branches, and furthermore this way of reasoning could be extended to cover all other reasons for differences in input structures and thus lead to an expansion of the number of economic activities ad infinitum. In these cases where the individual producer units represent blends of traditional production and contracting-out, this approach would anyway not be feasible.

8.68. Even in gross recording, the input structures of principals and contractors would probably be quite different from the input structure when processing on own account. However, specific adjustments may in certain cases be appropriate. If for example, the share of oil refining made on contract basis (as a contractor) varies drastically over time, it might be justified to apply the gross treatment in this case, while on the other hand an increasing trend in goods sent abroad for processing should not be counteracted. Practical data problems will also limit the options. Whereas it may be perfectly realistic to implement the gross treatment in the above oil refinery case, it would require industrial insight and data beyond any realistic possibility to adjust for the latter general trend.

8.69. The increasing activity by businesses for goods sent for processing, whether domestically or internationally, will in any case affect the I-O coefficients (both for the principal and the contractor), and imputing sets of data that are completely detached from the actual economic transactions and their statistical recording is not a viable way to deal with the complications following from the institutional changes taking place in the economy. The increasing importance of outsourcing under globalization of markets makes these inherent institutional changes more rapid, and more significant, and this is a phenomenon that the I-O compilers and analytical users will have to cope with - not by making an artificial world of their own that denies these structural changes rather than exposing them.

(d) Data and balancing issues

8.70. There are three main data sources involved in making the industry and product estimates for goods sent for processing in the SUTs:

- Industrial statistics in which manufacturers provide information on receipts for doing work to orders of others (as contractor) and sub-contracting expenses (as principal) but in which manufacturers are not asked to estimate values for the materials received for processing or for the processed goods when returned to the principal.
- Merchandise trade statistics in which estimated values for the goods sent abroad for – and returned from – processing abroad are included as a border crossing principle rather than a change of ownership principle is being followed.
- Statistics on international trade in services in which in-going and out-going processing fees are recorded.

8.71. If data from all three data sources are just taken at face value and entered into the SUTs, major imbalances will obviously result.

8.72. Under the net treatment, the merchandise trade related to goods sent abroad for processing will have no counterpart in the data recorded by domestic industrial statistics and therefore must be removed from the merchandise trade data. This is often possible as these types of goods have been given a special code in the customs procedure. If, however, they are indistinguishably included, a more comprehensive approach may be needed based on specific information on industrial practices and processes. Under the net approach, the processing fees recorded in the statistics on international trade in services should be directly applicable, and in principle consistent with (but not equal to) the processing fees recorded in domestic industrial statistics, as these also include payments for domestic processing.

8.73. In order to get qualitative data on the fees paid and received for international processing, detailed comparisons of different data sources at the firm level may be required. Survey data on import and export of services may yield the basis for the fee paid and received but may be incomplete both in terms of respondents and in terms of product detail. These data must be supplemented, and reconciled, with data on industrial production and international goods flows under processing. They must also be consistent with firm data on turnover and costs ensuring the domestic account and rest of the world account are consistent.

8.74. Under the gross treatment, the imbalance between supply and use of goods would be removed by imputing additional inputs and outputs for domestic industries corresponding to the merchandise imports and exports related to processing. As the processing fees are in this case embedded in the value of the processed goods, they should be removed from the statistics on international trade in services before these data are entered into the SUTs.

8.75. In order to keep track of the conceptual and data linked complexities of goods sent for processing, both domestically and internationally, it is recommended to establish a sub-system in which all the related goods and services balances are separately set out and analysed to secure full coverage and consistency in the SUTs before the data are entered into the full system.

2. Investment goods repaired abroad

8.76. Investment goods which are sent abroad for major repair result in substantial amount of value being created in the reconstruction. Both the export and the re-import are part of the import and export flows. However, in case of minor repair, maintenance, or servicing, the flows concerned are not to be recorded under imports and exports. In case of major repairs, similar problems of recording in a SUTs framework do occur. Thus, for practical reasons one could assume that it usually would be only a minor repair. Furthermore, one could assume that cross-border transportation of investment goods for repair is quite rare and thus be negligible (with the exception of products like aircraft and ships, where the activity and values involved are often very significant).

3. Imports for re-exports

8.77. Another challenge in the compilation of the Imports Use Table concerns re-exports. Re-exports are transactions of goods which were previously imported with a change in economic ownership and then exported without any substantial transformation. These re-exports are included as exports in foreign trade statistics. In cases of products that are not produced domestically, any exports of these products could easily be identified as re-exports. It should be noted that – with the exception of transport margins – re-exports of services are, by concept, not possible, thus the identification of re-exports is only a problem for goods.

4. Direct expenditures by residents abroad

8.78. A further challenge which may also be of some importance concerning the data involved is the direct purchases abroad by residents in connection with tourism. These direct purchases abroad by residents should cover all purchases of goods and services made by residents while travelling abroad for business or pleasure.

Such purchases are part of the import flows and need to be estimated on a product basis. Therefore, these purchases have to be allocated to intermediate use in case of business travellers and to household final consumption in the case of private travellers.

5. Transit trade

8.79. These are goods admitted under special customs procedures that allow the goods to pass through the territory. They are excluded from the general merchandise of the territory of transit. The issue of transit trade takes various forms, for example, quasi-transit trade, etc. and pose challenges statistically and in terms of measurement. For some countries, this can be significant, especially with large ports. Transit trade ('simple transit') and quasi-transit trade flows do appear in merchandise trade statistics and should be excluded in National Accounts and Balance of Payments.

E. Enhancements to the Imports Use Table for analytical uses

8.80. In addition to those enhancements described above, the analytical potential of the Imports Use Table for users is considerably enhanced if the Imports Use Table also showed supplementary classifications such as the distinction between “competitive imports” and “complementary imports”, or imports sub-divided by regions such as imports by country/region of origin.

8.81. *Competitive imports* are products that are also domestically produced and thus are consequential in estimating an accurate domestic use table. *Complementary imports* (also sometimes referred to as non-competitive imports) are products that are not domestically produced.

8.82. This distinction is of analytical interest as both types of imports can be expected to have a different relationship with and importance for the national economy. Competitive imports can be the subject of economic analysis concerning substitution policies and effects. Complementary imports, as products not being produced in the national economy, are sometimes vital and analyses may focus on the impact of changes in their prices or volume.

8.83. In theory the distinction between competitive and complementary imports seems to be clear. However, in practice a number of borderline cases have to be solved. For the validity of this distinction, the product level of disaggregation is of utmost importance. Even on a very detailed product level it is sometimes very difficult to classify the products as competitive or complementary. Furthermore, this classification may not be stable over time.

8.84. Compared to the distinction between competitive and complementary imports, a geographical breakdown of the use table of imports is easier to compile as there may be data problems but no basic conceptual problems. Usually for the goods, information on the geographical origin of the imports is available in foreign trade statistics. For services, the data situation concerning the geographical breakdown of imports is less favourable.

8.85. The main problem in compiling use tables on imports with a geographical breakdown is how to allocate a single product imported from two geographical regions to the respective use categories: should one allocate it proportionally to the assumed users? However, similar questions already arise when compiling the use table of imports without geographical breakdowns: is the import share of an imported product the same in all use categories? In consequence, a geographical breakdown might need such additional assumptions in order to allocate the imports.

Chapter 9. Compiling Supply and Use Tables in volume terms

A. Introduction

9.1. One of the major objectives of National Accounts is to provide comprehensive and coherent data which can be used for analysing and evaluating the performance of an economy. Data on the real growth of major economic flows such as production, household consumption, capital formation and exports serve as inputs for formulating economic policy. Furthermore, the National Accounts data play a key role in helping to investigate the causal mechanisms within an economy.

9.2. Estimation of the parameters for macroeconomic models by applying econometric methods requires consistent time series of National Accounts data with a focus on annual changes. Therefore, the decomposition of annual current price changes into price changes and volume changes is an important aspect of the compilation of National Accounts.

9.3. Contrary to data in current prices, much of the data in volume terms cannot be directly observed. They have to be derived from current price data combined with appropriate price and volume indicators, implying that estimates in volume terms are more modelled or based on proxies rather than estimates used when formulating data in current prices. In addition, the choice of index formulae influences the result of the estimates in volume terms.

9.4. The calculation of price and volume changes for the transactions of goods and services in the national accounts is ideally supported through the use of the SUTs framework. When established in an accounting framework, the volume indices and deflators of several variables at different levels of aggregation are inter-related in a systematic way. By applying an appropriate combination of price and volume index formulae, all the identities and relationships of SUTs in current prices are maintained in the SUTs in volume terms.

9.5. When balanced both in current prices and in volume terms, the SUTs ensure coherent and consistent deflation of the components of the production and expenditure approaches to measuring GDP as well as coherent and consistent estimates of price and volume indices. Another advantage of compiling price and volume measures within the SUTs framework is that price and volume measures can be derived for important balancing items as GVA and GDP through applying the so called "double deflation" approach – this is the recommended SNA approach to estimating GVA in volume terms.

9.6. This Chapter focuses on the compilation of SUTs in volume terms. Section B provides an acknowledgement that there are alternative approaches to compiling SUTs in volume terms. Section C describe the compilation of SUTs in volume terms using the "H-Approach" and Section D and E presents more details on how to deflate the various components of the SUTs. Finally, Section F presents some considerations for compilation of IOTs in volume terms. The balancing of SUTs in current prices and in volume terms (as well as at basic prices and at purchasers' prices) is covered in Chapter 11.

B. Recognition of alternative approaches

9.7. Based on issues like the availability of data, resources and time, it is important to note that there are different ways of deflating SUTs as well as different sequences in doing so. These variations will also in turn generate different balancing schemes and, most importantly, different degrees of quality for the detail and the aggregates.

9.8. This Chapter focuses on a recommended approach although alternative approaches are available. For example, the deflation of uses at purchasers' prices as inputs to generate the SUTs in volume terms and balance the rest of SUTs, which may be deflated at basic prices (or producer prices), for example, output. This approach may be easier to implement but has in-built incoherency and inconsistency reflected through balancing different valuations, albeit balanced out, the impact on the quality of the aggregates is implicit and not explicit, and for some areas like GFCF is clearly sub-optimal as appropriate price indices at purchasers' prices are not usually available.

9.9. Also, SUTs in volume terms for one period can be compiled using SUTs in current prices for one period and deflators. However, the recommended approach contains a time-series dimension.

9.10. Another alternative approach is to remove taxes, subsidies, trade and transport margins and imports, and deflate domestic output at basic prices (with weighting for exports using export price indices) and deflate imports using import price indices. Trade and transport margins and taxes and subsidies in volume terms are estimates using rates of the previous year and the volume change at basic prices.

9.11. The underlying principles of this approach forms the recommended approach covered in detail in this Chapter (referred to as the "H-Approach") and an overview shown in Figure 9.1. This is a transparent, coherent and consistent approach compiling SUTs both in current prices and in previous years' prices as well as better matching of the valuation of current price values with appropriate price indices.

9.12. There are many benefits of the "H-Approach" as, for example, it allows for the data confrontation to take place in both current prices and in volume terms and also ensures consistent deflation across the National Accounts. In addition, the incorporation of high-quality alternatives to help improve the quality of the SUTs in volume terms, for example, deflating household final consumption expenditure using Consumers Price Indices (CPIs). The result through using a dual approach or all the information available allows for better quality estimates of household final consumption expenditure to be produced but they will be different from purely using the CPIs. There is a variety of reasons using CPIs but there are some deficiencies, for example, CPIs may not allow for discounts or bulk purchases, etc. or fully meet National Accounts requirements. Thus the implied HHFCe deflator from the SUTs would be, and should be, different from the CPI. However, for areas like capital formation, it is unlikely that direct price collection at purchasers' prices exists to be used to deflate components like gross fixed capital formation, thus alternative proxies (for example, producer prices) may be used. In these cases, the use of the "H-Approach" provides a much better basis and results in a higher quality volume estimate.

9.13. The "H-Approach" presumes SUTs in current prices for the year t, SUTs in current prices for the year t-1 and appropriate deflators are available. However, this is not a necessary pre-condition as SUTs in volume terms can be created with just SUTs in current prices for the year t and appropriate deflators. However, this approach does not reflect the time series dimension and the use of margin and tax rates in the previous year.

C. Overview of the steps in the "H-Approach" with a focus on volumes

9.14. This section provides an overview of the compilation process, where Figure 9.1 shows a framework for estimating SUTs simultaneously at purchasers' prices and at basic prices and in current prices and volume terms. This section supplements the "H-Approach" as covered in Chapter 2 and Chapter 3.

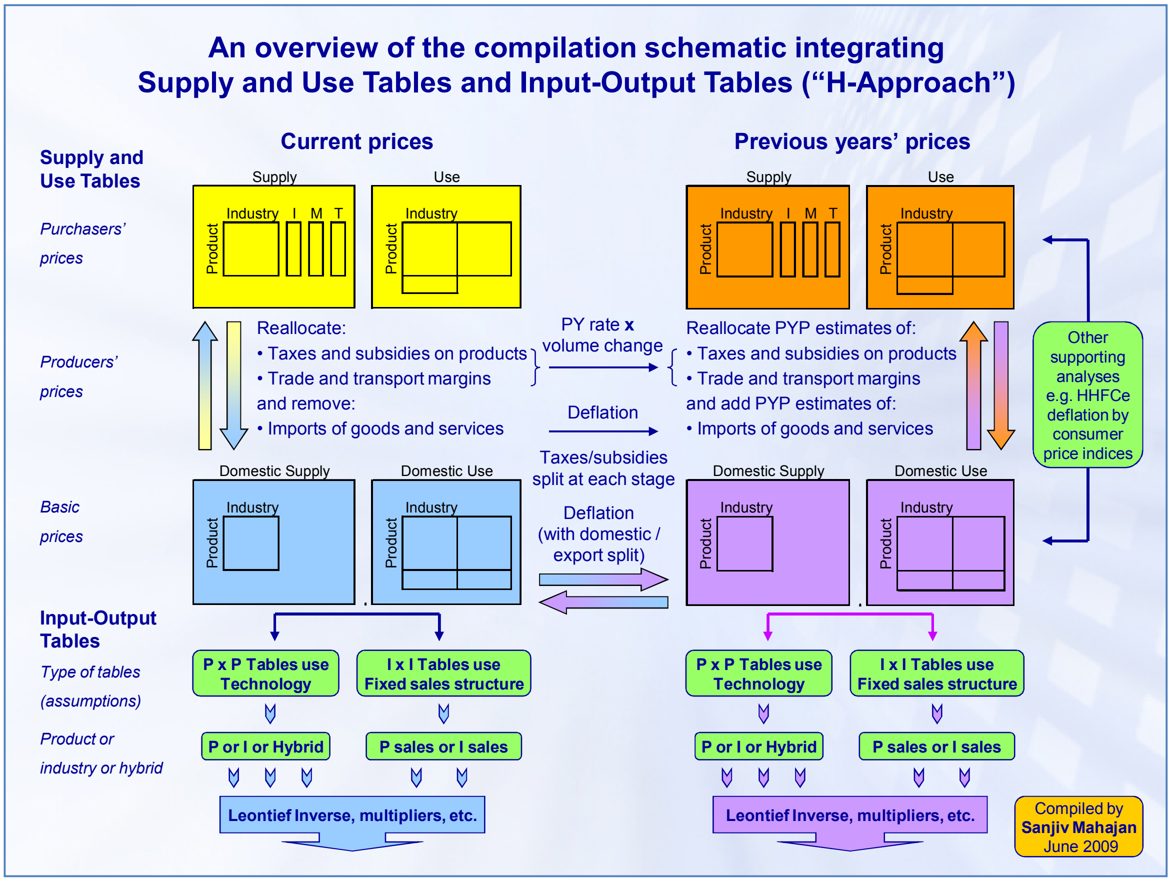
9.15. On the left-hand side of the "H", the current price data are presented, whilst the right-hand side of the "H" presents the volume data in previous years' prices. In the middle, the joins through the deflation connection are shown as well as the link to the IOTs in the bottom left-hand side and bottom right-hand side. The compilation flow can be from left-top to left-middle then through deflation to the right-middle and then to right-top. As explained in Chapter 3, if better final use based purchasers' price deflators exist, for example, CPIs, then a compilation flow starting from the right-top can be incorporated, reverse engineering through a balanced approach. The "H-Approach" allows for the use of such deflators. However, in terms of system design, there are different options of how better quality price deflators can be used but need to be clearly set out at the outset. For example, it may be agreed that the deflation of HHFCe using CPIs gives a better measure of volume of HHFCe in practice than deflation at basic prices, thus these deflators could be incorporated, whereby the objective would be to retain these results and balance back to the basic price valuation of HHFCe.

9.16. This framework is shown as a summary in Figure 3.4 and Figure 3.5 covering a simplified version of the "outputs" in the compilation schematic for SUTs and IOTs in current prices and in previous years' prices. Applying this compilation scheme, this generates consistent and coherent estimates of volume and price indices for all entries of the SUTs linking the different valuations and the valuation matrices as well as the IOTs.

9.17. Figure 9.1 provides an overview that underpins the annexes covering the sequence and the stage of production processes compiling SUTs in both current prices and in volume terms, in Chapter 4.

9.18. As stated in the introduction, many of the above transactions in volume terms cannot be directly observed. Therefore, volume estimates have to be derived from current price data combined with information on price and/or volume changes. As a consequence, the starting point for volume estimates are the SUTs in current prices as shown in the top left corner of Figure 9.1.

Figure 9.1 An overview of the compilation schematic linking SUTs in current prices and in volume terms



1. Step 1

9.19. Once current price SUTs at purchasers' prices (i.e. top left-hand side of Figure 9.1) have been established, the separation of the valuation matrices covering taxes on products, subsidies on products, trade margins and transport margins, and the separation of the Imports Use Table are used to derive a Domestic Use Table at basic prices (i.e. middle of the left-hand side of Figure 9.1). The compilation of each of these matrices and tables is covered in Chapters 7 and 8 of this Handbook.

9.20. At this stage (i.e. middle of the left-hand side of Figure 9.1), the tables for imported goods and services and domestically produced goods and services form the starting point for the compilation of the IOTs in current prices (i.e. bottom of the left-hand side of Figure 9.1) but also the first step in the "deflation" phase for compiling SUTs in volume terms.

2. Step 2

9.21. For intermediate consumption at purchasers' prices in the Use Table, appropriate price indices are mostly not available. The output and import price indices might be used as an approximation (see below), however the optimal process is to compile the Use Table at basic prices by the deduction of the valuation matrices from the Use Table at purchasers' prices, shown on the left-hand side of Figure 9.1. In order to apply the most appropriate price indices, the Use Table at basic prices should be split between uses of imported goods and services (Imports Use Table) separate from uses of domestically produced goods and services (Domestic Use Table) shown in middle of the left-hand side of Figure 9.1.

9.22. The Domestic Use Table at basic prices is deflated using appropriate price deflators (or use of volume indicators) applied across each product in both the Supply Table and Use Table allowing for the separation of domestically consumed products and exported products (deflated using export price indices (EPIs)). This assumes that the sale price charged by the seller is the same as the purchase price paid by the purchaser. Implicitly, this may not, for example, allow for bulk purchases made at a discounted price, however, if the deflation is carried out at a very detailed level, then the impact will be insignificant.

9.23. In the ideal case, producer price indices (PPIs) are a correctly weighted average of domestic sales and exports. However, in practice, often a weighted average has to be constructed by applying weights of the previous year. The preferred option is to split produced goods and services between those consumed domestically and those exported, and then deflate using PPIs and EPIs, respectively.

9.24. The same approach holds for the imports of goods and services when applying import price indices (IPSs).

9.25. The above step results in SUTs at basic prices in previous years' prices. These data in volume terms sit in the middle of the right-hand side of Figure 9.1.

9.26. In the case, when the SUTs in current prices and at purchasers' prices are already balanced, the above step should result in balanced SUTs at basic prices in previous years' prices, assuming the requirements on prices mentioned above are fulfilled. However, in practice, some balancing will be required.

3. Step 3

9.27. Step 3 consists in the deflation of the valuation matrices for taxes, subsidies and margins (trade and transport) by applying the previous year rates to the volumes at basic prices (or volume change as appropriate).

9.28. In combination with the SUTs at basic prices, in previous years' prices, the volume changes can be calculated, which form the base for the volume estimates for all the individual entries of the valuation matrices. In this compilation step, there are two key issues:

- Firstly, one has to check the plausibility of the volume estimates, in particular trade and transport margins for the goods and services which have large changes in quality, as the quality change is part of the volume changes in the National Accounts. The consequences for GVA in the trade and transport industries might be unacceptable.

- Secondly, separate independent PPIs might be available for transport services. Confrontation with the implicit price indices resulting from the process indicated by Figure 9.1 might lead to unacceptable differences with the observed price indices. Thereby, a re-evaluation of earlier estimates may be necessary.

4. Step 4

9.29. Step 4 consists on the compilation of SUTs at purchasers' prices in previous years' prices - as shown in the top-right corner of Figure 9.1, by adding the SUTs at basic prices and the valuation matrices in previous years' prices obtained in the previous steps.

9.30. At this stage, additional plausibility checks are available, and in some cases, essential. For example, as described earlier, the use of household final consumption expenditure in volume terms using CPIs. Confrontation of the resulting implicit price indices from the SUTs at purchasers' prices with observed purchasers' price indices like the CPI may reveal implausible results. This will lead to re-evaluation and adjustment of earlier estimates.

9.31. The re-assessment and allocation of adjustments may ultimately imply, in some cases, that the current price SUTs at purchasers' prices may need to change or one or several of the intermediate steps may need to be altered.

9.32. In the case of starting with balanced SUTs in current prices and at purchasers' prices, each transitionary step thereafter creates a balanced matrix. Therefore the resulting SUTs in previous years' prices both at basic prices and at purchasers' prices will also be balanced. Any adjustments resulting from the additional plausibility checks will be incorporated in a balanced manner and improve plausibility and in turn quality.

5. Step 5

9.33. Step 5 consists in the compilation of IOTs in previous years' prices using the same assumptions as applied for the compilation of IOTs in current prices. This is shown in the bottom right-hand side of Figure 9.1.

6. Other points to note

9.34. Options on the starting point, whether the current price SUTs at purchasers' prices and at basic prices balanced as a starting point or whether they are unbalanced is discussed in Chapter 11 of this Handbook. This choice does not alter the steps or the processes of deflation but do have different impacts on processes, resources, systems and schedules needed to compile these tables.

9.35. Figure 9.2 shows the links between the table in Figure 9.1 at the current price estimates and in volume estimates for two successive years. In particular:

- The link between the SUTs of year t-1 in current prices of t-1 and the SUTs year t in prices of t-1 are the SUTs with the corresponding volume indices.
- The connecting link between the SUTs in current prices of year t and the SUTs of year t in prices of t-1 are the SUTs with the information on price indices.
- From the SUTs in current prices of year t and year t-1, the SUTs with value indices can be derived.

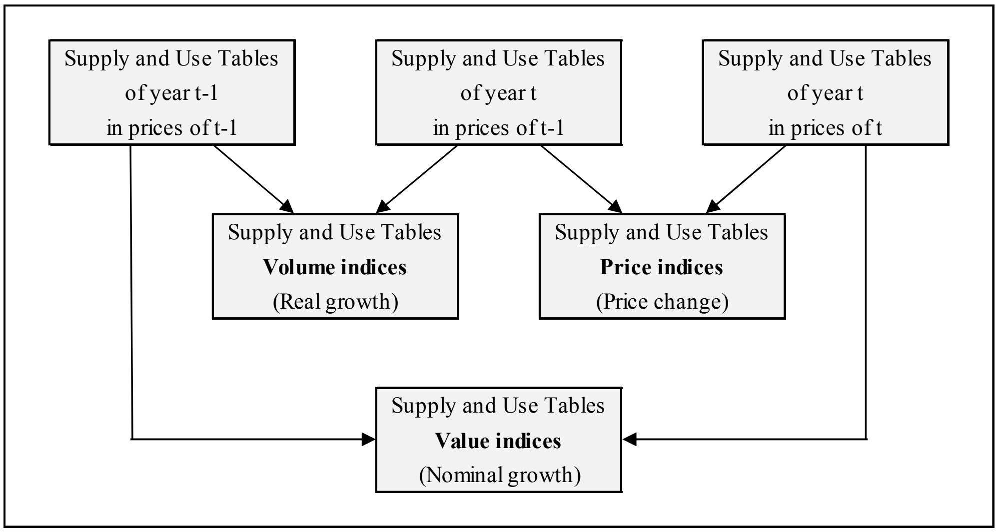
9.36. At the end of this estimation process, a complete picture is available as laid out in Figure 9.2, for every column of the SUTs, not only in current prices but also in previous years' prices for outputs, intermediate uses, final uses and imports of goods and services. It should be noted the SUTs may be unbalanced at this stage.

9.37. This set of data allows for checking the consistency of the data, whereby even if the results in current prices look plausible, the analysis of volume and price data may show large problems. For example, comparing changes in the volume of output by industry with the corresponding changes in the volume of intermediate consumption and the volume of GVA.

9.38. The analysis in volume terms is far superior, especially when prices are changing rapidly. In several cases, these data can be checked with actual data in volumes, for example, use of energy products or the volume of sales by product like agriculture.

9.39. The value/price/volume analysis can lead to amendments on either of the estimated variables before the balancing process has commenced.

Figure 9.2 Link between SUTs in current prices and in volume terms



9.40. An empirical example of SUTs reflecting the components of Figure 9.2 (including prices indices, volume indices and value indices) is shown in Table 9.1 and Table 9.2. From these tables, information on inflation, real growth and nominal growth can be extracted at a detailed level as well as nominal GDP, real GDP growth and the GDP deflator. Table 9.3 also shows that the growth rates for GDP can be directly derived from the SUTs by applying the formulae for the production, income and expenditure approaches.

9.41. It should be noticed that the estimates of "direct purchases abroad by residents" and "purchases on the domestic territory by non-residents" in rows (11) of Table 9.1 and rows (11) and (12) of Table 9.2 are not shown separately in these tables but incorporated within the products of the table. This is an alternative presentation of direct purchases abroad by residents and domestic purchases by non-residents - these adjustments form the difference between the national concept and domestic concept of household final consumption expenditure. The breakdown by product allows for more appropriate deflation by product whereas the two aggregates form a heterogeneous suite of products.

Table 9.1 The Supply Table in current prices and in volume terms

			OUTPUT OF INDUSTRIES							Imports	Total supply at basic prices	VALUATION			Total supply at purchasers' prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Output at basic prices			Trade and transport margins	Taxes less subsidies on products	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Supply Table at current prices in year T														
PRODUCTS	Agriculture	(1)	25 773	153			20	16	25 962	15 384	41 346	10 903	535	11 438	52 784
	Manufacturing	(2)	1 262	316 757	1 757	18 741	5 157	11 821	355 495	336 807	692 302	112 979	39 419	152 398	844 700
	Construction	(3)	92	1 104	87 896	296	2 062	2 134	93 584	1 564	95 148		8 260	8 260	103 408
	Trade	(4)	144	9 919	356	116 902	2 893	672	130 886	3 429	134 315	- 109 321	829	- 108 492	25 823
	Transport	(5)	385	17	69	63 645	1 348	977	66 441	10 671	77 112	- 14 864	- 996	- 15 860	61 252
	Communication	(6)		4 722		41 679	2 895	585	49 881	6 277	56 158	198	3 160	3 358	59 516
	Finance and business services	(7)	489	6 992	1 053	13 015	195 536	73 409	290 494	55 242	345 736		9 124	9 124	354 860
	Other services	(8)	304	2 512		2 687	3 540	216 628	225 671	16 638	242 309	105	3 008	3 113	245 422
	Total	(9)	28 449	342 176	91 131	256 965	213 451	306 242	1 238 414	446 012	1 684 426		63 339	63 339	1 747 765
Adjustments	CIF/FOB adjustments on imports	(10)								- 3 569	- 3 569				- 3 569
	Direct purchases abroad by residents	(11)													
	Total	(12)	28 449	342 176	91 131	256 965	213 451	306 242	1 238 414	442 443	1 680 857		63 339	63 339	1 744 196
	Price index (T-1 = 100)														
PRODUCTS	Agriculture	(1)	102.0	104.1			100.0	100.0	102.0	106.9	103.8	97.5	107.6	97.9	102.4
	Manufacturing	(2)	107.5	108.0	101.3	99.9	100.5	101.3	107.2	108.0	107.6	100.2	101.9	100.7	106.2
	Construction	(3)	103.4	100.8	100.5	102.1	100.9	99.8	100.5	101.6	100.5		100.1	100.1	100.5
	Trade	(4)	98.0	100.1	99.2	99.7	99.9	99.9	99.7	100.0	99.7	99.5	102.3	99.5	100.4
	Transport	(5)	102.4	100.0	101.5	102.0	101.6	101.6	102.0	102.2	102.0	103.5	99.4	103.2	101.7
	Communication	(6)		97.5		99.6	97.4	98.3	99.2	98.3	99.1	101.5	100.5	100.6	99.2
	Finance and business services	(7)	102.9	101.0	100.5	100.7	100.2	101.0	100.4	101.0	100.5		93.6	93.6	100.3
	Other services	(8)	102.4	100.2		102.2	115.9	100.8	101.0	103.4	101.1	99.1	110.2	109.8	101.2
	Total	(9)	102.2	107.4	100.5	100.3	100.4	100.8	102.4	106.5	103.4		100.8	100.8	103.3
Adjustments	CIF/FOB adjustments on imports	(10)								108.1	108.1				108.1
	Direct purchases abroad by residents	(11)													
	Total	(12)	102.2	107.4	100.5	100.3	100.4	100.8	102.4	106.5	103.4		100.8	100.8	103.3
	Supply Table of year T at previous years' prices														
PRODUCTS	Agriculture	(1)	25 274	147			20	16	25 457	14 386	39 843	11 183	497	11 680	51 523
	Manufacturing	(2)	1 174	293 265	1 734	18 755	5 129	11 673	331 730	311 934	643 664	112 711	38 690	151 401	795 065
	Construction	(3)	89	1 095	87 486	290	2 043	2 138	93 141	1 540	94 681		8 253	8 253	102 934
	Trade	(4)	147	9 913	359	117 309	2 897	673	131 298	3 428	134 726	- 109 828	810	- 109 018	25 708
	Transport	(5)	376	17	68	62 377	1 327	962	65 127	10 444	75 571	- 14 367	- 1 002	- 15 369	60 202
	Communication	(6)		4 845		41 862	2 973	595	50 275	6 385	56 660	195	3 144	3 339	59 999
	Finance and business services	(7)	475	6 925	1 048	12 924	195 168	72 709	289 249	54 690	343 939		9 745	9 745	353 684
	Other services	(8)	297	2 507		2 628	3 055	214 997	223 484	16 094	239 578	106	2 729	2 835	242 413
	Total	(9)	27 832	318 714	90 695	256 145	212 612	303 763	1 209 761	418 901	1 628 662		62 866	62 866	1 691 528
Adjustments	CIF/FOB adjustments on imports	(10)								- 3 303	- 3 303				- 3 303
	Direct purchases abroad by residents	(11)													
	Total	(12)	27 832	318 714	90 695	256 145	212 612	303 763	1 209 761	415 598	1 625 359		62 866	62 866	1 688 225
	Volume index (T-1 = 100)														
PRODUCTS	Agriculture	(1)	99.9	96.1			87.0	88.9	99.9	103.5	101.1	103.6	111.9	103.9	101.8
	Manufacturing	(2)	95.4	104.5	89.4	98.5	94.4	103.1	103.8	103.3	103.6	103.6	98.7	102.3	103.3
	Construction	(3)	127.1	129.4	104.1	117.9	89.3	99.9	103.9	101.2	103.8		98.2	98.2	103.4
	Trade	(4)	79.5	94.4	104.1	104.8	99.0	90.5	103.6	101.4	103.6	103.4	98.8	103.5	104.1
	Transport	(5)	98.9	100.0	82.9	103.2	129.2	101.9	103.6	100.3	103.1	104.9	106.5	105.0	102.7
	Communication	(6)		109.4		101.6	109.6	97.2	102.7	97.8	102.1	97.0	97.5	97.5	101.9
	Finance and business services	(7)	99.6	103.0	97.1	103.3	102.7	100.4	102.1	107.4	102.9		98.2	98.2	102.8
	Other services	(8)	95.2	99.1		99.4	100.3	100.5	100.5	98.3	100.3	94.6	101.9	101.6	100.4
	Total	(9)	99.6	104.2	103.6	103.3	102.4	100.6	102.6	103.5	102.8		98.6	98.6	102.7
Adjustments	CIF/FOB adjustments on imports	(10)								100.9	100.9				100.9
	Direct purchases abroad by residents	(11)													
	Total	(12)	99.6	104.2	103.6	103.3	102.4	100.6	102.6	103.5	102.8		98.6	98.6	102.7
	Supply Table of T-1 at current prices														
PRODUCTS	Agriculture	(1)	25 299	153			23	18	25 493	13 900	39 393	10 799	444	11 243	50 636
	Manufacturing	(2)	1 230	280 614	1 939	19 032	5 431	11 317	319 563	301 843	621 406	108 774	39 201	147 975	769 381
	Construction	(3)	70	846	84 076	246	2 289	2 141	89 668	1 521	91 189		8 404	8 404	99 593
	Trade	(4)	185	10 503	345	111 978	2 927	744	126 682	3 381	130 063	- 106 185	820	- 105 365	24 698
	Transport	(5)	380	17	82	60 429	1 027	944	62 879	10 408	73 287	- 13 701	- 941	- 14 642	58 645
	Communication	(6)		4 428		41 199	2 713	612	48 952	6 530	55 482	201	3 224	3 425	58 907
	Finance and business services	(7)	477	6 724	1 079	12 509	190 079	72 409	283 277	50 908	334 185		9 925	9 925	344 110
	Other services	(8)	312	2 531		2 644	3 045	213 878	222 410	16 366	238 776	112	2 678	2 790	241 566
	Total	(9)	27 953	305 816	87 521	248 037	207 534	302 063	1 178 924	404 857	1 583 781		63 755	63 755	1 647 536
Adjustments	CIF/FOB adjustments on imports	(10)								- 3 272	- 3 272				- 3 272
	Direct purchases abroad by residents	(11)													
	Total	(12)	27 953	305 816	87 521	248 037	207 534	302 063	1 178 924	401 585	1 580 509		63 755	63 755	1 644 264
	Value index (T-1 = 100)														
PRODUCTS	Agriculture	(1)	101.9	100.0			87.0	88.9	101.8	110.7	105.0	101.0	120.5	101.7	104.2
	Manufacturing	(2)	102.6	112.9	90.6	98.5	95.0	104.5	111.2	111.6	111.4	103.9	100.6	103.0	109.8
	Construction	(3)	131.4	130.5	104.5	120.3	90.1	99.7	104.4	102.8	104.3		98.3	98.3	103.8
	Trade	(4)	77.8	94.4	103.2	104.4	98.8	90.3	103.3	101.4	103.3	103.0	101.1	103.0	104.6
	Transport	(5)	101.3	100.0	84.1	105.3	131.3	103.5	105.7	102.5	105.2	108.5	105.8	108.3	104.4
	Communication	(6)		106.6		101.2	106.7	95.6	101.9	96.1	101.2	98.5	98.0	98.0	101.0
	Finance and business services	(7)	102.5	104.0	97.6	104.0	102.9	101.4	102.5	108.5	103.5		91.9	91.9	103.1
	Other services	(8)	97.4	99.2		101.6	116.3	101.3	101.5	101.7	101.5	93.8	112.3	111.6	101.6
	Total	(9)	101.8	111.9	104.1	103.6	102.9	101.4	105.0	110.2	106.4		99.3	99.3	106.1
Adjustments	CIF/FOB adjustments on imports	(10)								109.1	109.1				109.1
	Direct purchases abroad by residents	(11)													
	Total	(12)	101.8	111.9	104.1	103.6	102.9	101.4	105.0	110.2	106.3		99.3	99.3	106.1

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Table 9.2 The Use Table in current prices and in volume terms

			INPUT OF INDUSTRIES							FINAL USE								
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at purchasers' prices
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Use Table at current in year T																		
PRODUCTS	Agriculture	(1)	5 514	17 236	114	205	248	1 091	24 408	5 937			143		- 91	22 387	28 376	52 784
	Manufacturing	(2)	10 133	175 862	26 285	26 880	7 573	30 984	277 717	122 814		9 119	51 545		1 409	382 096	566 983	844 700
	Construction	(3)	298	1 718	24 504	1 608	2 212	15 934	46 274	453		566	54 015			2 100	57 134	103 408
	Trade	(4)	107	2 975	336	7 421	2 115	576	13 530	4 750						7 543	12 293	25 823
	Transport	(5)	291	3 230	162	23 566	2 738	1 903	31 890	5 679		492				23 191	29 362	61 252
	Communication	(6)	170	3 027	1 068	13 842	7 911	6 089	32 107	10 794	868		6 717		2	9 028	27 409	59 516
	Finance and business services	(7)	2 067	36 341	7 131	46 730	61 900	52 851	207 020	77 968	5	3 585	16 820			49 462	147 840	354 860
	Other services	(8)	172	2 306	1 236	4 214	4 569	13 381	25 878	55 061	4 610	153 396	1 162		206	5 109	219 544	245 422
	Total	(9)	18 752	242 695	60 836	124 466	89 266	122 809	658 824	283 456	5 483	167 158	130 402		1 526	500 916	1 088 941	1 747 765
Adjustments	CIF/FOB adjustments on exports	(10)														- 3 569	- 3 569	- 3 569
	Direct purchases abroad by residents	(11)																
	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	18 752	242 695	60 836	124 466	89 266	122 809	658 824	283 456	5 483	167 158	130 402		1 526	497 347	1 085 372	1 744 196
GVA	Compensation of employees	(14)	2 677	42 141	18 786	71 831	70 666	111 939	318 040									318 040
	Other taxes less subsidies on production	(15)	- 722	176	5	18	- 930	1 190	- 263									- 263
	Consumption of fixed capital	(16)	3 683	18 241	2 234	18 024	13 259	51 627	107 068									107 068
	Net operating surplus	(17)	4 059	38 923	9 270	42 626	41 190	18 677	154 745									154 745
	GVA	(18)	9 697	99 481	30 295	132 499	124 185	183 433	579 590									579 590
	Total input at basic prices	(19)	28 449	342 176	91 131	256 965	213 451	306 242	1 238 414	283 456	5 483	167 158	130 402		1 526	497 347	1 085 372	
Price index (T-1 = 100)																		
PRODUCTS	Agriculture	(1)	105.8	109.9	102.7	108.5	102.5	96.2	108.2	100.4			94.7		568.8	97.7	98.0	102.4
	Manufacturing	(2)	114.1	111.5	103.3	107.0	103.9	103.5	109.2	102.1		99.5	99.6		85.7	106.8	104.9	106.2
	Construction	(3)	101.4	103.1	100.3	102.4	101.1	101.8	101.0	97.4		97.1	100.0			102.0	100.0	100.5
	Trade	(4)	100.0	101.2	101.2	101.7	102.4	101.8	101.7	102.2						97.3	99.1	100.4
	Transport	(5)	101.7	101.4	101.9	102.4	100.4	102.1	102.1	101.8		103.1				101.3	101.4	101.7
	Communication	(6)	100.0	98.3	97.9	98.7	99.6	99.2	99.0	102.4	100.9		96.7		100.0	98.1	99.5	99.2
	Finance and business services	(7)	101.4	100.8	100.4	100.7	101.7	98.7	100.5	101.7	100.0	101.8	95.7			99.0	100.1	100.3
	Other services	(8)	102.4	101.4	102.1	102.5	102.4	105.6	103.9	102.7	103.8	100.2	101.7		99.5	101.8	100.9	101.2
	Total	(9)	109.3	109.0	101.6	102.2	101.7	101.1	104.5	102.1	103.3	100.2	99.1		83.0	104.9	102.6	103.3
Adjustments	CIF/FOB adjustments on exports	(10)														108.1	108.1	108.1
	Direct purchases abroad by residents	(11)																
	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	109.3	109.0	101.6	102.2	101.7	101.1	104.5	102.1	103.3	100.2	99.1		83.0	104.8	102.6	103.3
GVA	Compensation of employees	(14)	102.7	102.1	101.3	101.8	101.5	101.4	101.6									101.6
	Other taxes less subsidies on production	(15)	98.0	193.4	- 500.0	- 1 800.0	98.8	113.9	48.3									48.3
	Consumption of fixed capital	(16)	99.1	100.7	99.4	99.9	98.8	97.7	98.8									98.8
	Net operating surplus	(17)	79.8	106.1	92.4	93.1	96.3	103.8	97.7									97.7
	GVA	(18)	90.8	103.5	98.3	98.6	99.5	100.6	100.1									100.1
	Total input at basic prices	(19)	102.2	107.4	100.5	100.3	100.4	100.8	102.4	102.1	103.3	100.2	99.1		83.0	104.8	102.6	
Use Table at previous years' prices																		
PRODUCTS	Agriculture	(1)	5 212	15 677	111	189	242	1 134	22 565	5 912			151		- 16	22 911	28 958	51 523
	Manufacturing	(2)	8 882	157 696	25 450	25 123	7 291	29 932	254 374	120 255		9 167	51 739		1 645	357 885	540 691	795 065
	Construction	(3)	294	1 667	24 422	1 570	2 188	15 654	45 795	465		583	54 033			2 058	57 139	102 934
	Trade	(4)	107	2 940	332	7 299	2 065	566	13 309	4 646						7 753	12 399	25 708
	Transport	(5)	286	3 186	159	23 022	2 728	1 863	31 244	5 579		477				22 902	28 958	60 202
	Communication	(6)	170	3 079	1 091	14 028	7 939	6 139	32 446	10 538	860		6 947		2	9 206	27 553	59 999
	Finance and business services	(7)	2 039	36 056	7 102	46 387	60 856	53 536	205 976	76 632	5	3 523	17 570			49 978	147 708	353 684
	Other services	(8)	168	2 274	1 210	4 112	4 461	12 675	24 900	53 632	4 443	153 068	1 143		207	5 020	217 513	242 413
	Total	(9)	17 158	222 575	59 877	121 730	87 770	121 499	630 609	277 659	5 308	166 818	131 583		1 838	477 713	1 060 919	1 691 528
Adjustments	CIF/FOB adjustments on exports	(10)														- 3 303	- 3 303	- 3 303
	Direct purchases abroad by residents	(11)																
	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	17 158	222 575	59 877	121 730	87 770	121 499	630 609	277 659	5 308	166 818	131 583		1 838	474 410	1 057 616	1 688 225
GVA	Compensation of employees	(14)	2 606	41 261	18 537	70 563	69 589	110 413	312 969									312 969
	Other taxes less subsidies on production	(15)	- 737	91	- 1	- 1	- 941	1 045	- 544									- 544
	Consumption of fixed capital	(16)	3 718	18 116	2 247	18 045	13 424	52 821	108 371									108 371
	Net operating surplus	(17)	5 087	36 671	10 035	45 808	42 770	17 985	158 356									158 356
	GVA	(18)	10 674	96 139	30 818	134 415	124 842	182 264	579 152									579 152
	Total input at basic prices	(19)	27 832	318 714	90 695	256 145	212 612	303 763	1 209 761	277 659	5 308	166 818	131 583		1 838	474 410	1 057 616	
Volume index (T-1 = 100)																		
PRODUCTS	Agriculture	(1)	102.0	103.3	119.4	71.3	103.4	101.1	102.6	101.5			84.8		- 9.1	102.0	101.1	101.8
	Manufacturing	(2)	99.5	106.3	101.6	99.3	99.9	97.5	103.6	99.4		102.8	112.5		43.1	104.0	103.2	103.3
	Construction	(3)	100.7	126.0	109.8	102.3	101.2	99.8	105.9	103.3		96.0	101.9			91.6	101.4	103.4
	Trade	(4)	97.3	99.0	108.1	99.3	99.2	95.0	99.2	99.2						117.4	109.9	104.1
	Transport	(5)	100.0	97.7	100.0	101.7	108.4	96.4	101.5	100.8		97.3				104.9	103.9	102.7
	Communication	(6)	98.8	102.5	100.6	104.7	101.3	95.3	101.6	97.5	100.0		102.9		7.4	107.9	102.2	101.9
	Finance and business services	(7)	98.9	104.9	104.0	104.8	104.7	99.1	103.2	100.5	100.0	96.2	100.2			106.2	102.2	102.8
	Other services	(8)	99.4	103.6	98.5	107.8	102.7	99.1	101.5	101.8	99.8	99.7	98.2		72.6	103.1	100.2	100.4
	Total	(9)	100.2	105.7	105.1	102.7	103.8	98.6	103.2	100.2	99.8	99.8	105.6		42.7	104.4	102.4	102.7
Adjustments	CIF/FOB adjustments on exports	(10)														100.9	100.9	100.9
	Direct purchases abroad by residents	(11)																
	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	100.2	105.7	105.1	102.7	103.8	98.6	103.2	100.2	99.8	99.8	105.6		42.7	104.4	102.4	102.7
GVA	Compensation of employees	(14)	100.1	100.5	98.8	101.4	101.6	100.4	100.8									100.8
	Other taxes less subsidies on production	(15)	137.2	- 104.6	5.3	.9	94.4	136.4	55.5									55.5
	Consumption of fixed capital	(16)	101.6	100.8	101.5	100.3	100.4	102.0	101.3									101.3
	Net operating surplus	(17)	99.7	101.2	104.8	109.0	101.5	110.7	104.7									104.7
	GVA	(18)	98.6	101.0	100.9	103.8	101.5	101.9	102.0									102.0
	Total input at basic prices	(19)	99.6	104.2	103.6	103.3	102.4	100.6	102.6	100.2	99.8	99.8	105.6		42.7	104.4	102.4	

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Table 9.2 The Use Table in current prices and in volume terms (continued)

			INPUT OF INDUSTRIES							FINAL USE								Total use at purchasers' prices
										Final consumption expenditure								
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Households	NPISH	General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Use Table of T-1 at current prices																		
PRODUCTS	Agriculture	(1)	5 108	15 176	93	265	234	1 122	21 998	5 823			178		176	22 461	28 638	50 636
PRODUCTS	Manufacturing	(2)	8 926	148 356	25 043	25 305	7 297	30 707	245 634	120 960		8 919	45 974		3 820	344 074	523 747	769 381
PRODUCTS	Construction	(3)	292	1 323	22 247	1 534	2 161	15 686	43 243	450		607	53 047			2 246	56 350	99 593
PRODUCTS	Trade	(4)	110	2 970	307	7 347	2 082	596	13 412	4 683						6 603	11 286	24 698
PRODUCTS	Transport	(5)	286	3 260	159	22 630	2 517	1 933	30 785	5 535		490				21 835	27 860	58 645
PRODUCTS	Communication	(6)	172	3 004	1 084	13 401	7 835	6 439	31 935	10 806	860		6 748		27	8 531	26 972	58 907
PRODUCTS	Finance and business services	(7)	2 062	34 384	6 828	44 243	58 107	53 998	199 622	76 231	5	3 664	17 538			47 050	144 488	344 110
PRODUCTS	Other services	(8)	169	2 194	1 229	3 815	4 345	12 786	24 538	52 706	4 451	153 552	1 164		285	4 870	217 028	241 566
PRODUCTS	Total	(9)	17 125	210 667	56 990	118 540	84 578	123 267	611 167	277 194	5 316	167 232	124 649		4 308	457 670	1 036 369	1 647 536
Adjustments	CIF/FOB adjustments on exports	(10)														- 3 272	- 3 272	- 3 272
Adjustments	Direct purchases abroad by residents	(11)																
Adjustments	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	17 125	210 667	56 990	118 540	84 578	123 267	611 167	277 194	5 316	167 232	124 649		4 308	454 398	1 033 097	1 644 264
GVA	Compensation of employees	(14)	2 603	41 042	18 765	69 595	68 466	110 000	310 471									310 471
GVA	Other taxes less subsidies on production	(15)	- 537	- 87	- 19	- 106	- 997	766	- 980									- 980
GVA	Consumption of fixed capital	(16)	3 660	17 973	2 213	17 989	13 366	51 781	106 982									106 982
GVA	Net operating surplus	(17)	5 102	36 221	9 572	42 019	42 121	16 249	151 284									151 284
	GVA	(18)	10 828	95 149	30 531	129 497	122 956	178 796	567 757									567 757
	Total input at basic prices	(19)	27 953	305 816	87 521	248 037	207 534	302 063	1 178 924	277 194	5 316	167 232	124 649		4 308	454 398	1 033 097	
Value index (T-1 = 100)																		
PRODUCTS	Agriculture	(1)	107.9	113.6	122.6	77.4	106.0	97.2	111.0	102.0			80.3		- 51.7	99.7	99.1	104.2
PRODUCTS	Manufacturing	(2)	113.5	118.5	105.0	106.2	103.8	100.9	113.1	101.5		102.2	112.1		36.9	111.1	108.3	109.8
PRODUCTS	Construction	(3)	102.1	129.9	110.1	104.8	102.4	101.6	107.0	100.7		93.2	101.8			93.5	101.4	103.8
PRODUCTS	Trade	(4)	97.3	100.2	109.4	101.0	101.6	96.6	100.9	101.4						114.2	108.9	104.6
PRODUCTS	Transport	(5)	101.7	99.1	101.9	104.1	108.8	98.4	103.6	102.6		100.4				106.2	105.4	104.4
PRODUCTS	Communication	(6)	98.8	100.8	98.5	103.3	101.0	94.6	100.5	99.9	100.9		99.5		7.4	105.8	101.6	101.0
PRODUCTS	Finance and business services	(7)	100.2	105.7	104.4	105.6	106.5	97.9	103.7	102.3	100.0	97.8	95.9			105.1	102.3	103.1
PRODUCTS	Other services	(8)	101.8	105.1	100.6	110.5	105.2	104.7	105.5	104.5	103.6	99.9	99.8		72.3	104.9	101.2	101.6
PRODUCTS	Total	(9)	109.5	115.2	106.7	105.0	105.5	99.6	107.8	102.3	103.1	100.0	104.6		35.4	109.4	105.1	106.1
Adjustments	CIF/FOB adjustments on exports	(10)														109.1	109.1	109.1
Adjustments	Direct purchases abroad by residents	(11)																
Adjustments	Purchases in the domestic territory by non-residents	(12)																
	Total	(13)	109.5	115.2	106.7	105.0	105.5	99.6	107.8	102.3	103.1	100.0	104.6		35.4	109.5	105.1	106.1
GVA	Compensation of employees	(14)	102.8	102.7	100.1	103.2	103.2	101.8	102.4									102.4
GVA	Other taxes less subsidies on production	(15)	134.5	- 202.3	- 26.3	- 17.0	93.3	155.4	26.8									26.8
GVA	Consumption of fixed capital	(16)	100.6	101.5	100.9	100.2	99.2	99.7	100.1									100.1
GVA	Net operating surplus	(17)	79.6	107.5	96.8	101.4	97.8	114.9	102.3									102.3
	GVA	(18)	89.6	104.6	99.2	102.3	101.0	102.6	102.1									102.1
	Total input at basic prices	(19)	101.8	111.9	104.1	103.6	102.9	101.4	105.0	102.3	103.1	100.0	104.6		35.4	109.5	105.1	

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Table 9.3 Gross domestic product in current prices and in volume terms

Production approach		Income approach		Expenditure approach	
GROSS DOMESTIC PRODUCT					t at current prices
Total output at basic prices	1 238 414	Compensation of employees	318 040	Household final consumption expenditure	283 456
- Intermediate consumption	- 658 824	+ Other net taxes on production	- 263	+ NPISH final consumption expenditure	5 483
		+ Capital consumption	107 068	+ Government consumption expenditure	167 158
		+ Net operating surplus	154 745	+ Gross fixed capital formation	130 402
				+ Acquisitions less disposals of valuables	
= Value added at basic prices	579 590	= Value added at basic prices	579 590	+ Changes in inventories	1 526
				+ Exports of goods and services	497 347
+ Taxes less subsidies on products	63 339	+ Taxes less subsidies on products	63 339	- Imports of goods and services	- 442 443
= Gross domestic product	642 929	= Gross domestic product	642 929	= Gross domestic product	642 929
INFLATION					Annual change of prices in percent
Total output at basic prices	2.4	Compensation of employees	1.6	Household final consumption expenditure	2.1
- Intermediate consumption	4.5	+ Other net taxes on production	-51.7	+ NPISH final consumption expenditure	3.3
		+ Capital consumption	-1.2	+ Government consumption expenditure	0.2
		+ Net operating surplus	-2.3	+ Gross fixed capital formation	-0.9
				+ Acquisitions less disposals of valuables	0.0
= Value added at basic prices	0.1	= Value added at basic prices	0.1	+ Changes in inventories	-17.0
				+ Exports of goods and services	4.8
+ Taxes less subsidies on products	0.8	+ Taxes less subsidies on products	0.8	- Imports of goods and services	6.5
= Gross domestic product	0.1	= Gross domestic product	0.1	= Gross domestic product	0.1
GROSS DOMESTIC PRODUCT					t at prices of previous year
Total output at basic prices	1 209 761	Compensation of employees	312 969	Household final consumption expenditure	277 659
- Intermediate consumption	- 630 609	+ Other net taxes on production	- 544	+ NPISH final consumption expenditure	5 308
		+ Capital consumption	108 371	+ Government consumption expenditure	166 818
		+ Net operating surplus	158 356	+ Gross fixed capital formation	131 583
				+ Acquisitions less disposals of valuables	
= Value added at basic prices	579 152	= Value added at basic prices	579 152	+ Changes in inventories	1 838
				+ Exports of goods and services	474 410
+ Taxes less subsidies on products	62 866	+ Taxes less subsidies on products	62 866	- Imports of goods and services	- 415 598
= Gross domestic product	642 018	= Gross domestic product	642 018	= Gross domestic product	642 018
REAL GROWTH					Annual real growth rates in percent
Total output at basic prices	2.6	Compensation of employees	0.8	Household final consumption expenditure	0.2
- Intermediate consumption	3.2	+ Other net taxes on production	-44.5	+ NPISH final consumption expenditure	-0.2
		+ Capital consumption	1.3	+ Government consumption expenditure	-0.2
		+ Net operating surplus	4.7	+ Gross fixed capital formation	5.6
				+ Acquisitions less disposals of valuables	0.0
= Value added at basic prices	2.0	= Value added at basic prices	2.0	+ Changes in inventories	-57.3
				+ Exports of goods and services	4.4
+ Taxes less subsidies on products	-1.4	+ Taxes less subsidies on products	-1.4	- Imports of goods and services	3.5
= Gross domestic product	1.7	= Gross domestic product	1.7	= Gross domestic product	1.7
GROSS DOMESTIC PRODUCT					t-1 at current prices
Total output at basic prices	1 178 924	Compensation of employees	310 471	Household final consumption expenditure	277 194
- Intermediate consumption	- 611 167	+ Other net taxes on production	- 980	+ NPISH final consumption expenditure	5 316
		+ Capital consumption	106 982	+ Government consumption expenditure	167 232
		+ Net operating surplus	151 284	+ Gross fixed capital formation	124 649
				+ Acquisitions less disposals of valuables	
= Value added at basic prices	567 757	= Value added at basic prices	567 757	+ Changes in inventories	4 308
				+ Exports of goods and services	454 398
+ Taxes less subsidies on products	63 755	+ Taxes less subsidies on products	63 755	- Imports of goods and services	- 401 585
= Gross domestic product	631 512	= Gross domestic product	631 512	= Gross domestic product	631 512
NOMINAL GROWTH					Annual nominal growth rates in percent
Total output at basic prices	5.0	Compensation of employees	2.4	Household final consumption expenditure	2.3
- Intermediate consumption	7.8	+ Other net taxes on production	-73.2	+ NPISH final consumption expenditure	3.1
		+ Capital consumption	0.1	+ Government consumption expenditure	0.0
		+ Net operating surplus	2.3	+ Gross fixed capital formation	4.6
				+ Acquisitions less disposals of valuables	0.0
= Value added at basic prices	2.1	= Value added at basic prices	2.1	+ Changes in inventories	-64.6
				+ Exports of goods and services	9.5
+ Taxes less subsidies on products	-0.7	+ Taxes less subsidies on products	-0.7	- Imports of goods and services	10.2
= Gross domestic product	1.8	= Gross domestic product	1.8	= Gross domestic product	1.8

Netherlands 2011

D. Price and volume indicators in theory

9.42. The price and volume changes for aggregates are derived from price and volume changes of separate products preferably at a low level of aggregation. Ideally, price changes on the product level should refer to specific products, for example, every year the prices of exactly the same product can change (for example due to brand type, weight, quality, etc.) and should be observed. Generally speaking, in terms of quality, the greater the number of products in the SUTs, the better the requirement of matching appropriate values and prices will be achieved.

9.43. The price and volume indicators have to meet a number of requirements in order to be appropriate for estimating price and volume indices within the SUTs framework. These requirements are discussed in relation to the concept of output. However, they are applicable to all other transactions in goods and services. Examples of the requirements include:

- The prices and quantities should **relate directly to output**. This means that they should refer to complete end-products and not to contributory activities or to contributory intermediate or primary inputs. In the case of prices, they also have to refer to the right valuation, for example, output at basic prices.
- The prices and quantities should have **sufficient stratification** implying that different prices and quantities should be available for all different product groups making up the output.
- The product classification of prices and quantities should have **sufficient and detailed matching**. This requirement will be fully met, for example, if there is only one product in a product group. If there is more than one product within a product group, an additional requirement is that the composition of the product group does not change over time – this is more often not the case.
- The prices and quantities should be **sufficiently representative** for the product group. Usually, prices and quantities available do not cover all products of the product group and / or are based on a sample survey. Changes in the prices / quantities that are observed should be representative of changes in the prices and quantities that are not observed.
- If prices differ amongst users for the same products, then separate price indices should be collected and used, for example, this is very important when distinguishing price changes between domestic users and for export.
- The changes in values resulting from changes of quality should be excluded from the price index and included in the volume index.

9.44. The requirement of matching for volume estimation implies that the compilation of SUTs in volume terms will require much more detail in terms of products (and prices) than is necessary for the compilation of SUTs in current prices. However, preferably the classification of the SUTs in volume terms is similar to the level of detail of the SUTs in current prices.

9.45. The requirements of SUTs in volume terms forms one of many criteria to assess when considering the size of the SUTs – this covered in more detail in Chapter 4. A balance between the assumptions to be made in order to get enough detail to achieve homogeneity for price and values and the gain in quality must be taken into account when determining the classifications in the SUTs.

9.46. Mostly integral information, neither on prices nor on quantities, is available. Therefore, estimates will be based on limited information. It is recognised that limited price data and limited quantity data do not provide the same possibilities. It may be expected that price information from a sample with a certain size is more representative than quantity information from a sample of the same size. This statement is based on the consideration that if there is a competitive market for a "specific" product grouping, then there will be a tendency to use one price for the total supply of that product. In that case, a relatively small sample will be sufficient for observing the price and price changes of the total supply of that product.

9.47. However, changes in quantities are less liable to such equalising tendencies, for example, it is true that in an expanding market, all producers will try to increase their supply but the realization will depend on restrictive factors such as production capacity and financing facilities. Along with fast growing producers, there will be slow growing producers, and maybe, even shrinking producers. This implies in order to obtain reliable estimates for quantities, the samples will have to be (much) larger. As a consequence, it is common practice to derive price indices from price samples and afterwards compile data in volume terms by combining current price data and price indices. In many cases, this approach is efficient and cost-saving.

9.48. Although the standard price method can be applied for many goods and services, there are still a number of transactions for which observation of prices has not been realised or even not possible. The latter point refers to particular cases, in which, owing to the nature of the definition and measurement of output in current prices, the direct observation of appropriate prices is not possible, for example, non-market services, FISIM and insurance services.

E. Price and volume indicators in practice

9.49. This section briefly covers a range of price and volume indicators that may be available for the building blocks to produce SUTs in volume terms and is not meant to be exhaustive. These indicators should be considered applicable, as appropriate, to the various parts of the "H-Approach", for example, ensuring consistency as far as possible between the Supply Table components and the Use Tables components. The section covers:

- Supply Table at basic prices
- Use Table at basic prices
- GVA by industry
- Valuation matrices

9.50. The Chapter 15 of the 2008 SNA and the Handbook on Price and Volume Measures in National Accounts (Eurostat, 2016) provide much more details on the choice of index formulae.

1. Supply Table at basic prices

9.51. This section considers the domestic production of goods and services and imports of goods and services separately.

(a) Domestic production

Producers' price indices

9.52. The PPIs usually fulfil the general requirements for price indicators like valuation, adjustment for quality change and level of detail, and preferably separate prices are available for domestic sales and for exports. For total output, a weighted average should be used. Therefore PPIs are the best indicators for the deflation of output of goods and services (either by product as required or by industry).

9.53. For most PPIs, they are collected as producers' prices which will suffice for many industries. However, industries paying large amounts of excise duties (for example, oil, alcohol and tobacco) will require adjustments such as when "rates" have changed. One disadvantage of PPIs is that they are mostly Laspeyres type indices and might use fixed weighting schemes, generally updated only once every five years. This argues in favour of applying PPIs at the lowest possible level of detail when deflating the domestic supply of products for domestic consumption.

9.54. It is not always possible to observe prices directly because the concerning products are not the same over time, for example, unique goods and services and goods changing rapidly in quality such as computers, mobile phones, tablets, etc.

9.55. If the products in the Domestic Output part of the Supply Table sold for domestic consumption are deflated using PPIs (or adjusted to form basic price indices), then the same indices need to be used for the corresponding products in the Domestic Use Table on the right-hand side of the "H-Approach", thereby ensuring consistency as well as a balance. The Domestic Output part of the Supply Table that is sold for export should be deflated using Export Price Indices for consistency. Export price indices are covered later in this Chapter.

9.56. Price indicators other than direct observation for some products may have to be considered, for example: tariff indices, model pricing, hedonic price indices, unit value indices, consumer price indices, extrapolation by quantity indicators, input methods, and non-market production.

(i) Tariff indices

9.57. Certain types of services (for example, commercial services and services of general medical practitioners) are paid for by tariffs, for example, a fee per time unit. Problems with these types of indices are that changes in the quality of the services provided as well as changes in the productivity per time unit are not accounted for in this approach. So, tariff-based price indices are only appropriate deflators if adjustments can be made for changes of quality and productivity or when it is known for sure that such changes are within acceptable limits.

(ii) Model pricing

9.58. In the model pricing approach, the producers are asked to provide price estimates for typical products. Model price indices are candidate approximate deflators, when there are significant changes in product specification from one year to the next and especially in areas where products are unique. An important advantage is that since the same product or project is priced, the quality is unchanged. However, there are some disadvantages in areas like rapid product change and the degree of representation of the observed price change for total supply is questionable.

(iii) Hedonic price indices

9.59. Hedonic price indices are candidate deflators when product specification and quality change significantly. The method is based on an assessment of certain measurable characteristics that make up such a product, for example, in personal computers, memory and processing speed are two such characteristics. The main advantage is that quality changes are explicitly captured and thereby productivity changes are also taken into account. A serious drawback is the complexity of the method. Furthermore, the resulting quality adjustment factor seems to be highly dependent on the choice of the characteristics and the choice of the regression model.

(iv) Unit value indices

9.60. Unit value indices of a product can be derived when for both the current year and the base year information on value and quantity is available for domestic supply (for example, from production surveys). Dividing the values by the corresponding quantities gives so-called unit values. Under certain conditions a unit value index can be applied as a price index, for example, when a PPI is not available. However, a problem with unit value indices is that they often refer to heterogeneous products, and therefore, their usefulness is, generally limited to cases in which they refer to homogeneous (mass) products whereby the quality does not change rapidly over time.

9.61. For unit values, they are *quantity weighted* as opposed to the regular price indices, which will be *time weighted* (such as the annual average of monthly indices). In some cases, where quantities do not move smoothly over the year and prices vary a lot, unit values may be the only approach to get the correct relationship between current price value and volume. Thus we may often choose to rely on unit values for energy products and some agricultural products, with changes in inventories in current prices adjusted accordingly.

(v) Consumer price indices

9.62. For some products, CPIs can be used as approximate deflators for domestic supply. However, only in cases in which private households buy a considerable part, or all, of the supply of a product, and trade and transport margins and taxes and subsidies play a very small part in the value at purchasers' prices. Special attention has to be given to changes in tax rates, especially taxes like VAT. As only non-deductible VAT should be taken into account, any modification in the laws of VAT deduction rights must be treated in the same way as a modification of the rates of invoiced VAT and therefore as a variation of the price of the tax. This effect could not be fully detected if one uses CPI to deflate taxes because only the products of final consumption are considered in CPI, and not for example, those of intermediate consumption of exempt industries.

9.63. The CPIs are serious candidate deflators for service products mainly provided to private households. An advantage of CPIs is that they take account for changes in quality. On the other hand, most CPIs are Laspeyres type and might use fixed weighting schemes, generally up-dated only once every five years, and this is a disadvantage. This argues in favour of applying CPIs at the lowest level of detail as possible when deflating the domestic supply of products for domestic consumption.

(vi) Extrapolation by quantity indicators

9.64. Although the standard price method can be applied for many goods and services, there are still various transactions for which observation of prices has not been realised or even not possible. The latter refers to particular cases, where due to the nature of the definition and measurement of output in current prices, direct observation of appropriate prices is not possible, for example, non-market services, FISIM and insurance companies. If price observation is not possible, then the use of quantity information is an alternative.

9.65. As mentioned above, for some products, it is impossible to collect price data, and in order to decompose a value change in a price change and a volume change, quantity indicators must be used. For some industries, mostly object of government involvement (for example, public transport, medical services and cultural services) or government supervision (for example, banking and insurance), a lot of detailed quantity data are already collected by the NSOs or government agencies. Examples can be found in the medical sector (for example, number of in-patients of short-stay hospitals classified by diagnoses related groups), the cultural sector (for example, the number of visitors attending theatrical performances), and the banking sector (for example, the number of saving accounts, number of credits granted to commercial and private customers, number of payments on bank accounts). Of course, quantity indicators have to fulfil the general requirements concerning quality adjustment.

(vii) Input methods

9.66. Input methods use the weighted price or volume changes of intermediate and primary inputs as a proxy for the price or volume change of the output of an industry. The advantage of input methods for deflation within a SUTs framework, the necessary data are readily available, as all inputs exist in the SUTs in current prices, and can be deflated on the Use Table side consistently with the Supply Table side. It should be noted that the input method is recommended for capitalized R&D although it is not the total production of an industry. However a considerable disadvantage is that the price and volume indicators are not directly related to output. As a result, the change in GVA in volume terms, and also productivity changes of an industry, cannot be calculated in a proper way. For that reason, input methods have to be avoided as much as possible. Another disadvantage is that input methods can only be applied for the total production of an industry. A separate deflation of the different products of an industry is impossible. It should be noted that although the output method is recommended by the SNA, it should only be used when the method, and results, have been test carefully for an appropriate number of years.

(viii) Non-market production

9.67. Special attention must be paid to non-market production by general government and NPISHs. By definition the output of non-market producers in current prices equals the sum of the costs of inputs. As the SUTs accounting rules are valid both in current prices and in volume terms, it can be argued the output of non-market producers in volume terms equals the sum of inputs in volume terms. This implies that in fact an input method is applied. However, this approach introduces a considerable restraint on the estimation of volume and price indices for the non-market services. Independent estimates of GVA in volume terms and productivity changes are not possible if the input method is used. If non-market services contribute a significant amount in an economy, estimates of the volume growth of macroeconomic variables like GDP are liable to be biased if input methods are applied. Applying quantity methods can improve the estimates of output and GVA in volume terms. Preferably, the quantity indicators should be adjusted for changes in quality.

(b) Imports of goods and services

Import price indices

9.68. Import price indices usually fulfil the general requirements for price indicators like valuation, adjustment for quality change and detail. Therefore import prices are the best indicators for the deflation of import of goods and services. One disadvantage with most import price indices are that they tend to be Laspeyres type indices and may use fixed weighting schemes, generally updated only once every five years. This argues in favour of applying import price indices at the lowest possible level of detail when deflating the imports of goods and services. One problem is the limited availability of import price data covering services, so alternatives will need to be sought.

(i) Unit value indices

9.69. Foreign Trade Statistics often provide the value of imports as well as the corresponding quantities at a detailed level. Using this information, unit value indices can be derived. A problem with unit value indices when used for deflation purposes is that they often cover a heterogeneous set of product groups. Sometimes, the unit of measurement is kilograms or the unit is simply the number of items. This implies that in many cases, unit value indices suffer from heterogeneity issues. Therefore, the possibilities for their use as deflators are limited. However, if no appropriate information from price statistics is available, and the unit values refers to a similar mass products, for which the quality does not change rapidly over time, they may be applied as useful proxy deflators.

(ii) Other proxies

9.70. Generally, directly observed deflators for services are limited in terms of availability, and implies that deflation of services within SUTs may have to use proxies based on rough assumptions – nonetheless, deflation through SUTs ensures consistency. A good assumption may be for every product, the price generating conditions at the domestic market tend to bring about one price, which may hold for both domestic supply and imported services. In terms of the strength of this assumption, the price index of the domestic supply of a service is an acceptable proxy for the price index of the imports of that service. The validity of the assumption depends whether imports are a large part of the domestic market and/or if imported services are of same quality to domestically produced services.

2. Use Table at basic prices

9.71. In the ideal scenario, the Use Table at basic prices can be derived as sum of the Domestic Use Table at basic prices and the Imports Use Table at basic prices both in volume terms.

(a) Domestic Use Table at basic prices

9.72. Assuming a competitive economy, for the deflation of the Use Table with goods and services from domestic production, PPIs are appropriate price indices as (in the main, except areas like duty-related industries, as already covered) they are valued at basic prices. In cases where volume indicators are used for the compilation of the volume estimates in the Supply Table, the residually derived price indices (i.e. the implied price index derived from the difference between the value index and the volume index) can be used. If available, it is better to apply dedicated volume or price indices for specific transactions.

(b) Imports Use Table at basic prices

9.73. Assuming a competitive economy, for the deflation of the Imports Use Table, import prices are appropriate price indices. In cases where volume indicators are used for the compilation of the volume estimates in the Supply Table, the residually derived price indices can be used. If available, again, it is better to apply dedicated volume or price indices for specific transactions.

3. GVA by industry

9.74. Although GVA is not deflated directly, this section covers how GVA is established in volume terms and its constituents.

(a) Double deflation approach

9.75. Total GVA in current prices by industry is compiled as the difference between output and intermediate consumption of goods and services. For the estimates in volume terms, the same method is applied. As a result, following condition holds:

GVA in volume terms	*equals*	Deflated output
	less	Deflated intermediate consumption

9.76. The corresponding price and volume indices are derived afterwards. This approach is also known as the "double deflation" approach.

9.77. From a theoretical perspective, this approach is superior to the so-called single deflation methods, since this approach takes into account changes of both the composition of outputs and composition of inputs to derive GVA as a residual. With a "double deflation" approach, the volume index of GVA is the result of independent estimates of the volume indices of output and intermediate consumption, and the results are pre-eminently appropriate for productivity analysis. It is important to note, that additional quality assurance is often needed when establishing plausible volume growth rates, in particular, where intermediate consumption forms a large proportion of output. There are three variations of the "double deflation" approach.

9.78. *Double deflation.* As described, "double deflation" covers the deflation of current price estimates for output and of intermediate consumption separately using appropriate price indices. The volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

9.79. *Double extrapolation*. In double extrapolation, the previous year values of output and intermediate consumption are extrapolated using appropriate volume indices, and then the volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

9.80. *Extrapolation and deflation*. This is a combination of extrapolation of output of the previous year by a volume index and deflation of intermediate consumption of the current year by a price index, and then the volume estimate of GVA is derived by subtracting the volume of intermediate consumption from the volume of output.

(b) Compensation of employees

9.81. Compensation of employees is part of total GVA and it is useful to estimate it in volume terms as it increases the range of options for economic analysis using SUTs, for example, the results can be used in the analysis of labour productivity. Another application is in price analysis, for example, the price change of the output of an industry is linked, and explained, by the price changes of the inputs including compensation of employees.

9.82. Compensation of employees consists of two parts, wages and salaries, both in cash and in kind, and employers' social contributions. The deflation of both parts should be closely connected since both relate to the same labour input. So, both volume indices have to be the same, thus it is not necessary to estimate price and volume indices for both parts separately.

9.83. Since employers' social contributions are liable to complex legislation, it is difficult to observe their price index. This means that in practice, wages and salaries will be deflated, and the resulting volume index will also be applied in the calculation employers' social contributions in volume terms.

9.84. An important question relates to the appropriate unit of the volume of labour. Many candidate units suffer from heterogeneity, for example, the numbers of employed persons do not account for the number of hours worked per person. Even full-time equivalent jobs are not sufficiently adequate since they do not account for reductions in working hours and differences in education level, skill, etc. of the employees. Therefore, for the purpose of measuring the volume of the input of labour in an industry, the most appropriate quantity unit, may be the actual number of hours worked classified into education levels, skills, etc. The corresponding price is the value of this unit.

(c) Other taxes and subsidies on production

9.85. The payment of other taxes on production is related to the use of certain inputs in the production process or to socially unwelcome results of production processes. Examples of the former include taxes on real estate property, taxes on motorcars and motor-lorries owned by producers. An example of the latter are levies on pollution caused by a production process.

9.86. Taxes can be based on values (for example, the value of a building) or quantities (for example, tons of pollutants), implying that the deflation of other taxes on production is in principle comparable with the deflation of taxes on products, and that the same formulae are applicable. However, in practice the deflation of other taxes on production is more difficult because of a serious lack of appropriate indicators for price and volume.

9.87. In principle, price or quantity indicators can be used to derive other taxes on production in volume terms. However, because of the complexity of the tariff structure of most taxes, and the lack of appropriate data, quantity methods will prevail. The use of quantity indicators requires a direct link between them and the tax. For instance, the indicator for the tax on real estate property needs a direct relation to the amount of real estate property owned by producers. A candidate proxy indicator is the volume index of the total stock real estate property. The index of the total tons of emitted pollutants per kind of pollution tax could be an appropriate indicator for taxes on pollution. The price indices are derived afterwards from the combination of the value index and the volume index, and they can be applied for the deflation of the tax payments by industry.

9.88. The practical elaboration of volume estimation of taxes on production presented above can be similarly applied to subsidies on production.

(d) Gross operating surplus

9.89. Gross operating surplus in volume terms is a residual item calculated as GVA minus Compensation of employees and minus other taxes on production plus subsidies on production. Direct deflation of gross operating surplus is impossible because no appropriate price or volume indices are available. Furthermore, the economic interpretation of gross operating surplus in volume terms is questionable, and many view it as a meaningless concept.

4. Valuation matrices

(a) Trade margins

9.90. Trade margins are the remuneration for the services mainly provided by the trade industry to producers, consumers and exports in the distribution of goods. Trade margins can also be generated by industries other than the trade industry. As with other services, the appropriate deflation of trade services requires price or volume indicators directly related to the service provided. Next to the difficulty to define the services provided by the trade industry precisely, numerous aspects influence the quality of the services of the trade industry, for example, the amount of information given to the customers, after sales services, delivery time, assortment, quality of shop assistants and availability of parking lots. Therefore methods to observe or derive price and volume indices based on direct price and quantity indicators are not available.

9.91. As trade margins in current prices are defined as the difference between the value of goods sold and the value of the same goods purchased for resale by trade industry. An alternative, and theoretically sound solution, would be "double deflation", meaning independent deflation of sales and purchases for resale, and subsequently, calculate trade margins in volume terms as the difference. This approach requires high quality price indices for both purchases for resale and sales of products by the trade industry (and other industries as appropriate).

9.92. A third option is applying a proxy for the estimation of the volume index of the trade margin on a product, based on the assumption that the volume change of trade margins equals the volume change of the underlying product flow. An alternative way to formulate this proxy is to take as percentage of trade margins in volume terms to be applied on the product flow in volume terms, the percentage of the current prices of period t-1. The percentages of trade margin are defined as the ratio of trade margins and the relevant product flow valued at basic prices. In this option, the price change is a residual item derived from the current price trade margins and the trade margins in volume terms. This method provides better quality results when applied at a detailed product and industry level. By applying the margin rate in the previous year assumes no change in quality on the margin. Some countries do this by taking the mid-point rate between the two years but other approaches can be applied.

9.93. For every entry of the Use Table, if applicable, the trade margins in volume terms can be estimated as:

$$TR_{t/t-1} = TR_{t-1/t-1} \times VI_{flow}$$

where

$TR_{t/t-1}$= trade margins of t in prices of $t-1$

$TR_{t-1/t-1}$= trade margins of $t-1$ in prices of $t-1$

VI_{flow} = volume change of the underlying product

9.94. The underlying assumption is more valid, if the degree to which trade involved in the concerning transactions does not change from one year to another. However, the position of trade in a market, reflected in the "involvement rate" which can be defined as the ratio between turnover of trade and the relevant product flow which can differ from year to year. These changes influence the estimates in volume terms.

9.95. The relation of the flow and the turnover of trade can be written as:

$$VI_{trt} = F \times VI_{flow}$$

where

VI_{trt} = volume index of turnover trade

F = rate of trade in the product flow

Trade margins in volume terms can be written as:

$$TR_{t/t-1} = TR_{t-1/t-1} \times VI_{trt}$$

9.96. If $F = 1$, then the involvement rate of trade in the product flow has not been changed from period $t - 1$ to period t, and the volume index of the turnover of trade equals the product flow.

9.97. If $F \neq 1$, then the product flow assumption is not valid. In order to refine the estimates, the collection of data on involvement rates by product (and preferably industry) is necessary.

9.98. A further major improvement can be achieved by collecting a detailed breakdown of trade margins, by type of product, and by type of outlet, assuming that different outlets provide different qualities of services. In this way, the quality changes due to turnover shifts between outlets can be addressed.

(b) Transport margins

9.99. For transport margins, there is more than one way for estimating the volume estimates.

9.100. The first approach is similar to the method for compiling trade margins in volume terms - that is using the 'rates' of the previous year. This implicitly assumes that transportation costs are proportional to the value of the product and this may not be universally true.

9.101. An alternative option for the deflation of transport margins is the use of price indices for the output of transport industries. A necessary condition is the existence of a matrix of transport margins, by type of transport (column) and by type of product (row). By column, the price index of the relevant type of transport can be applied. The resulting volume change of the transport margins can be checked for plausibility with the volume changes resulting from the 'margin method'. Generally, it is expected that these two volume changes should be similar.

9.102. A further approach is to firstly derive volume estimates, by applying the volume changes of the transported products on the previous years' results, and secondly, inflate these with the appropriate price indices in order to arrive at current price estimates. Consequently, the initial current price estimates will then be overruled.

(c) Taxes on products

9.103. Taxes on products are taxes that are payable per unit of a certain good or service purchased. The tax may be a specific amount of money per unit of quantity of a good or service, or it may be calculated as a specified percentage of the price per unit or value of the goods and services purchased.

9.104. Taxes on products affect the price of a product and not the volume. This means that for deflation, for a specific product, it is a requirement that the volume index including any taxes on products equals the volume index excluding any taxes on products. As a result, also the volume index of the tax must equal the volume index at basic prices of the product on which the tax is applied. However, it should be noted that the **volume index of GVA for the whole economy will not necessarily move in line with the volume index of GDP** as there is no direct link between the volume of taxes on products (or subsidies on products) and the volume of GVA. The taxes on products are directly linked to the sales of goods and services, therefore relate to the volume of output and not GVA. The volume change of GVA is not necessarily the same as the volume change of output because the volume change of intermediate consumption might (will) be different as a consequence of more efficient production, outsourcing etc.

9.105. In the case of taxes on products on "quantities", for every entry of the Use Table, if applicable, taxes on products in volume terms can be estimated as:

$$T_{t/t-1} = T_{t-1/t-1} \times QI_{flow}$$

where

$T_{t/t-1}$ =tax on products t in prices of $t-1$

$T_{t-1/t-1}$ =tax on products $t-1$ in prices of $t-1$

9.106. Examples of this application cover excise duties on tobacco, alcoholic drinks and fuel.

9.107. In the case of taxes on products on "values", for every entry of the Use Table, if applicable, taxes on products in volume terms can be estimated as:

$$T_{t/t-1} = T_{t-1/t-1} \times VI_{flow}$$

where

$T_{t/t-1}$ =tax on products t in prices of $t-1$

$T_{t-1/t-1}$ =tax on products $t-1$ in prices of $t-1$

9.108. An example of taxes levied on prices is VAT.

9.109. In the case of taxes on products on "value", the price index of the tax is usually different for different transactions. The reason is that they depend on the price index of the value at basic prices of the transactions. Furthermore, different tariffs exist for different products.

9.110. This approach for calculating taxes on products can lead to odd looking results when a new tax appears or an existing tax disappears as shown in Box 9.1.

(d) Subsidies on products

9.111. The practical elaboration of the estimation in volume terms of the taxes on products presented above also applies in the same way to subsidies on products – thus the equations in that section also apply to subsidies on products (replace T with S).

9.112. It must be recognised that the assumption that the volume change of trade (and transport) margins and taxes and subsidies on products equals the volume change of the transactions at purchasers' prices can lead to unacceptable results – the focus is the volume change at basic prices. For products with a rapid increase of quality (for example, computers, mobile phones, etc.) and also the volume changes of the relevant valuation layers, include this 'change in quality'. This may lead to unacceptable growth rates of GVA and labour productivity for specific branches in wholesale and retail. Thus ad hoc adjustments may be needed.

9.113. Similar to taxes, new subsidies can appear or an existing subsidy disappears, and this is covered in Box 9.1.

Box 9.1 Treatment of newly introduced and disappearing taxes and subsidies

Newly introduced and disappearing taxes and subsidies

As described when using Laspeyres volume indices and Paasche price indices, taxes on products and subsidies on products affect the price of a product and not the volume, implying that the volume index of the value including tax (or subsidy) of a product equals the volume index of the value excluding tax (or subsidy).

As a result, the latter also equals the volume index of the tax (or subsidy) value. In case of newly introduced or disappearing taxes (or subsidies), these conditions give rise to remarkable results. In the example to demonstrate the impact, trade and transport margins are omitted for convenience. However, these results are in conformity with the registration of changes in taxes on products as a price change.

Newly introduced taxes on products

Applying the guidelines, the volume change at purchasers' prices equals the volume change at basic prices, implies that taxes on products in volume terms equal zero, while the current price amount is not zero, as shown in the table below.

	Year Current prices	Price index	Year t Volume terms	Volume index	Year t-1 Current prices
Output at basic prices	1 000	100	1 000	100	1 000
Taxes on products	100	0	0	0	0
Output at purchasers' prices	1 100	110	1 000	100	1 000

As expected the introduction of a tax on products results in an increase of the purchasers' prices.

Disappearing taxes on products

Applying the guidelines, the volume change at purchasers' prices equals the volume change at basic prices, implies that taxes on products in volume terms are not zero, while in current prices the amount equals zero, as shown in the table below.

	Year Current prices	Price index	Year t Volume terms	Volume index	Year t-1 Current prices
Output at basic prices	1 000	100	1 000	100	1 000
Taxes on products	0	0	100	100	100
Output at purchasers' prices	1 000	91	1 100	100	1 100

As expected the disappearance of a tax on products results in a decrease of the purchasers' prices.

5. Use Table at purchasers' prices

9.114. The Use Table at purchasers' prices can be derived from the Use Table at basic prices and the valuation matrices. In order to keep consistency in the system, the bridge columns between the Supply Table at basic prices and the Use Table at purchasers' prices are derived from the valuation matrices (row totals).

9.115. For the Use Table at purchasers' prices, alternative options for price and volume estimation are available using indicators appropriate for this valuation. This option leads to additional plausibility checks on volumes and prices, especially for the valuation matrices.

(a) Intermediate consumption by industries

9.116. Intermediate consumption price indices (ICPIs) usually fulfil the general requirements like valuation, adjustment for quality change and detail. Therefore ICPIs are the best indicators for the deflation of intermediate consumption of goods and services. A key problem is that ICPIs are very rarely collected by NSOs, and if available, do not cover intermediate consumption of services. Thus the "H-Approach", in a sense removes this problem by deflating at basic prices (or producers' prices) at a very disaggregated level by product, whereby a single price can be used for both output and intermediate consumption by product, thereby matching the price paid by the purchaser as the same price received by the seller.

9.117. In some cases, where ICPIs are not available, CPIs can be used as proxy deflators for intermediate consumption of products. An important requirement is that market conditions for intermediate use and areas like household final consumption expenditure are comparable. This means for example, the share of wholesale and retail margins in the purchasers' price is the same. An example of goods where intermediate use and household final consumption expenditure often show comparable price changes is fuel for motor-cars.

9.118. In a number of cases, the error in the estimation of total GDP due to the use of less appropriate price indices will be limited. When intermediate consumption is the main part of turnover of a domestically produced product, the under-estimation of intermediate consumption, and thus, over-estimation of GVA in one industry will be counter-balanced by an under-estimation of output (product, trade or transport margins) thus an under-estimation of GVA in another industry.

(b) Exports of goods and services

9.119. Export price indices usually fulfil the general requirements like valuation, adjustment for quality change and detail. Therefore export price indices are the best indicators for the deflation of exports of goods and services. A problem is that export price statistics covering services tend to be available on a limited scale. In addition, they tend to have the disadvantage of mostly being Laspeyres type indices and that use fixed weighting schemes generally updated only once every five years. This argues in favour of applying them at the lowest level of detail as possible.

9.120. *Deflation by unit value indices*. Foreign Trade Statistics often provide the value of exports as well as the corresponding quantities at a detailed level. From this information unit value indices can be derived. A problem with unit value indices when used for deflation purposes is that they often refer to heterogeneous product groups. The unit of measurement can be kilos or simply the number of products. That means that unit value indices in many cases suffer from heterogeneity issues. Therefore the possibilities for their use as deflators are limited. However, if no appropriate information from producer's price statistics is available and the unit values refer to similar mass products where the quality does not change rapidly over time, then they can be applied as useful proxies of deflators.

9.121. Presently, deflation using exports price data and unit value indices is only possible for export of goods. Direct deflators for services are limited in terms of their availability. A general problem is the exact observation of the exports by product group according to the classification in the SUTs. The second, and for deflation most important, problem is that the price observation of exported services is not a well-developed area in many countries. For that reason, in the national accounts for the deflation of the exports of services tend to resort to proxies based on rough assumptions.

9.122. A simple but rough assumption is that for every product, the price index for exports equals the price index of domestic production. Another possibility would be to collect information on the price changes of that service in the customer countries (see imports of services).

(c) Household final consumption expenditure

9.123. CPIs usually fulfil the general requirements such as valuation, adjustment for quality change and detail. Therefore CPIs are the best indicators for the deflation of household final consumption expenditure (for both goods and services). Most CPIs are Laspeyres type, which argues in favour of applying CPIs at the lowest possible level of detail. Balancing the SUTs at basic prices is complicated when CPIs are used due to the differences in valuation. Thus household final consumption expenditure deflated using CPIs should be used to validate the household final consumption expenditure deflated at basic prices and transformed to household final consumption expenditure at purchasers' prices, which is the right-hand side of the "H-Approach".

(d) Government consumption

9.124. Collective and 'individual' government consumption equals government production minus sale of market production by government and own account fixed capital formation. Estimates in volume terms can be derived following the same approach. For social benefits-in-kind, similar indicators as for consumption of households can be used.

(e) Gross fixed capital formation

9.125. Specific price indices for fixed capital goods usually fulfil the general requirements like valuation, adjustment for quality change and detail. Therefore, directly collected specific price indices for capital goods form the best indicators for deflation of GFCF in goods. A major problem is that price indices for capital goods are hardly ever collected as part of prices collection in NSOs but proxy producer price type indices are used. Again, the disadvantages are that price indices for capital goods are often Laspeyres type and that they use fixed weighting schemes generally up-dated only once every five years. This argues in favour of applying price indices for capital goods at the lowest level of detail as possible when deflating the domestic supply of products. For GFCF, more weight will be given to the deflation of GFCF through the basic price valuation to purchasers' price valuation on the right-hand side of the "H-Approach" when compared with the results using proxy price indices for capital goods.

(f) Changes in inventories

9.126. The calculations of changes in inventories in current prices and in volume terms are often closely interlinked. If high quality current price estimates can be made because reliable and appropriate data are available, then it is often possible to make high quality estimates in volume terms as well, since the same data are used.

9.127. In the ideal case, information is available on the exact times and quantities of additions to and withdrawals from the inventory and the price of the product at those times. Then it is in principle straightforward to calculate the changes in inventories in current prices and in volume terms. Additions and withdrawals have to be valued at the prices prevailing at the times at which they take place. The changes in inventories in volume terms can be calculated by valuing the quantities of additions and withdrawals at the average prices of the previous year.

9.128. In practice, the data available for the calculation of changes in inventories do not allow a 'perfect' estimation. Assumptions and approximations have to be made. The estimation methodology for changes in inventories (both in current prices and in volume terms) is highly dependent on the kind of information on inventories that is available. In general, enterprises will not provide data on quantities but only on the value of the level of their inventories at the beginning and end of the year according to their own bookkeeping system. This means calculating the current price value from the volume change is difficult as the adjustment for holding gains/losses is incorrect or missed. These bookkeeping systems also do not generally value inventories according to SNA rules but for example follow a historic cost system, LIFO system, etc. Therefore, these values cannot be used directly in the National Accounts. In order to calculate correctly the change in volume of inventories, information is needed on the bookkeeping system used in the enterprise. The first step is to estimate the change in volume, and then multiply the result with an appropriate price index to arrive at changes in inventories in current prices. As a result, the quality of this process, and the quality of the subsequent estimates, provides some scope to adjust the current price changes in inventories in the balancing process.

F. Input-Output Tables in volume terms

9.129. As with SUTs, IOTs can be compiled in volume terms. However, the reference year in particular can be a problem for IOTs because they are often compiled at irregular, non-annual intervals, for example, once every five years. This does not line up with other National Accounts data which are required by international standards to make use of the previous year as base year in the calculation of volume measures and the "chaining" of annual data at prices of a fixed reference year.

9.130. The SUTs in volume terms will generally be compiled at prices of the previous year. This enables the calculation of growth rates by comparing the volume measures with the current price values of the previous year. Results of "chaining" complete SUTs will not be additive, i.e. the SUTs will result in which the elements of a row will not add up to the row total, and likewise, for the columns. The resulting tables can only be used to analyse the time path of one particular element at a time. They cannot be used very well for example for the analysis of the time path of the total input structure of an industry or the market shares for a product.

9.131. For IOTs, if they are only compiled once every five years, it is of course possible to use the previous years' prices as well but the results cannot be used to calculate growth rates, which would clearly reduce the usefulness of such tables.

9.132. The alternative would be to compile IOTs in prices of the year five years prior to the current year, for example, the year 2010 in prices of 2005. This could be done by performing the same transformation process as for the current price IOTs but this would require the availability of coherent SUTs in the same valuation, which is a problem when "chaining" is used, as already mentioned.

9.133. Another possibility of deriving such IOTs is to deflate directly the IOTs in current prices by finding appropriate price or volume indices for the products. These should be indices of the price or volume change in the five years between the base year and the current year. This procedure implies the use of a different base year than for the SUTs in volume terms, introducing the risk of inconsistencies.

9.134. The recommended approach would be to compile IOTs annually, and to apply the same price and volume methodology as used for SUTs.

Chapter 10. Linking the Supply and Use Tables to the Institutional Sector Accounts

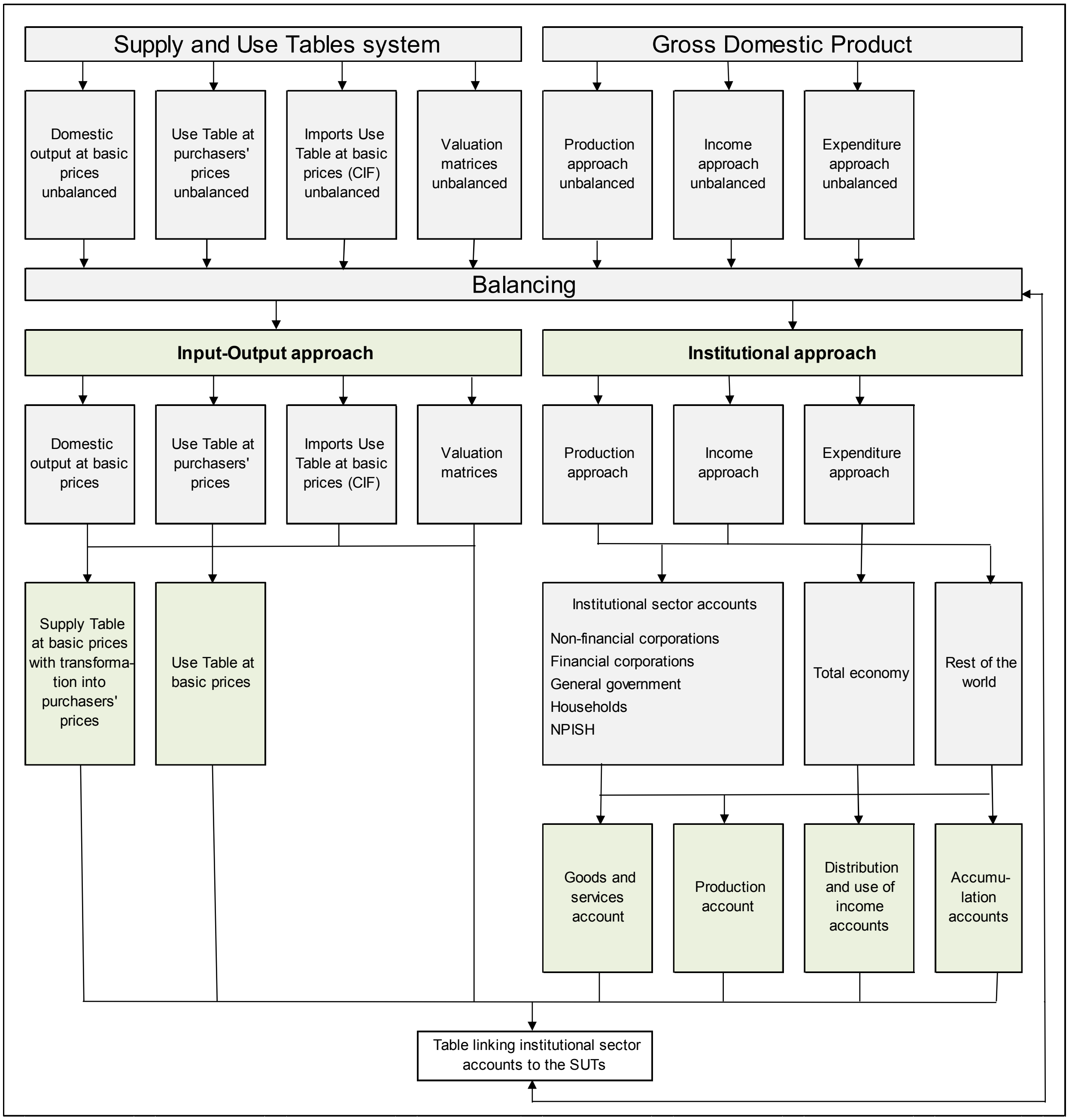
A. Introduction

10.1. When compiling SUTs, it is important that the SUTs are linked to, and consistent with, the institutional sector accounts of the SNA. This is fundamental to ensure a full integration of the accounts and also a full integration of the SUTs with the regular annual compilation of the National Accounts. Thus data in the SUTs, such as GVA and GDP, are consistent and coherent with the institutional sector accounts, and vice-versa. This is achieved through the compilation and balancing process of SUTs incorporating a table that cross-classifying data by industry, by type of factor incomes and by institutional sector.

10.2. Linking SUTs to the institutional sector accounts extends the role of SUTs to increase the quality, consistency and coherency of the National Accounts, where the SUTs have specific links bringing together parts of the National Accounts. Figure 10.1 shows the links between the industry accounts (for example, the SUTs system) and the institutional sector accounts as part of the balancing framework within the National Accounts. Figure 10.1 provides a different perspective from that illustrated in Figure 1.1 but a more detailed diagram linking the two parts of the National Accounts framework.

10.3. This Chapter describes the links between the SUTs and the institutional sector accounts. In particular, it starts in Section B with a description of the institutional sectors in the National Accounts and the differences in perspective of the institutional accounts and SUTs. Section C provides a description on how the SUTs are linked to the institutional sector accounts and the layout of the table linking these accounts. Section C also provides a numerical example of the linking table and how the SUTs are linked to the good and services accounts, production accounts and generation of income accounts. Section D presents various approaches to establish the link between the SUTs and the institutional accounts and describe some issues that may arise in the compilation of the linking table.

Figure 10.1 Links between the industry accounts and the institutional sector accounts



B. Institutional sectors and sub-sectors

10.4. The institutional sectors of the 2008 SNA group together institutional units on the basis of their principal functions, behaviour and objectives. The following institutional sectors are distinguished in the 2008 SNA:

- *Non-financial corporations* are institutional units that are principally engaged in the production of market goods and non-financial services. (2008 SNA, paragraph 4.94)

- *Financial corporations* consist of all resident corporations that are principally engaged in providing financial services, including insurance and pension funding services, to other institutional units. (2008 SNA, paragraph 4.98)
- *General government* consists of the following groups of resident institutional units: (a) All units of central, state or local government; (b) All non-market Non-profit institutions (NPIs) that are controlled by government units. (2008 SNA, paragraph 4.127). It consists of institutional units that, in addition to fulfilling their political responsibilities and their role of economic regulation, produce services (and possibly goods) for individual or collective consumption mainly on a non-market basis and redistribute income and wealth.
- *Households* consists of all resident households (2008 SNA, paragraph 4.158). Households are institutional units consisting of one individual or a group of individuals. All physical persons in the economy must belong to one and only one household. The principal functions of households are to supply labour, to undertake final consumption and, as entrepreneurs, to produce market goods and non-financial (and possibly financial) services. The entrepreneurial activities of a household consist of unincorporated enterprises that remain within the household except under certain specific conditions.
- *NPISHs* consists of all resident NPIs, except those controlled by government, that provide non-market goods or services to households or to the community at large. (2008 SNA, paragraph 4.31).

10.5. Table 10.1 provides a summary of institutional sectors, sub-sectors and between market and non-market producers. Often there is a misconception that the distinction between market and non-market producers corresponds to the distinction between private and public sector. This is not the case in the National Accounts. The public sector includes all resident institutional units controlled directly or indirectly by resident government units. In other words, the public sector consists of all units of the general government sector plus all resident public corporations (2008 SNA, paragraph 22.164). Therefore the public sector includes both market and non-market producers as long as they are controlled directly or indirectly by resident government units.

10.6. It should be noted that the SUTs and the institutional sector accounts reflect different views of looking at and measuring the economy. In the SUTs, the analysis by products and industries emphasises the production processes, the flows of goods and services, and the use of primary inputs (for example, capital, labour, etc.). Thus the units are chosen to reflect technical-economic relations, for example, units of production such as establishments. As a result, economic activities are studied from the viewpoint of the specific units that carry out the production. The balance between supply (resources) and uses of products constitutes the central element of this type of functional analysis.

10.7. In the institutional approach, the analysis focuses on the generation and distribution of income, and the investment and financing of capital by institutional sectors. In this case, the units are chosen that reflect the general economic behaviour of "institutional units" according to their economic objectives, functions and behaviour.

Table 10.1 Summary of institutional sectors and sub-sectors

Market / non-market producers	Institutional sectors	Sub-sectors (summary)
Market	Non-financial corporations	
Market	Financial corporations	Central Bank Deposit-taking corporations except the Central Bank Money market funds (MMF) Non-MMF investment funds Other financial intermediaries except insurance corporations and pension funds (ICPF) Financial auxiliaries Captive financial institutions and money lenders Insurance corporations (IC) Pension funds (PF)
Non-market	General government	Central government State government Local government Social security funds*
Market	Households	
Non-market	Non-profit institutions serving households	
n/a	Rest of the w orld	

* Social security funds may also be grouped at the various government level.

10.8. Table 10.2 provides a summary of the key features of the SUTs approach and institutional approach. The two types of approaches are linked and should be integrated via the linking table

10.9. Ideally, if a single common unit could meet both the needs of SUTs as well as the institutional sector accounts, this would further improve the coherency, consistency and compilation of the two areas of the National Accounts framework (see also Section D on the compilation methods). However, in the 2008 SNA the recommended unit for the SUTs is the establishment and for the institutional sector account is the institutional unit. Information on the legal status and ownership of the establishments is important for the cross-classification establishments into institutional sectors.

Table 10.2 Main features of SUT approach and institutional sector approach

	SUT approach	Institutional sector approach
Objectives	Production relationship Goods and services flows (equilibrium of resources and uses)	To record the economic data of institutional units grouped in terms of their economic objectives, functions and behaviour.
Accounts	Goods and services account Production account Generation of income account (integrated in the SUT framework)	A complete system of accounts: Goods and services account; Production account; Distribution and use of income account; Accumulation accounts, Balance sheets
Types of units: Elementary Aggregates	 Production units (establishments, etc.) Industries (type of economic activity)	 Institutional units (households, corporations, etc.) Institutional sectors

10.10. As an establishment always belongs to an institutional unit, it is possible to link the production activities of industries and institutional sectors. Output of an institutional unit is equal to the sum of the outputs of the individual establishments of which the institutional unit is composed, thus including deliveries between establishments within the institutional unit.

10.11. To clarify relationships and contents of industries and institutional sectors, the 2008 SNA proposes the cross-classification of GVA and its components (and if possible, also for output and intermediate consumption) by both industry and by institutional sector. This is essentially the GVA part of the Use Table broken down also by sectors to become the table linking SUTs to institutional sectors.

10.12. In order to implement the table linking SUTs and institutional sector accounts, it would be a great advantage to have good clear links between units and institutional sectors on the Business Register, and then in turn, also as a feature of business survey results. The split by institutional sector of units classified by industry would meet the compilation requirements. This would also facilitate similar cross-classifications for output, intermediate consumption and variables like GFCF and compensation of employees.

C. Table linking SUTs and institutional sector accounts

10.13. Figure 10.2 shows how the SUTs are linked to the sequence of accounts by institutional sector through a linking table. The linking table contains in the rows information by institutional sector on the following:

- Transaction of production accounts: total output and intermediate consumption.
- Transactions on the generation of income account: GVA, compensation of employees, other taxes less subsidies on production and imports.
- Transaction of the accumulation accounts: GFCF.

10.14. The linking table thus records complete data of three specific sector accounts of the whole system: the production account, the generation of income account and the accumulation accounts broken down simultaneously by industries (by column) and by institutional sector (by row). In this way, the systems inter-relations become clear and their coherence is warranted in both the institutional sector accounts and the SUTs.

10.15. The starting point for linking the SUTs to the institutional sector accounts is the Supply Table at basic prices including a transformation at purchasers' prices and the Use Table at purchasers' prices. Table 10.3 shows a numerical example of the linking table linking the SUTs in Tables 5.2 of Chapter 5 and Table 6.1 of Chapter 6 to the institutional sector accounts.

Figure 10.2 Link between the SUTs and institutional sector accounts

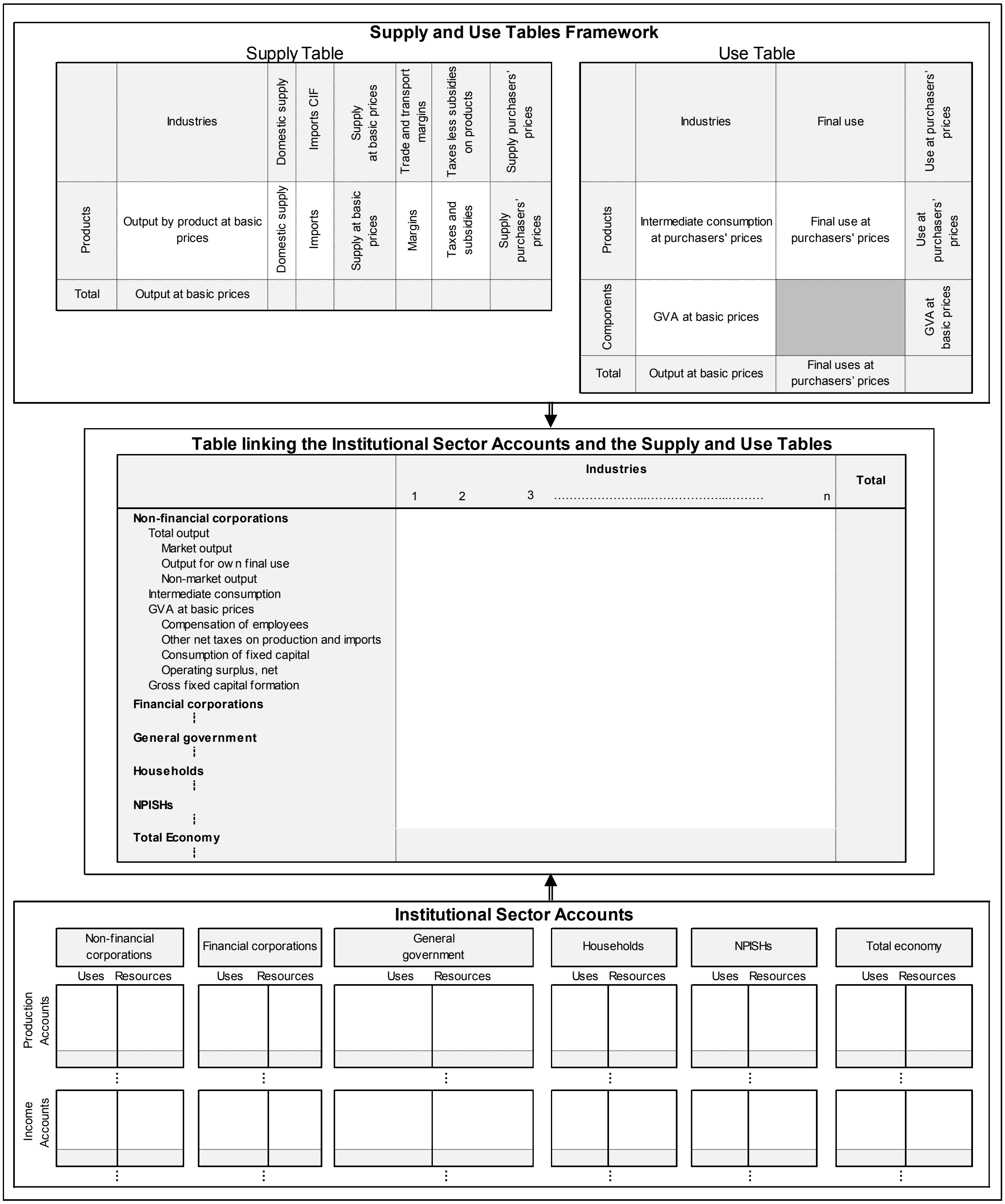


Table 10.3 Numerical example showing the table linking the SUTs and institutional sector accounts

Million Euro

INSTITUTIONAL SECTORS	INDUSTRIES						Total
	Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	
	(1)	(2)	(3)	(4)	(5)	(6)	
1. Non-financial corporations							
Total output	1 837	196 180	37 517	112 204	53 204	8 809	409 751
Market output	1 828	192 193	37 244	110 468	52 633	8 685	403 050
Output for own final use	9	3 988	273	1 736	571	124	6 701
Other non-market output							
Intermediate consumption	972	136 868	24 907	52 394	24 513	3 129	242 784
Gross value added at basic prices	864	59 313	12 611	59 810	28 691	5 679	166 967
Compensation of employees	349	29 839	9 247	32 573	13 008	4 912	89 928
Other net taxes on production and imports	- 133	1 017	479	1 360	955	- 340	3 337
Consumption of fixed capital	165	12 533	1 370	8 598	9 208	526	32 401
Operating surplus, net	482	15 923	1 515	17 279	5 519	582	41 300
Gross fixed capital formation	277	14 376	1 058	10 419	14 605	931	41 665
2. Financial corporations							
Total output					25 058		25 058
Market output					24 802		24 802
Output for own final use					256		256
Other non-market output							
Intermediate consumption					12 351		12 351
Gross value added at basic prices					12 706		12 706
Compensation of employees					8 125		8 125
Other net taxes on production and imports					926		926
Consumption of fixed capital					1 810		1 810
Operating surplus, net					1 846		1 846
Gross fixed capital formation					1 923		1 923
3. General government							
Total output	18	225		5 753	3 045	53 382	62 423
Market output	18	221		151	1 489	578	2 457
Output for own final use				300	314	2 223	2 837
Other non-market output		4		5 302	1 241	50 581	57 129
Intermediate consumption	13	149		2 555	1 366	15 609	19 692
Gross value added at basic prices	5	77		3 198	1 678	37 773	42 731
Compensation of employees	3	12		1 494	782	30 725	33 017
Other net taxes on production and imports	1	1		127	34	1 260	1 423
Consumption of fixed capital	1	20		1 582	625	5 890	8 118
Operating surplus, net	0	44		- 5	237	- 103	173
Gross fixed capital formation	2	11		2 318	1 251	5 661	9 243
4. Households							
Total output	8 012	3 544	7 413	16 880	28 141	9 096	73 086
Market output	7 918	3 503	4 218	16 782	9 391	8 847	50 659
Output for own final use	95	41	3 195	98	18 749	249	22 428
Other non-market output							
Intermediate consumption	4 455	1 975	2 559	6 270	8 307	2 746	26 311
Gross value added at basic prices	3 558	1 569	4 854	10 610	19 834	6 350	46 775
Compensation of employees	198	828	992	3 839	1 081	1 390	8 329
Other net taxes on production and imports	- 1 495	60	67	267	89	- 70	- 1 081
Consumption of fixed capital	1 622	249	183	777	7 264	580	10 675
Operating surplus, net	3 233	432	3 612	5 726	11 399	4 450	28 852
Gross fixed capital formation	2 036	129	101	586	12 114	887	15 853
5. Non-profit institutions serving households							
Total output						8 029	8 029
Market output						7	7
Output for own final use						74	74
Other non-market output						7 948	7 948
Intermediate consumption						2 356	2 356
Gross value added at basic prices						5 672	5 672
Compensation of employees						4 944	4 944
Other net taxes on production and imports						253	253
Consumption of fixed capital						475	475
Operating surplus, net						0	0
Gross fixed capital formation						734	734
6. Total							
Total output	9 867	199 950	44 931	134 837	109 447	79 315	578 347
Market output	9 763	195 916	41 462	127 401	88 315	18 116	480 975
Output for own final use	104	4 029	3 468	2 134	19 890	2 670	32 295
Other non-market output		4		5 302	1 241	58 529	65 077
Intermediate consumption	5 440	138 991	27 466	61 219	46 538	23 841	303 495
Gross value added at basic prices	4 428	60 958	17 465	73 618	62 909	55 475	274 852
Compensation of employees	551	30 679	10 239	37 906	22 997	41 971	144 343
Other net taxes on production and imports	- 1 627	1 077	546	1 755	2 004	1 103	4 858
Consumption of fixed capital	1 788	12 803	1 553	10 958	18 908	7 472	53 480
Operating surplus, net	3 715	16 400	5 128	22 999	19 001	4 929	72 171
Gross fixed capital formation	2 314	14 516	1 160	13 323	29 892	8 212	69 418

Austria 2011

10.16. Among the institutional sector accounts, the Goods and Services Accounts, the Production Accounts and the Generation of Income Accounts are important for balancing the SUTs and the institutional sector accounts.

10.17. If the Good and Services Accounts, Production Accounts, and Generation of Income Accounts are compiled and balanced in an integrated manner as part of the SUTs compilation and balancing process, then all of the components of the first three accounts of the National Accounts framework are available from the balanced SUTs. This ensures a high degree of consistency and coherency between the SUTs and the institutional sector accounts. In addition, there is a powerful data quality feedback loop from the institutional sector accounts affecting SUTs, and vice versa.

10.18. Furthermore, when the data for GFCF is compiled by industry, by product and by institutional sector and as an "integrated" input to the Use Table, this also provides a key link between the SUTs and part of the accumulation accounts. Although these could be compiled as a satellite system, they should be integrated as an input to the SUTs process and are available on a consistent basis after the SUTs are balanced.

10.19. Although this type of approach is recommended, in many countries the SUTs are compiled separate from the institutional sector accounts. See also Section D on compilation methods.

1. Goods and services accounts

10.20. The goods and services accounts show for the whole economy, the total supply of a product and how it has been used. The main components for the whole economy balance are:

Output + imports + taxes on products – subsidies on products (**Total resources**)
equals
Intermediate consumption + final consumption + gross capital formation + exports (**Total uses**)

10.21. The goods and services are traced through the economy from their original producers (either resident producers or producers abroad) to their users (either resident users or users abroad). With output being valued at basic prices and uses at purchasers' prices, then taxes on products less subsidies on products must be included in the resources part to ensure a purchasers' prices balance can be struck.

10.22. It is important to note that the goods and services account is by definition in balance and therefore has no balancing item, and all the components are available from the SUTs. In essence, all of these are totals of variables available in the SUTs. Table 10.4 shows a numerical example covering goods and services.

Table 10.4 Goods and services for the whole economy

Million Euro

Uses	Total	**Resources**	Total
Intermediate consumption	303 492	Output	578 360
Final consumption expenditure	226 258	Imports of goods and services	157 871
Final consumption by households	159 792	Taxes less subsidies on products	33 778
Final consumption by non-profit organisations	5 416	Taxes on products	34 416
Final consumption by government	61 050	Subsidies on products (-)	- 638
GCF	74 612		
GFCF	69 418		
Changes in inventories	2 335		
Acquisition less disposal of valuables	2 859		
Exports of goods and services	165 648		
Total	770 009	Total	770 009

Austria 2011

2. Production account

10.23. The Production Account shows the transactions relating to the production process and is drawn up for institutional sectors and for industries. For the whole economy, and for each institutional sector, the resources include output and the uses include intermediate consumption.

10.24. The Production Account generates one of the most important balancing items in the system, GVA, the value generated by any unit engaged in production activity and in turn, the link to the major aggregate, i.e. GDP. GVA is economically significant for both the institutional sectors and the industries.

10.25. As with balancing items for all the accounts, value added may be calculated before or after consumption of fixed capital is allowed for, therefore is available on a gross or net basis. Given that output is valued at basic prices and intermediate consumption at purchasers' prices, GVA will not include taxes on products and include subsidies on products.

10.26. The Production Account at the whole economy level includes in resources, in addition to the output of goods and services, the taxes on products less subsidies on products. This enables GDP at market prices to be obtained as a balancing item.

10.27. Again, all the components are available from the SUTs and are totals for the variables available in the SUTs. Table 10.5 shows a numerical example covering the production account for the whole economy. The same variables underpin the whole economy by the institutional sectors, except that GVA is shown instead of GDP as the balancing item in the uses side.

Table 10.5 Production Account for the whole economy

Million Euro

Uses	Total	**Resources**	Total
Intermediate consumption	303 492	Output	578 360
		Market output	480 989
		Output for own final use	32 295
		Non-market output	65 075
GDP	308 647	Taxes less subsidies on products	33 778
Consumption of fixed capital	53 469	Taxes on products	34 416
NDP	255 177	Subsidies on products (-)	- 638
Total	612 138	Total	612 138

Austria 2011

10.28. All the estimates for the Production Account for the whole economy in Table 10.5 can be derived from the SUTs in order to derive GDP. Alongside this, GVA by industry can also be linked and similarly derived from the same SUTs as shown in Table 10.6.

Table 10.6 Link between GDP and industries' GVA

Million Euro

Industries	Output	Intermediate consumption	Gross value added at basic prices	Taxes on products	Subsidies on products	GDP at market prices
Agriculture	9 867	5 440	4 427			
Manufacturing	199 950	138 991	60 959			
Construction	44 931	27 466	17 465			
Trade, transport and communication	134 837	61 219	73 618			
Finance and business services	109 461	46 538	62 923			
Other services	79 314	23 839	55 475			
Total	578 360	303 492	274 868	34 416	638	308 647

Austria 2011

3. Generation of income account

10.29. The Generation of Income Account analyses the extent to which GVA can cover compensation of employees and other taxes less subsidies on production. It measures the gross operating surplus, which is the surplus (or deficit) on production activities before account has been taken of the interest, rents or charges which the production unit must pay on financial assets or on tangible non-produced assets which it has borrowed or rented and must receive on financial assets or on tangible non-produced assets of which it is the owner.

10.30. The gross operating surplus corresponds to the income which the units obtain from their own use of their production facilities. Although the institutional sector accounts have balancing items in each of the accounts, gross operating surplus is the last balancing item in the National Accounts framework that can be calculated linking industries, institutional sectors and sub-sectors.

10.31. In the case of unincorporated enterprises in the household sector, the balancing item of the Generation of Income Account implicitly contains an element corresponding to remuneration for work carried out by the owner or members of his family which cannot be distinguished from his profits as entrepreneur. This is referred to as "mixed income".

10.32. In the case of own account production of accommodation services by owner-occupier households, the balancing item of the generation of income account is an operating surplus, and not mixed income.

10.33. The Generation of Income Account can also be presented by industries and is usually published with the main National Accounts releases. These can be shown as the industry columns of the Use Table and presented as sectors, sub-sectors and industries which are the source, rather than the destination, of primary income.

10.34. The importance of these industries (and underlying units) being the same as applied in the SUTs, Industry by Industry IOTs and the institutional sector accounts is essential. If not, it is not ideal but a clear bridge addressing the differences is needed.

10.35. All the components could be available from the SUTs and would be totals of variables available in the GVA part of the Use Table if the SUTs incorporated these components as part of the SUTs compilation and balancing process.

10.36. Table 10.7 shows a numerical example of the generation of income account for the whole economy. It is underpinned with a similar breakdown by institutional sector (and by industry) except that GVA is shown instead of GDP as the starting point, in line with GVA being the balancing item of the production account for each institutional sector.

Table 10.7 Generation of income account for the whole economy

Million Euro

Uses	Total	**Resources**	Total
Compensation of employees	144 343	GDP	308 647
Wages and salaries			
Employers' social contributions			
Taxes on production and imports			
Taxes on products	34 416		
VAT type taxes			
Taxes and duties on imports excuding VAT			
Taxes on products except VAT and import taxes			
Other taxes on production	4 858		
Subsidies	- 638		
Subdsidies on products			
Other subsidies on production			
Gross operating surplus	125 667		
Gross mixed income			
Total	308 647	Total	308 647

Austria 2011

10.37. The income approach to measuring GDP is obtained by summing together:

- gross operating surplus;
- compensation of employees;
- taxes on production and imports less any subsidies on production; and
- taxes on products and imports less any subsidies on products.

D. Compilation methods

10.38. With the tables linking the SUTs to the institutional sector accounts, a direct comparison can be made with information from the SUTs and the institutional sector accounts for each period. This at least guarantees that after the balancing process consistency is obtained between the SUTs and the sector accounts. Even after independently compiling the SUTs and institutional sector accounts, the linking table may be established to check the consistency of results.

10.39. A compilation procedure is so that, in a first stage, the SUTs on the one hand and institutional sector accounts on the other hand are independently compiled. In a second stage, the comparison between the two types of information is made in the linking table. In the case of incompatibilities of data, a revision process will start on both approaches until a new assessment is reached.

10.40. There are, however, other possibilities of compilation methods (see Eurostat, 2008) as shown in Box 10.1 to link the SUTs to the institutional sector accounts.

Box 10.1 Compilation methods for linking SUTs with the institutional sector accounts

General structure of the national accounts compilation procedure	The role of the linking matrix in the compilation process
Method A Independent compilation of SUTs and institutional sectors accounts.	Ex-post reconciliation of both approaches
Method B Compilation based on instruments and statistical sources of SUTs as a core element with a secondary role of institutional sectors accounts.	The linking matrix would be the first stage in the compilation of institutional sectors accounts.
Method C Compilation based on instruments and statistical sources of institutional sectors accounts with a secondary role of SUTs.	The linking matrix would be the first stage in the compilation of SUTs.
Method D Simultaneous compilation of SUTs and institutional sectors accounts.	The linking matrix as a central instrument in the compilation of the system of national accounts.

10.41. In Method A, the two approaches are elaborated in an independent way. The unique possible role of the linking matrix is to contrast them and to help in the reconciliation process. Method B and Method C represent two opposite alternatives in the compilation of National Accounts. Method B focuses on the production SUTs methods and corresponding sources of information. Method C promotes the institutional sectors from which SUTs elements will be derived. In both alternatives the role of the linking matrix is similar. It represents the missing link between the two approaches. When the SUTs approach is the starting point, the linking matrix gives data for the first two accounts of institutional sectors - production and generation of income accounts. In case institutional sector accounts are the main and initial stage, the linking matrix helps to distribute data over the different industries as a first stage of the compilation of SUTs.

10.42. The recommended approach would be starting simultaneously from an institutional and SUTs perspective as indicated in Method D. The advantage of this method is that the two different perspectives are totally compatible from the very beginning of the National Accounts compilation process. In terms of the relevance of the linking table, such a method would mean that the linking table is in the core of all the compilation process.

10.43. The statistical requirements for this method are, however, significant, at the same time, so are the benefits. The main aspect is that the databases should be structured according to the institutional sector with which the units are associated. As indicated in the linking table, there are five basic types of information required (broken down by institutional sectors) to prepare SUTs:

- Production data broken down into matrixes by products and industries and valued at basic prices, or at least the total for each industry.
- Intermediate consumption data, broken down by products and industries and valued at purchasers' prices, or at least the total for each industry.
- Data on the cost of primary inputs, particularly wage earners compensations (with a breakdown of wages and salaries and employers' social contributions), and consumption of fixed capital. These data should be disaggregated by industries.
- Data on the GFCF and stock variations broken down by types of products and industries. In the case of GFCF, the data are valued at purchasers' prices, while in the case of changes in inventories (stock variations) the data are shown at basic prices.
- Data on labour input broken down by the employers' industries and by employment category (wage and salary earners, self-occupied). Also defined by the amount of people employed and hours worked.

10.44. The availability of such cross-classified database allows for a simultaneous compilation of SUTs and institutional sector accounts and the overall improvement of all requirements to compile the national accounts as follows:

- One of main advantages of the linking table is that it allows the possibility to state and analyse the different types of production (market, non-market, for own final use) which depend on the institutional approach. Definition of the concepts of market output, output for own final use and other non-market output can only be understood by looking also at features of the institutional unit and the establishment that produce that output. The distinctions are defined in a top-down way, i.e. the distinction is first defined for institutional units, then for establishment (local KAUs) and then for their output.
- The simultaneous compilation of institutional sectors / industries aspects is a prerequisite for the estimation of "value added" type of taxes. If some details of intermediate consumption and GFCF are available in the suggested approach, then it is possible to achieve a more accurate compilation of VAT.
- The linking table allows a clear identification of non-market household production activities: the (imputed) production of rental services of owner occupied dwellings; output of household services produced by employing paid staff; own-account construction, etc.

10.45. When the compilation of the linking table is at the core of the compilation of National Accounts (as in Method D in Box 10.1), it is important to cross classify the original data by industry and sector. In this regard, it is important to keep the link between national accounting, from the one side, and business accounting and public finance, from the other side, as close as possible.

10.46. From the perspective of compiling the linking table, major problems arise from vertically integrated enterprises. A vertically integrated enterprise is one in which different stages of production, which are usually carried out by different enterprises, are carried out in succession by different parts of the same enterprise (2008 SNA, paragraph 5.23). Business accounting data will be consolidated, without specific detail on the stages and intra-enterprise transactions involved among the different units. This causes difficulties in distinguishing: intermediate consumption and other current costs as output of one stage which is, for example, intermediate consumption of another stage. Moreover, gross operating surplus may not be differentiated among the different parts of the enterprise, thus appropriate adjustments would be required – more details of the type of redefinition required is covered in Chapter 5.

10.47. The 2008 SNA recommends (see 2008 SNA, paragraph 5.26) that when a vertically integrated enterprise spans two or more sections of ISIC, at least one establishment must be distinguished within each section. With such a treatment, activities of units engaged in vertically integrated activities will not cross section boundaries of ISIC.

Chapter 11. Balancing the Supply and Use Tables

A. Introduction

11.1 The balancing of SUTs is a fundamental step in the compilation process of SUTs. The usefulness of the SUTs is underpinned by the set of identities between elements of the tables which allow to consistently integrate the components of the three approaches to measuring GDP.

11.2 In fact, since the SUTs are populated in the first stage with data derived from many sources each of which has its own sample and reliability margins, definitions and peculiarities, the basic identities of the SUTs are not met when the tables are first put together (as described in the previous chapters) and the resulting estimates of GDP emerging from the three approaches are likely to be very different, and different from year to year. In order to achieve a single, coherent and consistent estimate, all the identities and plausibility relations in the SUTs have to be met, and thereby the initial unbalanced SUTs need to be balanced, preferably with a time series perspective and not just a single period in mind.

11.3 The ideal scenario, linked to the "H-Approach" to the compilation of SUTs (as shown in Figure 9.1), implies that the full set of SUTs is balanced simultaneously at basic prices and at purchasers' prices as well as in current prices and in volume terms. In addition, if the balancing takes into account also the institutional sector accounts, IOTs, physical SUTs and EE-IOTs, balanced as a single package or sequentially, the integration and reliability of the system is greatly enhanced.

11.4 This approach, however, is demanding in terms of data, resources and computer systems. In practice, balancing will often be less extensive and more sequential procedures are applied. The sequential theme, may, for example, concern volume estimates, valuation matrices or the import matrix. The choice of a variant for the balancing process in practice depends upon criteria such as the availability of data. In the estimation of volume data, the application of appropriate price indices is a key factor to consider.

11.5 Whatever choice of the set-up of the balancing, it is important to recognise that any version of the SUTs or a particular stage of the process is not finished until all the subsequent estimates are made and checked for plausibility. The balancing phase is then an iterative process and feedback loops to earlier stages in the process improve quality of the final result as well as can indicate future improvements to source data.

11.6 The main objective of this Chapter is to provide an overview of the balancing of SUTs. Section B provides an overview of the basic identities that need to be satisfied in the SUTs system. Section C describes different methods of balancing - sequential and simultaneous methods - and a general approach to investigate and resolve inconsistencies. Section D describes a step by step procedure of a simultaneous balancing in current prices and in volume terms. Section E describes the benefits of extending the balancing to include also the institutional sector accounts, IOTs, physical SUTs and EE-IOTs. Finally, Section F provides a list of practical considerations for balancing. These include, for example, the use of automated and manual balancing procedures, the role of balancing in benchmark years and the importance of documenting the adjustments to the data. Annex A to Chapter 11 provides a numerical example of how the unbalanced initial SUTs are balanced through a simultaneous balancing process.

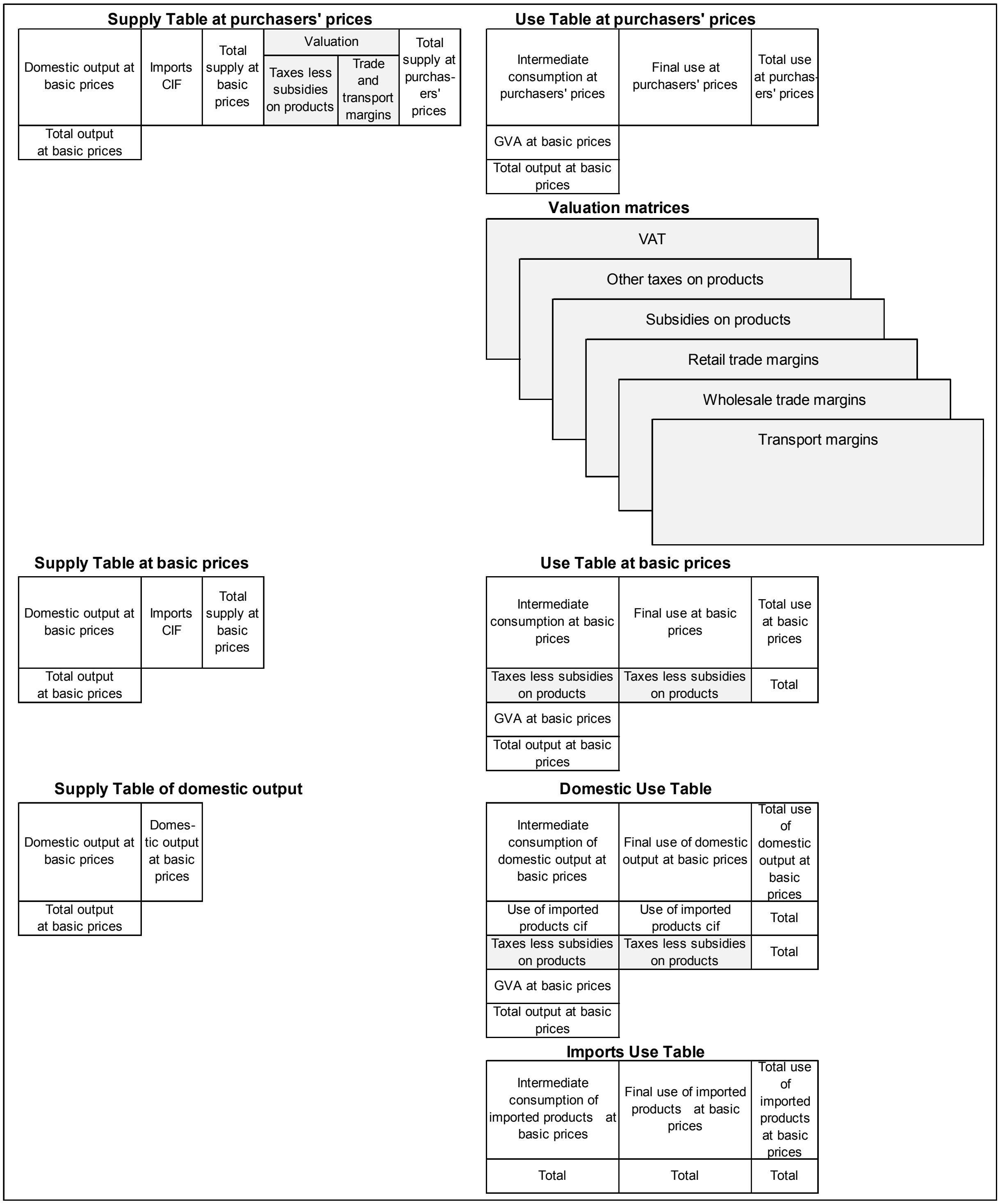
B. Overview of the system and basic identities

11.7 The balancing starts with a set of tables which consists of the following (in current prices and previous years' prices):

- SUTs at purchasers' prices
- Valuation matrices
- SUTs at basic prices
- Use Table at basic prices with split between Domestic Use Table and Imports Use Table.

11.8 Thus the full system of SUTs as presented in Figure 2.2 in Chapter 2 consists of SUTs both at purchasers' prices and basic prices and a set valuation matrices bridging the valuation gap between the Supply Table and the Use Table as well as the corresponding dimension covering previous years' prices. The Use Table at basic prices is also split between a table showing uses of domestically produced goods and services (Domestic Use Table) and a table showing the imports of goods and services (Imports Use Table). Although not shown here, the Domestic Output Table at basic prices is needed to be split between that for domestic consumption and that for export for the purposes of deflation as covered in Chapter 9. Figure 11.1 shows the full set of tables and matrices irrespective of the price basis. In addition, the IOTs at basic prices, IOTs of domestic output at basic prices and the Input tables of imports also play a key feedback role in terms of quality, coherency and consistency (whether through sequential or simultaneous balancing).

Figure 11.1 Simplified SUTs system



11.9 In the ideal case, all tables and matrices presented in Figure 11.1 are balanced simultaneously both in current prices (top-down in the scheme and the top left-hand side of the "H-Approach") and in volume terms (bottom-up in the scheme and the top right-hand side of the "H-Approach"). In doing so, implausible results like imports for a product smaller than re-exports (apart from when the re-exports have come from inventories) and negative values at basic prices can be avoided. In addition, the volume and price changes can be judged on plausibility with possibly implications for the current price estimates.

11.10 Being an accounting framework, the SUTs have basic identities which are directly linked to the three approaches to measuring GDP. With the inclusion of taxes and subsidies in the SUTs, differences will exist in the identities at the macro (total economy) and at the meso (product or industry) level.

1. Basic Identities of SUTs

(a) Supply = Use

11.11 The "total supply equals total use" identity has to be satisfied for the whole economy (macro level) and also for each product (product level). In the first case, at the macro level, this identity has to be satisfied at purchasers' prices. Total supply at purchasers' prices consists of domestically produced, and imported, goods and services plus taxes on products less subsidies on products. At the macro level, trade and transport margins do not appear separately in this identity because they are part of the output of goods and services at basic prices. Total use consists of intermediate consumption, final consumption of households and government, gross capital formation and exports, which are all valued at purchasers' prices.

11.12 At the product level, the "total supply equals total use" identity is defined both at purchasers' prices and at basic prices. In the first case, the total supply consists of domestically produced and imported goods and services, trade and transport margins plus taxes on products less subsidies on products. The total use consists of intermediate consumption, final consumption, gross capital formation and exports, which all valued at purchasers' prices.

11.13 In the case of basic prices, the total supply consists only of domestically produced and imported goods and services. The total use consists of intermediate consumption, final consumption, gross capital formation and exports, which are all valued at basis prices. In the basic price case, the trade and transport margins are treated as ordinary services.

(b) Output = Input

11.14 The "total output equals total input" identity also is defined at different levels: for the whole economy (macro level) and by industry (industry level). For the whole economy, the output is at basic prices and the input consists of intermediate consumption at purchasers' prices and GVA at basic prices.

11.15 At the industry level, this identity is also defined at basic prices. The output is defined at basic prices and the input consists of intermediate consumption at purchasers' prices and GVA at basic prices. The column totals of the valuation matrices appear as separate rows in the SUTs system at basic prices.

(c) Trade and transport margins 'used' = trade and transport margins 'produced' and 'imported'

11.16 In the Supply Table at purchasers' prices, the trade and transport margins appear in separate columns. These columns provide the total constraint for the relevant valuation matrices. This means that for each product, the trade and transport margins in the Supply Table has to equal to the sum by columns of the relevant valuation matrices (i.e. Retail trade, wholesale trade and transport margins).

*(d) Value change = volume change * price change*

11.17 When the above identities are not met, it is not always easy to discover the causes and therefore it is always helpful to have additional information. For example, incorporating price and volume information considerably helps to identify and analyse inconsistencies within the SUTs. Preferably, the basic identities mentioned above apply both in current prices as well as in volume terms. This requirement depends upon the choice of the index formulae. In this case, the combination of the Laspeyres volume index and Paasche price index formula ensures the identities in this section also hold for the volume terms.

11.18 With the inclusion of volume estimates, the SUTs identities in current prices and in volume terms have to be fulfilled, as well as the less strict relations between variables based on price and volume changes can be judged on plausibility.

11.19 When viewing the industries, the volume change of production is very similar to the volume change of intermediate consumption. This relation is stronger for the output goods and input of raw materials than for services. However, when there is a large difference between the two volume changes, this indicates there may be something wrong in the data and further investigation is advisable.

11.20 When combined with labour data, the volume changes of GVA can be used to calculate changes in labour productivity. It is important to note, that the labour data should be on the same basis (for example, using the same statistical unit) as the economic data. If so, then labour productivity is expected to rise gradually every year (except for periods like the start of a recession). A decrease or a high growth of productivity can also indicate possible mistakes in the data.

11.21 When viewing products, in a competitive economy, it is expected that price changes are more or less the same for all economic agents (except for areas like foreign trade). If the price change of a certain user deviates significantly from the average, this may indicate something is wrong and further investigation is advisable.

11.22 For household final consumption expenditure, the plausibility of volume changes of products for ‘general’ use, like food, can be evaluated comparing with other indicators like the growth of the population.

11.23 An optional check is to view time series of variables. Sudden breaks in time series can indicate a signal of implausible data in the SUTs. Again, further investigation is necessary before any conclusion that adjustments are necessary. For example, the impact of globalization, and fast changing ways of organising production processes by enterprises, can lead to justified breaks in time series.

C. Balancing

11.24 Balancing of the SUTs refers to the iterative process of reconciling differences between the different parts of the SUTs. For balancing, no general theory or mathematical programs are available whereby the “whole” process can be automated. There is a clear, controlled role for automated balancing techniques but after, and only after, all the significant imbalances have been resolved manually. However, in balancing it is very important to follow a systematic approach to solve the problems. Basic identities, checks on plausibility and credibility, investigation of possible causes of inconsistencies. This section reviews the two main approaches to balancing (sequential and simultaneous balancing) and provides a general guide on how to investigate sources of inconsistency.

1. Simultaneous or sequential balancing

11.25 The compilation of SUTs in current prices and in volume terms can be organised in two ways: through a sequential approach whereby the SUTs is balanced first in current prices, subsequently these SUTs are deflated and then the SUTs in volume terms are balanced; or through a simultaneous approach whereby the SUTs in current prices and in volume terms are balanced at the same time. At the end of the balancing process, the tables in current prices and in volume terms are available and balanced. There are various advantages and disadvantages of each approach but in general, the simultaneous balancing approach is recommended.

11.26 The main advantage of sequential balancing is that it is, in general, less complicated because one has only to deal with values in current prices during balancing and also because there may be a lack of reliable price data on a sufficiently detailed level. However, the major disadvantage of a sequential approach is that problems encountered while compiling SUTs in volume terms sometimes make it necessary to make changes in the current price tables that have already been finished, and perhaps even published.

11.27 In general, in the sequential approach, it is preferable to have an iterative procedure with feedback loops to the SUTs in current prices. Also the SUTs in current prices should not be considered as "final" until all tables of the SUTs system (including SUTs in volume terms) are checked for coherency and plausibility.

11.28 The main advantage of the simultaneous approach is that it gives the possibility of analysing value, price and volume indices in relation to each other. The outcome of the analysis may affect data in volume terms as well as current price data. In other words, all three indices must give a plausible picture. This clearly improves the quality of the outcome of the balancing process. It must also be mentioned that the simultaneous approach can be useful not only in the balancing phase but also in the phase in which basic data are prepared for National Accounts purposes. The approach offers the opportunity to check the data by comparing price and volume indices before they are entered in the system of SUTs. Simultaneous balancing in current prices and in volume terms may result in a different allocation of adjustments than balancing in current prices only.

11.29 The simultaneous approach requires that every transaction of the SUTs must be available, current prices, deflation detail and prices of the previous year. In order to calculate indices, the system also requires values in current prices of the previous year. For every entry in the SUTs, three values must be available:

- a value for year *t* in prices of *t-1*;
- a value in current prices for year *t-1*; and
- a value in current prices for year *t*.

11.30 Figure 11.2 illustrates the above detail presented in the form of a "Six Pack".

Figure 11.2 The Six Pack

Description	Data	Description	Data
t at current prices	525	Price index	102.9
t in prices of *t-1*	510	Volume index	102.0
t-1 at current prices	500	Value index	105.0

11.31 The "Six Pack" allows compilers of National Accounts and SUTs to cross-check consistency of data – analytical tools should ensure such analyses are readily available to aid validation and balancing. Although the results in current prices look plausible at first sight, analysis of the volume and price data can show implausible results and lead to adjustments in the current price data. Important checks are the comparison between changes in the volume of output by industry, its intermediate consumption and GVA. Especially when prices are changing rapidly, it is evident that analysis in volume terms is to be preferred, for example, in oil and chemical industries.

11.32 A major advantage of the simultaneous approach is that it provides the opportunity of analysing value, price and volume indices in relation to each other, and the impact of any adjustments on all items of the "Six Pack" immediately, in terms of plausibility, including the impact on macro and meso economic aggregates like GDP and GVA by industry.

2. Balancing – investigative dimension

11.33 In general, an effective way to approach the balancing process is to investigate the inconsistencies in the SUTs in a systematic manner. In the first step, one would select the large inconsistencies. In the second step, one would carry out a critical search for results of data processed for compiling the National Accounts. Especially in the Use Table, main items are the result of partitioning source data into product groups. The allocation may be changed without altering the original aggregates. In practice, one will see that not all problems can be solved in this way. In the third step, one would consult the expert knowledge of the statistician who is compiling the source statistics. If large inconsistencies still remain, a fourth step is to contact the reporting company for a critical discussion of the data they have provided.

11.34 The balancing is driven by two linked underlying themes: the reconciliation of estimates of **industry GVA between the income based and production based approaches**; and the reconciliation of **supply and use for each product, essentially through matching production and expenditure**. As all of the components of production, income and expenditure are integrated within a single framework, when the identities are reconciled, the estimates based on the three approaches will be equal.

11.35 It should be mentioned that these reconciliations must also ensure that consistency and coherency over time is also achieved. For example, consistency over time of individual series, both within the SUTs and in suppliers' own detailed series; consistency over time of aggregated series; consistency of estimates in current prices, estimates in volume terms and the implied deflators, both at the aggregate and component level; and consistency in terms of growth rates and levels.

11.36 When assessing these aspects, the impact of revisions to earlier years and the quality of the relative data sources are also taken into account.

11.37 It should be noted that, during the balancing, the basic identities of SUTs in current prices and, if applicable, in volume terms, must be satisfied and that the values in the SUTs are consistent and plausible providing a coherent set of price and volume changes. In a set of balanced SUTs, the identities of the framework are met as well as less strict plausibility relationships like volume change of output of goods resembles the volume change of intermediate consumption. Through the process of balancing, the detection of inconsistencies and implausibility's on the one hand, and finding the causes on the other hand, forms the most important part of the exercise. With this knowledge, the resolution of any inconsistencies is much more straightforward.

11.38 Any difference between total supply and total use of any product implies an inconsistency in the system, and forms the start for a balancing procedure in which one has to look for the cause by:

- analysing the transformation of source data and the validity of assumptions made, see the various compilation chapters.
- analysing the underlying source data, if necessary, at the unit level.
- discussing the data with experts in the respective areas or even survey respondents.
- analysing the data in the form of time series.
- carrying out a number of credibility checks, for example:
  - GVA to total output ratios, albeit recognising that activities like processing require careful consideration.
  - changes in the composition of GVA weights.
  - taxes on products, trade and transport margins as a proportion of supply and use of products.
  - search for outliers in price and volume ratios (if applicable).
- comparing data with other data sources (which are not from the statistical office or central bank), for example qualitative and quantitative covering specific industries/products like company reports, regulatory reports, trade association analysis, etc.
- comparing and reconciling incongruencies between different survey data sources providing different estimates for the same or similar variables (for example, turnover from monthly sources compared with audited annual sources).
- using other "proxy" indicators to help the identification of plausible SUTs variables, for example, VAT based indicators to compare with GVA and turnover.
- analysing related volume ratios for variables like, output and intermediate consumption.

11.39 Working with statistical data based on sample surveys and questionnaires, and influenced by non-response type issues, etc. implies working with reliability margins (for each cell), and therefore inconsistencies will exist. The cause will then be a statistical measurement issue. In such a case, balancing could be automated using the reliability margins of the statistics concerned as weights. Some of the methods of automated balancing described later in this chapter are based on this principle.

11.40 However, statistics are never ideal and inconsistencies are not only caused by sampling, etc. but may have causes due to a non-statistical nature. It is these causes of inconsistencies that make manual balancing essential, and necessary, as a preliminary step prior to any form of automated balancing.

3. Examples of causes of data inconsistencies

11.41 There could be several reasons for data inconsistencies and they can arise at various stages of the collection and processing of data. Some of the inconsistencies that are frequently encountered in the compilation of SUTs are presented below.

(a) Inconsistencies in data at the unit level

11.42 For the collection of data on sales and purchases, most statistical units like enterprises, establishments or kind of activity units are defined. These units consist of sets of legal units. In the simplest case, the statistical unit is the same as the legal unit but often the statistical unit consists of more than one legal unit. Having a well-defined statistical unit does not necessarily mean that it corresponds to, for example, tax units used by the company concerned for their tax declaration or to the level of consolidation in the bookkeeping. Where the respondent follows his bookkeeping or tax records, the reporting unit is not likely to be the same as the statistical unit. This can lead to missing data for certain legal units or even double-counting. This risk increases when data are collected by different agencies, for example, the national statistical offices, national central banks and the tax authorities.

11.43 Another ever-increasing and widespread cause of inconsistencies is the impact of globalization, reflecting aspects like production abroad and the trade flows associated with intellectual property products as well as the impact of whether there is or is not a change of economic ownership. When the unit in a country is the economic owner of all goods and services purchased and sold, it will report its worldwide activity in business statistics, even when the goods concerned never enter the country of residence of the unit. On the other hand, foreign trade statistics on goods are based on goods crossing borders, so goods that never enter the country of residence of the unit will be missing. In this case, there is an inconsistency between business statistics and Foreign Trade Statistics, which both serve as a source for the SUTs system. The UNECE *Guide to Measuring Global Production* (UNECE, 2015) provides much more detail on how handle these type of issues.

11.44 Examples of other causes of inconsistencies at the unit level are mismatches and mistakes. An example of a mismatch is the difference between the calendar year and the bookkeeping year, where for a significant number of units the bookkeeping year differs from the calendar year used in the National Accounts (and other annual statistics). Entering the bookkeeping data in the questionnaire causes inconsistencies in the SUTs when these data are confronted with other statistics.

11.45 The survey questionnaires for business statistics are designed in a way that data covering different branches can be compared and added together. The needs of users like National Accounts require specific definitions of variables in the survey questionnaires, which cannot always be derived directly from bookkeeping records. When a respondent uses their own definitions of variables, this may also cause inconsistencies in the SUTs.

11.46 When detailed information on variables like output and intermediate consumption is sought via survey questionnaires, it is possible respondents allocate products to the wrong CPC product code, leading to incomparable contents of product codes in the SUTs.

11.47 Last but not least, a business can provide incomplete data. If, for example, data on changes in inventories is lacking, the transformation from either sales to output and/or purchases to intermediate consumption cannot be made. This will in turn also affect GVA and GDP.

(b) Inconsistencies in processing survey data

11.48 The processing of collected micro data to subject matter statistics can cause inconsistencies. Although procedures for grossing up are routine, the target population is less straightforward. An important issue in this regard is linked to the update of the business register and the consequence of identifying correctly active or non-active units during the reporting period. A further related issue is the outlier detection and treatment.

11.49 Small enterprises often get less detailed survey questionnaires, implying the necessity to break down the aggregated variables to the level of detail of the large enterprises. The assumptions made for this calculation may be incorrect. The same holds for the breakdown of variables from business statistics to the product classification used in the SUTs. For the compilation of valuation matrices, the trade and transport margins and taxes and subsidies on production must be allocated to the various users (industries and final consumption categories). If little information is available on the level of detail, then a range of assumptions is applied, which may also lead to inconsistencies, especially in the SUTs at basic prices.

11.50 Another cause of inconsistencies can be the coverage of the hidden and informal economy. When no or insufficient estimates for the hidden and informal economy are included in the SUTs, inconsistencies will arise. When, for example, a consumer buys a beer in the pub, they usually do not know whether it is, economically speaking, an "illegal" (for example, smuggled) or a "legal" beer, implying that in household consumption a beer is reported, while in business statistics the "illegal" beer will be missing.

(c) Inconsistencies in volume data

11.51 Deflating SUTs data can itself generate inconsistencies in the SUTs in volume terms. As most price index numbers based on observation are Laspeyres indices, inconsistencies result when working on a level of aggregation above the observation of the price data. The observed price data often do not keep account of discounts, bulk purchases and negotiated prices (especially in business to business sales), implying that they do not always match with the actual value of the transactions. The impact is less so due to the different prices paid but the impact through changing weights on price changes. Also, if the discounts bulk purchases, etc. are a constant share overtime, there is little impact. In the process of balancing the full SUTs system, the implicit price indices resulting from the SUTs system have to be reconciled with the observed indices like the CPIs and PPIs by specific products.

4. Reliability of data in the unbalanced SUTs

11.52 An important and very useful step before starting with the balancing process is the assessment of the reliability and quality of the data in the unbalanced SUTs. In general, less reliable data will, and should, be adjusted to a relative higher degree. However, one should bear in mind that even weaker estimates cannot endlessly absorb inconsistencies, for example, positive changes in inventories for a product for a large number of consecutive years are implausible or generate implausible ratios or movements in ratios, for GVA as a proportion of output or trade margin as a proportion of domestic output at basic prices.

11.53 The quality of the estimates will influence the "role" the variable will play in the balancing process of the SUTs. Some variables are pre-determined when entered directly into the system and kept at their original value throughout the whole balancing process. For example, data on taxes and subsidies which are directly derived from government administrative data sources and data derived from exhaustive sources (like regulatory sources).

11.54 A perfect sample with a 100 per cent response rate can still generate inconsistencies. Although such source statistics can be judged as very reliable, they can still be adjusted in the balancing process. Estimates using models, for example fixed input structures based on the previous period, expert guesses, use of data for the previous period, etc. are likely to be adjusted earlier in the balancing process.

11.55 A ranking of the reliability of estimates for entries and aggregates in the SUTs is very useful to bear in mind, especially through the manual balancing phase. This ranking information is an essential input for any automated balancing procedures and this is covered later in this Chapter.

11.56 Box 11.1 and Box 11.2 provide two examples illustrating the simultaneous balancing process. With each example, it is very important to have details on the reliability of the data before starting to look for a solution or implementing any adjustments.

11.57 Box 11.1 illustrates a situation where the discrepancies are balanced in current prices and in volume terms. The value, price and volume analysis can lead to adjustment of any of the estimated variables. Sometimes the results can be checked with observed quantity data, for example, for the supply and use of energy products, often quantity data are also available. Another possible check in the simultaneous approach is the ratio of the volume of GVA and the input of labour.

11.58 The example in Box 11.2 shows that comparing volume indices of the main supplier and the main user indicates a solution for a balancing problem.

Box 11.1 Example of discrepancies balanced in current prices and in volume terms

The price and volume changes of domestic production and exports can be compared in the simplified example below (need to accept there may be inconsistencies between the price indices from supply and use side by using a simplified example). This example, for demonstration purposes only, excludes margins, taxes, subsidies and imports. The supply minus use shows the discrepancies between supply (domestic production) and use (exports and by other users) in current prices and in volume terms.

	Supply minus use	Domestic production	Exports	Other uses		Domestic production	Exports	Other uses
Value *t* in current prices	-10	525	420	115	Price index	102.9	100.0	103.6
Value *t* in prices of *t-1*	-21	510	420	111	Volume index	102.0	105.0	111.0
Value *t-1* in current prices	0	500	400	100	Value index	105.0	105.0	115.0

In this example, there is a discrepancy both in current prices and in volume terms. The first step is to get an idea about the reliability of the data. In this case, data on both domestic production and exports in current prices are considered to be very reliable. Thus a sensible solution would be to adjust "other uses". If the price index (102.9) is considered to be correct, the adjustment should be made both in current prices and in volume terms. This results with the following situation.

	Supply minus use	Domestic production	Exports	Other uses		Domestic production	Exports	Other uses
Value *t* in current prices	0	525	420	105	Price index	102.9	100.0	102.9
Value *t* in prices of *t-1*	-12	510	420	102	Volume index	102.0	105.0	102.0
Value *t-1* in current prices	0	500	400	100	Value index	105.0	105.0	105.0

The discrepancy in current prices has been eliminated but in volume terms a discrepancy remains. Assuming the price of domestic production are reliable figures, and assuming that the difference between the volume index of domestic production and exports should not be too large, then the balancing results in an adjustment of the price of the export and a minor adjustment of other uses.

	Supply minus use	Domestic production	Exports	Other uses		Domestic production	Exports	Other uses
Value *t* in current prices	0	525	420	105	Price index	102.9	102.7	104.0
Value *t* in prices of *t-1*	0	510	409	101	Volume index	102.0	102.3	101.0
Value *t-1* in current prices	0	500	400	100	Value index	105.0	105.0	105.0

Box 11.2 Example of simultaneous balancing comparing volume indices

Large discrepancies between volume changes of the main user of important raw materials and volume changes of the main supplier (for instance imports) are an indication for inconsistent data.

	Supply minus use	Domestic production	Imports	Main user	Other uses		Domestic production	Imports	Main user	Other uses
Value *t* in current prices	0	50	468	426	92	Price index	100.0	104.0	100.0	100.0
Value *t* in prices of *t-1*	-18	50	450	426	92	Volume index	100.0	100.0	103.9	102.2
Value *t-1* in current prices	0	50	450	410	90	Value index	100.0	104.0	103.9	102.2

In this example, no discrepancy between supply and use in current prices is assumed. The value indices of imports and the main user are both plausible: 104.0 and 103.9 respectively. However, analysis reveals that volume indices of imports and the main user differ: 100.0 versus 103.9, which is not plausible. Further analysis is necessary to find the solution for this balancing problem. It is not inconceivable that the value in current prices also has to be adjusted.

5. Documentation

11.59 Many decisions leading to corrections, adjustments and subjective estimates are entered by the balancers, and these may provoke a struggle when referred to other statistical and available sources or with common sense considerations. Thus, it is important that the considerations and rationale behind the solutions implemented are visible to other balancers, and the solutions are sustainable and can be re-produced if the same problems are encountered in subsequent years. Such corrections should be recorded in a systematic way.

11.60 It is also important to record separately the steps and links between the source data through to the balanced data so that they can be reviewed in subsequent balancing exercises to investigate source data incoherence, bias, etc. (Mahajan and Penneck, 1999). For example:

National Accounts source data (covering business survey data, household survey data, census data, administrative based data, extrapolations and models (for example, PIM, FISIM), company accounts based data, etc.)

plus coverage (including exhaustiveness) adjustments

plus conceptual adjustments

plus quality (data validation) adjustments

plus balancing/coherency adjustments

equals **National Accounts final estimates** on 2008 SNA basis

11.61 Balancing adjustments can, and should, be part of a process table describing the steps from the source statistics to the final estimates in the balanced SUTs. If the balancing adjustments are recorded in a systematic manner, they can point to flaws in source statistics or even a bias in the balancing process itself. Again, the feedback loop can be powerful in that suppliers of source data can improve survey questionnaires, data collection, data processing, etc. cumulatively improving the quality of the National Accounts estimates.

D. A step by step procedure for simultaneous balancing

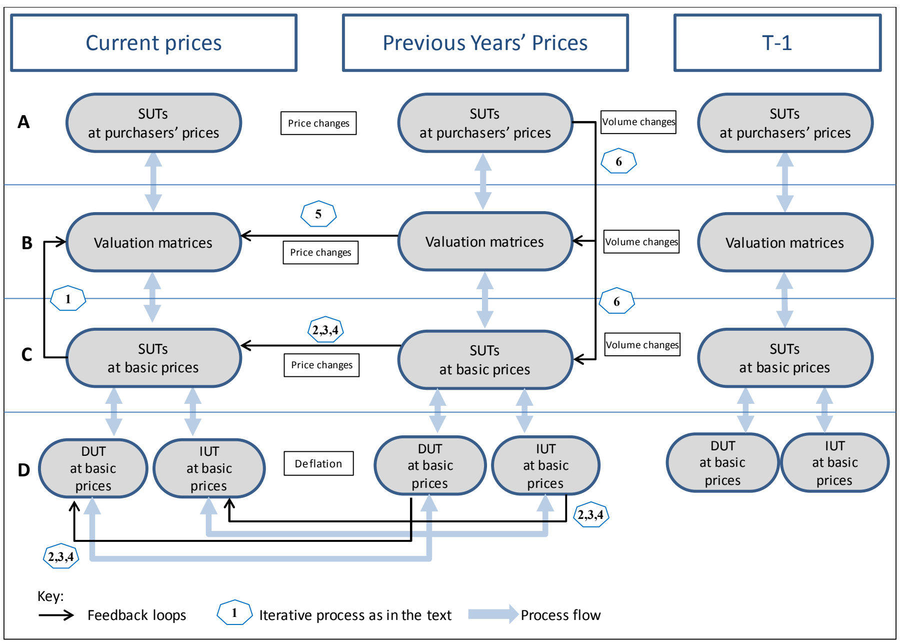
11.62 This section provides a step by step process for the simultaneous balancing of SUTs in current prices and in volume terms. The process presented below relies on a sequence of tables which starts from the SUTs at purchasers' prices, valuation matrices, SUTs at basic prices, and the Domestic Use Table and Imports Use

Table at basic prices. An alternative sequence could be to split the SUTs at purchasers' prices into the Domestic Use Table and Imports Use Table at purchasers' prices. However, the latter is not a commonly used sequencing of tables and the first is the recommended approach to the compilation of SUTs.

11.63 Figure 11.3 provides a scheme on how to carry out the balancing of SUTs indicating what types of balancing in done at each step. Note that balancing is an is iterative process, so the figures shows a number of feedback loops that need to be done in order to arrive to a final set of balanced SUTs in current prices and volume terms.

11.64 At the start of the balancing process, an estimate is available for all entries in the full SUTs system both in current prices and in volume terms. In combination with balanced and fixed data of the previous year, volume changes can then be compiled. The balancing effort starts by checking all the inconsistencies and implausible estimates in the system. This is summarised in the sequence of steps below.

Figure 11.3 An overview of the SUTs balancing framework for simultaneous balancing



(a) Differences between supply and use of products at purchasers' prices in current prices

11.65 These types of checks are represented in Part (A) in current prices in Figure 11.3. Differences between supply and use of products at purchasers' prices in current prices point towards inconsistencies possibly caused by data processing with National Accounts (for example, transformation to National Accounts definitions and requirements) or by inconsistencies in observed data (for example, as a result of the impact of globalization).

(b) Unwanted negative entries in the SUTs at basic prices - Part (B) and (C) in current prices

11.66 These types of checks are represented in Part (B) and Part (C) in current prices in Figure 11.3. The unwanted negative entries in the SUTs at basic prices can be caused by mistakes in the calculation of the valuation matrices, which would lead to a recalculation of these matrices. This is an iterative process until all unwanted negatives are eliminated and the valuation matrices look plausible. However, in some cases, negative entries are plausible in areas like changes in inventories or exports of goods (for example, merchanting). This step forms the first key iterative process of "balancing" the SUTs system (heptagon 1 in the figure).

(c) Differences between supply and use of products at basic prices in current prices

11.67 These checks are represented in Part (C) in current prices in Figure 11.3. These differences will point towards inconsistencies like those covered in (a) above due to issues such as data processing inconsistencies in observed data.

(d) Inconsistencies between domestic supply and use of products from domestic origin and use of imported products in current prices

11.68 These checks are represented in Part (D) in current prices in Figure 11.3. The Use Table is initially split into the Domestic Use Table and Imports Use Table independently of the Supply Table. Thus there may be inconsistencies at the product level such as, for example, the value of exports is larger than the value of domestic supply or the value of re-exports is larger than the value of imports. In these cases, values need to be adjusted. The breakdown of the supply of domestic and imports in the Supply Table can also be used to inform the split between the Domestic Use Table and Imports Use Table.

(e) Differences between the supply and use of products at basic prices in previous years' prices

11.69 These checks are represented in Part (C) and Part (D) in previous years' prices in Figure 11.3. When starting with balanced SUTs in current prices, the differences between supply and use of products in volume terms point towards inconsistencies in the applied price indices. For example, not deflating domestic output and exports separately or not using an appropriate weighted-average. Furthermore, there may be weaknesses in the PPIs regarding details on discounts, bulk purchases and negotiated prices which can cause inconsistencies. In addition, being a Laspeyres type index can also play a role in generating inconsistencies.

11.70 These checks can also point at errors in the SUTs in current prices. In this case, the SUTs in current prices need to be rebalanced. This forms the second key iterative process in balancing the full SUTs system (heptagon 2 in the figure).

(f) Plausibility of volume changes of output and intermediate consumption

11.71 These checks are represented in Part (C) comparing the SUTs in previous years' prices and the SUTs for period t-1 in current prices in Figure 11.3. When combined with previous years data, the deflated SUTs at basic prices in previous years' prices provides the framework to judge the volume changes of output, intermediate consumption and GVA at the industry level. Implausible results will need adjustment of the estimates in volume terms, and if necessary, the current price estimates in the SUTs. This forms the third iterative process in balancing the SUTs system (heptagon 3 in the figure).

(g) Plausibility of changes in labour productivity

11.72 These checks are represented in Part (C) comparing the SUTs in previous years' prices and the SUTs for period t-1 in current prices in Figure 11.3. Similar to the changes in volume of output and intermediate consumption, the changes in labour productivity can be used to assess the plausibility of the resulting GVA in volume terms at both the macro level and the industry level. Implausible results will require adjustment of the estimates in volume terms, and if necessary, the estimates in current prices in the SUTs. This forms the fourth iterative process in balancing the SUTs system (heptagon 4 in the figure).

(h) Confrontation of implicit price indices of valuation matrices and observed PPIs and changes in tariffs

11.73 These checks are represented in Part (B) in Figure 11.3 confronting the valuation matrices for period t in current and previous years' prices. The volumes for the valuation layers are calculated by applying the rates of the previous year to the estimates in volume terms. Therefore, for all entries of the valuation matrices, implicit prices can be compiled. If available, observed producer prices indices can be compared with these implicit prices indices. It is likely there will be possibilities for a data confrontation for specific areas, for example, transport services. For taxes and subsidies linked to the value of the concerning transaction (for example, VAT), the changes in tariffs can be used to assess the plausibility of the implicit prices. Implausible results will need adjustment of the estimates in volume terms, and if necessary, the current price estimates in the SUTs. This forms the fifth iterative process in balancing the SUTs system (heptagon 5 in the figure).

(i) Confrontation of implicit purchasers' price indices resulting from calculation and observed purchasers' price indices like the CPIs

11.74 These checks are represented in Part (A) in Figure 11.3 confronting the SUTs for period t in current prices and in previous years' prices. The SUTs in volume terms at purchasers' prices is compiled as sum of the SUTs at basic prices and the valuation matrices (all in volume terms). When the SUTs at basic prices are balanced, the SUTs at purchasers' prices are by definition also balanced. At this point in the balancing process, a confrontation of observed purchasers' price type indices like the CPI and the calculated implicit purchasers' price indices may show that the latter may be implausible, albeit they should not be the same. If there are significant differences, then the estimates in volume terms of all underlying component tables (the valuation matrices, and the SUTs at basic prices) may need to be reconsidered. This forms the sixth iterative process in balancing the SUTs system (heptagon 6 in the figure).

(j) Overall assessment of the second order effects of balancing steps (a) to (i)

11.75 Through the balancing procedure, the trade and transport margins are very likely to be adjusted as a result of manual and automated corrections. As a consequence, the total use of trade and transport margins will likely not equal the total supply, even if they were in balance in the initial version of the system, and will require to be constrained.

11.76 Similarly, VAT should be recalculated based on the adjusted results in the Use Table. The total of non-deductible VAT which is the result of the balancing procedure cannot be expected to exactly match the VAT receipts based on government accounts. If only official rates and tax legislation is used in the calculations, the computed VAT total will normally exceed the target, this is closer to the concept of theoretical VAT as opposed to the cash-collected VAT (on an accrued basis). However, to be realistic, the model used to estimate VAT should take into account the expected patterns of tax evasion by keeping account of various issues like the hidden economy. Nevertheless, the total estimated VAT will not equal the government data automatically, so final corrections will be needed. It may be preferable to proportionally adjust VAT in specific columns, where the exact share of VAT liable is uncertain. A final proportional adjustment of VAT on many products, most likely to be household final consumption expenditure, can be used to eliminate the remaining difference.

11.77 One important final check is to ensure that the resulting effective (and implied) tax rates do not exceed the legal rates, for example, the standard rate of VAT.

E. Alternative balancing methods

11.78 The ideal balancing scenario covered in the previous section based on the "H-Approach" consists in simultaneously balancing SUTs at basic prices and at purchasers' prices both in current prices and in volume terms. This balancing is data demanding and the choice between simultaneous balancing and any other variation of balancing methods heavily depends upon the availability of data, human resources and IT systems. If the ideal scenario is not possible, then alternatives can be considered such as, for example, balancing the SUTs at purchasers' prices and balancing at basic prices or prioritising between them or an iterative process with feedback loops.

11.79 The choice in selecting alternative scenarios will have different consequences, especially for the use of price indicators. In the ideal scenario, the price indicators match optimally with the SUTs being deflated in terms of underlying flows and valuations. Diversion from the ideal scenario will require additional compilation, assumptions and approximations in the use of price indicators.

1. Balancing SUTs at basic prices

11.80 Assuming that the balancing process is not ended before all components of the full SUTs are checked for plausibility, the balancing at basic prices only is a close approximation of the ideal scenario.

11.81 Balancing at basic prices requires stripping out the trade margins, transport margins, taxes on products and subsidies on products from the initial current price Use Table at purchasers' prices. The deflation of the SUTs then takes place at basic prices applying PPIs and import prices for the Supply Table and a weighted average of those indicators for the Use Table. Weights could be derived from the Domestic Use Table and Imports Use Table of the previous year. When the SUTs are balanced both in current prices and in volume terms, the volume changes of the valuation matrices can be compiled applying the volume changes of the corresponding entries of the Use Table.

11.82 Then, the SUTs at purchasers' prices including non-deductible VAT can be derived both in current prices and in volume terms. The resulting price indices can be checked for plausibility with observed indices on consumption of households (for example, the CPIs) and export price indices as in the ideal scenario. The price indices resulting from the sequentially compiled Domestic Use Table and Imports Use Table can also be checked for plausibility with the observed PPIs and import price indices.

2. Balancing SUTs at purchasers' prices

11.83 Balancing at purchasers' prices requires a very different approach for a number of entries in the SUTs, and in general, more approximations/assumptions because of the lack of appropriate price indices, especially for those cases where trade and transport margins play a substantial role. As a first step, non-deductible VAT may have to be stripped out from the initial Use Table, which includes VAT (often this step may be carried out in the pre-processing of source data for the SUTs).

11.84 As the Supply Table is valued at basic prices, the deflation for this part will be similar to the ideal scenario applying PPIs, import price indices or other appropriate indicators.

11.85 The compilation of the volumes of trade margins, transport margins, taxes on products and subsidies on products using this balancing approach will be done at an aggregate level. If applicable, at this stage, for each product only the total trade margins, transport margins, taxes on products and subsidies on products are included in the system as part of the bridge columns between the Supply Table and the Use Table. In order to compile the volume changes, the volume change of the underlying aggregated flows have to be determined. For an accurate estimate of the volume index of the valuation layers, it is therefore very important to determine which part of the supply or use of a product is liable to this valuation layer. For example, the retail trade margins are mainly linked to household final consumption expenditure.

11.86 For deflation of the Use Table at purchasers' prices (excluding the deflation of VAT), then price indicators are required other than those applied in the ideal scenario. Especially for intermediate consumption of goods and services and GFCF, where the 'ideal' price indices are often not available and must be replaced by proxies. More details are shown in Chapter 9.

F. Extending balancing SUTs to include institutional sector accounts, IOTs, PSUTs and EE-IOTs

11.87 The previous section describes a process for a simultaneous balancing of SUTs at basic prices and purchasers' prices both in current prices and in volume terms. Thus it focuses on the balancing within a SUTs system. However, the compilation of SUTs is not seen here a separate and isolated exercice from the compilation of the National Accounts and from the compilation of IOTs, PSUTs, EE-IOTs or other satellite accounts, if they are compiled. This implies that the balancing process has to be extended to ensure a coherent and consistent integration of SUTs with the National Accounts (i.e. intitutional sector accounts) and related products (for example, IOTs, PSUTs, EE-IOTs).

11.88 The balancing of SUTs can be extended to include additional accounts either in a simultaneously or sequentially manner. There are a clear benefits in this extended balancing due to the additional feedback loops which would eventually lead to further improvements in the quality of the SUTs as well as the other products in terms of consistency, coherence and integration. Thus it is, in general, recommended to extend the balancing to include

1. Institutional sector accounts

11.89 Together with the SUTs, the institutional sector accounts are in the core of the National Accounts. The sector accounts provide an overview of the various economic activities covering production, consumption, generation of income and distribution of income, accumulation of wealth and relations with the rest of the world. The SUTs and institutional sector accounts have thus several variables in common like output, intermediate consumption, GVA and its components linked by industry and by institutional sector. Analysing and balancing SUTs and the institutional sector accounts can point to implausible data in SUTs, implying a re-balancing of the SUTs, for example, highlighting classification issues or where cells should have zero or non-zero entries.

11.90 Like the SUTs system, the institutional sector accounts constitute a balancing framework consisting of a set of well-defined variables and a number of basic identities. For the total economy, the production account and the generation of income account are in fact an aggregate of the domestic production part of the SUTs without the dimensions products and industries. One-to-one links exist for production, intermediate consumption and GVA. In addition, compensation of employees is directly linked to the SUTs system. Other macroeconomic variables with a strong link between SUTs and institutional sector accounts are consumption of households and government (use of disposable income account), and fixed capital formation (capital account). Finally, taxes and subsidies on products and other taxes on production appear in both systems.

11.91 From a conceptual point of view, the links between SUTs and institutional sector accounts are strong. However, in statistical practice, it is not always easy to transform industry data on production into institutional sector data and vice versa. For that purpose, a set of tables is constructed with a dual classification. In this table the transactions are classified by industry (SUTs) and by institutional sector (sector accounts) (see the linking table in Chapter 10).

11.92 The SUTs are the most elaborated and detailed framework to estimate GDP and other macroeconomic variables in the scope of production, consumption, gross capital formation, exports, import, and income. The three approaches to measuring GDP are combined in one system based on a great variety of source data which are confronted and compared with each other in order to find possible causes of inconsistencies. With the high reliability, the strengths, and the quality of SUTs estimates, they have a strong influence on the sector accounts. Largely one can say that there is a one-way traffic between SUTs and institutional sector accounts. However, via the dual classification, there are possibilities for feedback in both directions. For the time being, feedback is limited because the level of aggregation in the institutional sector accounts is very high. Therefore, it is difficult to trace back inconsistencies and implausible results on a sector level to specific industries in the SUTs system.

11.93 When GVA by industry from the production approach is available, it should be balanced against the GVA from the income approach for the corresponding industry, linking the factor incomes and the institutional sectors. This link is extremely important between the industry accounts and the institutional sector accounts.

(1) Thus for each industry, using the production approach:
Total output at basic prices
less total intermediate consumption at purchasers' prices
equals GVA at basic prices (**production approach**)

(2) For the corresponding industry, using the income approach reflecting the different factor incomes:
Self-employment income (mixed income and quasi-corporations);
plus gross trading profits of private financial corporations;
plus gross trading profits of private non-financial corporations;
plus gross trading surplus of public corporations (financial and non-financial);
plus rental income;
plus non-market consumption of fixed capital;
less holding gains/losses; and
less intermediate consumption of FISIM.
plus other taxes on production and imports
less other subsidies on production
equals GVA at basic prices (**income approach**)

11.94 Note, for each of the factor income components shown in (2), there is an institutional sector breakdown.

11.95 The approaches shown in (1) and (2) bring together within the SUTs framework data from sources ranging from administrative data to business surveys, and when balanced, ensures a better quality estimate of GVA by industry, in turn for the whole economy GVA, and hence GDP and GNI.

11.96 The full breakdown in (2) in terms of data may not be available by detailed industry (and by institutional sector) for a range of reasons. The minimum that should be incorporated in the SUTs compilation and balancing process is covered in (3) below:

Gross operating surplus
plus compensation of employees
plus other taxes on production and imports
less other subsidies on production
equals GVA at basic prices (**income approach**)

11.97 Again note, for each component shown in (3), there is an institutional sector breakdown.

2. IOTs

11.98 The links between the SUTs and IOTs in the bottom left-hand side and right-hand side of the "H-Approach" have been covered through the links to the separation of imports of goods and services and valuation matrices needed to produce the SUTs at basic prices and the SUTs in volume terms, and then in turn, the IOTs.

11.99 By integrating the production of IOTs with the production and balancing of SUTs allows for powerful feedback loops to be effective, and timely, in indicating data problems within the SUTs or with the step(s) transforming SUTs to IOTs. For example, addressing negative cell entries in the IOTs can improve the quality of the SUTs. Producing IOTs (simultaneously or sequentially) alongside SUTs is recommended rather than being produced a significant period of time later or even less frequently than the SUTs.

3. PSUTs and EE-IOTs

11.100 The links with the PSUTs and EE-IOTs are of a different nature because the transactions in the physical SUTs are expressed in other units (for example, kilograms, terajoules, etc.) or are more detailed in terms of industries and products. The balancing of PSUTs and EE-IOTs in combination with SUTs and IOTs is described in Chapter 13.

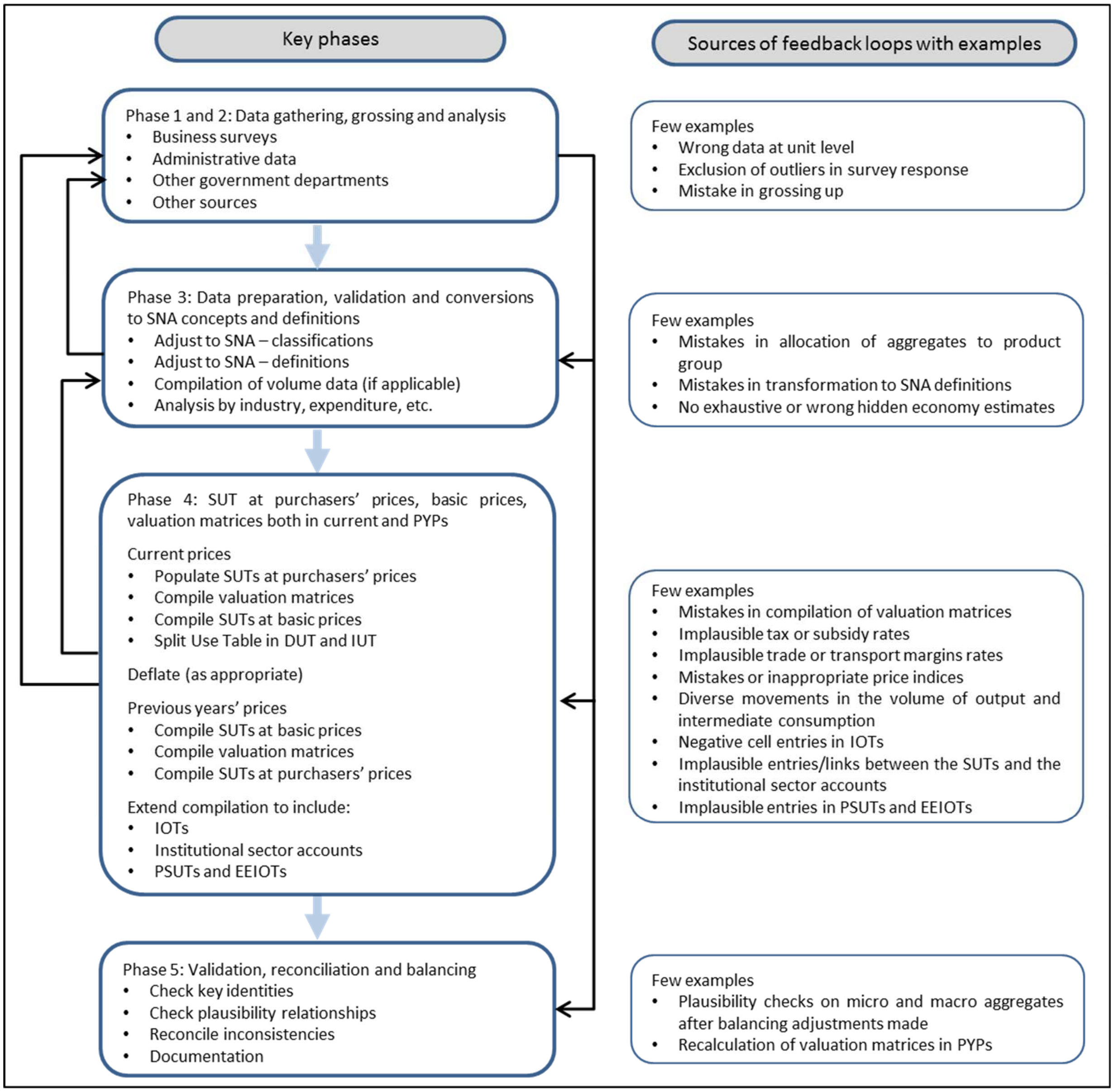
4. Key feedback loops generated by the balancing process

11.101 In the ideal scenario, all balancing is done simultaneously, implying that all feedback loops are part of an integrated process. This includes the feedback loops within the SUTs process as well as the loops going back to earlier steps in the full statistical process chain.

11.102 Figure 11.4 illustrates key feedback loops that can be generated from within the balancing process as well as examples of the sources of the feedback loops.

11.103 When the balancing is extended to cover also IOTs, the links to the institutional sector accounts, PSUTs, EE-IOTs, and other satellite accounts, there will be more feedback loops that become available than shown in Figure 11.4, and in turn, each adds a further data quality improvement dimension.

Figure 11.4 Sources of feedback loops emanating from the balancing process



G. Practical aspects of balancing

11.104 The balancing of SUTs is not a simple task as it requires priorities to be set because of time and resources constrains. Below are some practical considerations for the balancing process.

1. Automated and manual balancing

11.105 The balancing process covering full SUTs system incorporates automated and manual balancing. The first step is to separate the inconsistencies between those needing further research and those which can be resolved using automated procedures. In general, the large inconsistencies require more attention than smaller ones but also indicators like time series, revision analyses, I-O ratios and labour productivity can point to serious problems in the data. For the smaller inconsistencies, automated procedures may be used, nonetheless will still require assessment in terms of the quality and plausibility of the results.

11.106 For the inconsistencies selected for manual balancing, more or less a reversed version of the initial full statistical process from surveys to National Accounts can be applied. It would start with a critical investigation of the National Accounts process transforming source data into data for the use in SUTs. In particular, in the Use Table, there are many entries which are the result of splitting aggregated source data to the product level as required in the SUTs. The allocation may be changed without altering the initial aggregate total, and thus GVA. In practice, many of the problems will not be resolved through this approach. The next step is to consult the expert knowledge on the specific subject matter. If large inconsistencies still remain, a final step may be to contact the survey respondent or source supplier for a critical discussion of the data they have provided.

11.107 The adjustments to entries in the SUTs will obviously affect other flows and ratios. To make the balancing process systematic, for example, to take into account inter-industrial relationships, it is helpful to distinguish separable blocks of industries, whereby the main producers and users of products are represented and assign to these blocks separate groups of I-O specialist statisticians responsible for balancing. For example, cement would be definitely required by the construction industry, and therefore, cement supplies can be used to cross-check the plausibility of construction estimates. The SUTs can be divided into various groupings of related industries, for example one suite of groupings may be, albeit this is not exhaustive:

- Agriculture, and fishing (ISIC Rev. 4 Divisions 01, 03), manufacture of food products and beverages (ISIC Rev. 4 Divisions 10-12), hotels and restaurants (ISIC Rev. 4 Divisions 55-56);
- Manufacture of metals and metal products (ISIC Rev. 4 Divisions 24-25) and manufacture of machinery and means of transport industries (ISIC Rev. 4 Divisions 26, 29, 30);
- Forestry (ISIC Rev. 4 Division 02) and industries producing wood and wood products (ISIC Rev. 4 Divisions 16, 31);
- Quarrying and non-metallic mineral products (ISIC Rev. 4 Divisions 08, 23) and construction (ISIC Rev. 4 Divisions 41-43);
- Manufacture of textile (ISIC Rev. 4 Division 13) and textile products, footwear (ISIC Rev. 4 Divisions 14, 15);
- Chemical industries, including plastic products (ISIC Rev. 4 Divisions 19-22); and
- Energy sectors (ISIC Rev. 4 Divisions 05-06, 35).

11.108 Automation is essential for the preparation and management of the SUTs system. The SUTs IT system (including the supporting modules and analytical tools/function) will play different roles in the compilation process and, even more importantly, will need to be designed well and built with the range of different roles in mind.

11.109 A lot of the calculations in the preparation stage are carried out by automated procedures. In every stage of the process, the IT system can provide quick and clear overviews of the data in every chosen configuration. The IT system produces the first parts of the SUTs which are essential for the detection of major integration problems. The IT system finally allows searches in the deepest details to efficiently find the causes of balancing problems. Finally, the IT system can help to develop appropriate solutions as well as professional, and orderly, documentation of all the adjustments made during the compilation and balancing processes. The

IT system is a powerful instrument which is indispensable for all operations from the source data through to the final set of balanced SUTs.

11.110 Modules can be designed to adequately, and efficiently, eliminate small discrepancies between supply and use at the product level. This may imply one-dimensional proportional distribution of the discrepancies over selected set of users.

11.111 Balancing the whole SUTs system requires a multi-dimensional approach for the reconciliation of inconsistencies and a range of human inputs which cannot be automated. To date, experiences of balancing SUTs in an automated manner have shown that full automated balancing is a bridge too far, generating lower quality, many implausible movements requiring further investigation, and overall proving to be a major false saving. Most efforts have concluded that a combination of automated and manual statistical techniques and procedures is the best workable solution to underpin a SUTs system.

11.112 Working with statistical data based on sample surveys, survey questionnaires and influenced by non-response etc. means working with sample margins of error. Even when samples are perfect and response is 100 per cent there will be inconsistencies. Therefore a major cause for differences is a statistical one and it could be argued that balancing could be done in an automated manner using the sample margins of the statistics concerned as weights. However, statistics are never ideal and inconsistencies are not only caused by sampling etc. but various causes of a non-statistical nature. It is these causes of inconsistencies that make manual balancing necessary as a preliminary step prior to using automated balancing.

11.113 The decision what can be balanced using automated procedures and what should be done manually depends not only on the nature of the inconsistencies but also on the ‘setting’ of where the balancing takes place.

11.114 If the automated balancing of SUTs is carried out independently for consecutive years, and if applicable, for current prices and volume estimates, then the initial discrepancies must be small. Proven experience has shown that even small differences in initial data can lead to totally different results in RAS (covered below) and optimization procedures, which implies that the balanced SUTs are not comparable over time. As long as discrepancies are small, the chance of getting incomparable results may also be small.

11.115 A major step forward is to include linkages (for example, growth rate expectations) between consecutive years preferably including price and volume indicators. In setting such a scenario, the basic identities of the SUTs can be used as a restriction in the automated balancing process as well as criteria relating to plausibility as mentioned above. Including price and volume ratios and defined restrictions attributable to them would help to assure the plausibility of growth rates and comparability over time. This also allows the option to leave larges discrepancies to the automated system.

11.116 Box 11.3 provides a short description of authomated methods often used to remove some inconsistencies in the SUTs.

Box 11.3 Methods used for automated balancing SUTs

RAS method

The RAS method is a well-known and widely used method for data reconciliation. Its aim is to achieve consistency between the entries of some non-negative matrix and pre-specified column totals and row totals. It is very easy to apply and to understand. However RAS has a narrow scope of applicability, for example, it can only be applied to non-negative matrices.

It is used to revise the internal entries in a matrix so that they agree with the margin totals. RAS is used when the margin totals – total supply/use of commodities, or total gross output by kind of activity, for example – are believed to be correct but the breakdown inside the matrix is not consistent with the margin totals. Over the years, many extensions, variations and improvements of the RAS method have been developed. Some examples include:

- GRAS (Generalised RAS) allows for matrices in which some of the elements are pre-defined, in addition to the row totals and the column totals. The GRAS method allows for matrices with negative entries, Lenzen *et al.* (2007).
- TRAS (Three-stage RAS) extends RAS by including constraints on arbitrary subsets of the matrix elements, instead of only fixing row totals and column totals, Cole (1992) and Gilchrist and St. Louis (1999).
- KRAS, by Lenzen *et al*. (2009) includes the aforementioned features of GRAS and TRAS and further generalises RAS for the case of conflicting source data. The simplest case is when two data sources prescribe two different values for the same matrix entry. In order to converge, the original RAS method can use only conflicting values, whereas the KRAS Method will use both values and allow for different reliabilities of the data sources.

More details on different updating methods are covered in Chapter 18 of this Handbook and United Nations (1999).

Stone Method

The Stone method is another method for data reconciliation whereby it adjusts data in order to satisfy a set of linear constraints. In adjusting the initial data, the Stone Method uses information on the relative reliabilities of the initial data given in a covariance matrix. Data that are considered to be the most reliable are modified least, and vice versa. The Stone Method yields a set of fully reconciled data, with minimum variance. The Stone Method translates the reconciliation problem into a mathematical (weighted quadrati) optimization problem under linear constraints.

In practical applications of the method, a covariance matrix of the initial data are often unavailable. Therefore applications generally use estimates of relative variances. There are several ad hoc methods for estimating relative variances. One method is to have a specialist estimate of 95 per cent confidence intervals and to use the interval sizes as an approximation for variances. Another method may be to distinguish several categories such as relatively unreliable, normally reliable and relatively reliable, and all variables within the same group are assigned the same variance.

It is often desirable in practice for reconciliation to affect large values more than small values in an absolute sense. If this is the intention, then the following variances may be chosen:

$Var(x_i) = \theta_i^2 x_i^2$ where, θ_i is a parameter that depends on the reliability, or reliability category, of x_i.

In practice, determining the correct ratios between the various variances is a process of trial and error, which means that one particular ratio is chosen based on a degree of prior knowledge and simple assumptions (for example, that variances are equal in the absence of prior knowledge), and then judging whether the results are acceptable. If not, the variances are then modified.

Convex quadratic constrained optimization

An option for balancing SUTs both in current prices and in volume terms simultaneously is the application of loss function which includes current price and volume estimates as well as linear price and volume ratios. The loss function must be minimised under a set of linear constraints, and the loss is defined as the difference between the initial data and the balanced data. For the price and volume ratios, linear constraints are applied. The constraints are either strong or weak.

Strong constraints include, for example, identities of the SUTs and upper and lower boundaries (subsidies should be less or equal to zero). Weaker constraints include for example: volume change of output related to volume change of input; ratio of taxes and subsidies to the basic price estimate (in the form of a percentage of the variable like tax); ratio of margins to the basic price estimate (in the form of a percentage of the margins); and re-exports are smaller that the corresponding imports (weak because of differences in valuation).

More specific constraints on a product level can be specified in this optimization problem. It is also possible to extend the optimization problem, and to include, for example, the transformation to Industry by Industry IOTs, including the estimation of valuation matrices.

2. Balancing benchmark and consecutive years

11.117 In the ideal situation, the annual SUTs and IOTs present the state of art concerning the balancing of the basic statistics. However, the data from the annual SUTs and IOTs is further improved with every new benchmarking leading to a whole new time series. Benchmarking is a regular process in economic statistics whereby data sources for the same target variable with different frequencies are reconciled and the inconsistencies between the different estimates are corrected. Benchmarking leads to revisions of earlier estimates of the target variables. This section deals with two types of benchmark revisions for SUTs and IOTs - periodic benchmarking and annual benchmarking - and considerations about balancing of SUTs and IOTs in these two cases.

11.118 Periodic benchmarking refer to significant revisions, for example, conceptual changes, new or changed basic data sources that originates from incorporating data from periodic benchmark censuses (which are carried out every five to ten years), revised international guidelines like 2008 SNA and BPM 6 and other changes that cannot be incorporated on a continuous basis because of resource contraints. Backward revisions to the timeseries affecting several back years are also carried out based on the benchmark excersise.

11.119 In general, planning for period benchmark revisions should seek to coordinate all major changes to be synchronised for a common year for implementation. Thereby, say as a minimum, once every five years, a maximum degree of consistency within National Accounts, Balance of Payments and other related domains is achieved and the statistics concerned are based on the best possible data.

11.120 Annual benchmarking mainly refers in this context to the regular revisions to the annual accounts due to the availability of new and more complete data sources. Annual benchmarking, however, also include revisions due to the alignment of short-term survey results (say, turnover variable) based on small survey samples to much larger sample based annual structural surveys. The reconciliation of short term survey sources before the benchmaring process with the more complete and detailed annual data sources such as structural statistics are then feed through the SUTs framework. Combining annual benchmarking and annual chain-linking also ensures better accuracy of the levels and growth rates of the economy more quickly, and again, achieved through the SUTs framework.

11.121 Consistency is one of the key elements of National Accounts. Theoretically, the whole time series and every level of detail should be consistent. In practice, it may not be possible to publish all results at the same moment. However, the SUTs and the main aggregates such as GDP should be fully consistent. As more and more years of SUTs are produced, this poses a growing challenge of how to maintain consistency of SUTs as a long run dataset. For example, Statistics Denmark as part of their implementation of 2008 SNA and BPM 6 ensured that the Danish IOTs were retained on a consistent basis going back to 1966 – a significant exercise in its own right.

11.122 Annual benchmark revisions, done for example in the United Kingdom and Ireland, require less of a planning burden to synchronise a common year as the changes form an integral process to compiling annual SUTs.

11.123 In theory, the balancing procedure for period benchmark SUTs is the same as for SUTs compiled annually as well as investigations for the causes of inconsistencies and finding solutions. However, for non-benchmark years, a lot of information can be derived from the previous years. When balanced product-flow systems already exists for the previous year, it can safely be assumed that the general structure of the system will be more or less similar to the preceding year, unless of course specific information is available that there are major structural changes in some industries. Combined with price and volume estimates, the T-1-data provides a valuable source in detecting inconsistencies in the SUTs.

11.124 For periodic benchmark SUTs, all inconsistencies have to be investigated thoroughly and exhaustively. This is even more important as the level estimates of the subsequent years are based on this benchmark. As a consequence, balancing benchmark SUTs should be done manually to a high degree to achieve a high quality base. Thus, the room for automated procedures should be limited to small discrepancies.

3. Organization of the "balancing" function

11.125 The organization of the "balancing" function can be set-up in different ways across teams. For example:

- Centralised balancing team – a single person or a very small team of people form the central balancing team which have the designated role to take all the validated and investigated data from the compilation teams and balance the SUTs using the tools (manual and automated) at their disposal. They will lead and coordinate the implementation of balancing adjustments across the components and record the adjustments as "pure" balancing adjustments. They may generate the areas for "investigation" in liaison with the compiler(s). The team may also be organised whereby they do not just produce a balanced SUTs dataset but also feed back to the compiler(s) the balancing adjustments as appropriate, for example, HHFCe or GFCF to allow the compilers to generate publications consistent with the final dataset. Alternatively, the compilers could use the final dataset to generate the publications with no additional data flows in the system.
- De-centralised balancing – here the balancing is devolved to industry and/or product and/or topic specialists (e.g. say, energy or HHFCe) or the compiler(s). They will undertake a row and column balancing process related to their allocated row/column/topic. After so many iterations, the central team may then just use automated tools to achieve a final balance. The role of the central team is different in that they only focus on the automated part, whereas the manual balancing is left to the specialists as well as coordinate across the balancers.

11.126 There are pros and cons with either approach:

- For centralised balancing, the control and order assessment as well as the overall quality control sits with the central team and forms an efficient way of achieving a coherent and high-quality balance. The specialist experts knowledge can be used to quality assure the inputs and the balanced picture.

- For de-centralised balancing, this utilises the specialist experts knowledge to a greater degree but requires much more communication and coordination to be effective as well as balancing adjustments and quality adjustments may be less clear.

11.127 In both cases, issues like documentation, communciation and coordination are essential as well staff with appropriate skills and knowledge. However, a centralised balancing arrangement is preferred rather than a de-centalised balancing arrangement.

Annex A to Chapter 11. Balancing Supply and Use Tables

A11.1 This Annex presents a numerical example of the balancing of SUTs in current prices and in previous years' prices in line with the SUTs balancing framework shown in Figure 11.3 (fully consistenct with the "H-Approach"). This provide an examples of the type of thinking and issue resolution to achieve a balanced SUTs system. The numbers in the tables in this Annex have been divided by 1,000 for readability and presentational purposes, in reality the differences are larger than the small numbers shown. This Annex consists of three sections.

A11.2 Section 1 of this Annex shows the following (unbalanced) tables:

- Table A11.1: Supply and Use Tables 2011 in current price (SUTs at purchasers' prices, Taxes less subsidies on products, Trade and transport margins, SUTs at basic prices, Imports Use Table and Domestic Use Table).
- Table A11.2: Price indices for Supply and Use Tables 2011 (SUTs at purchasers' prices, Taxes less subsidies on products, Trade and transport margins, SUTs at basic prices, Imports Use Table and Domestic Use Table). Please note, some prices may be from actual source data or derived from independent volume estimates (using the valuation matrices) or implicit prices but a complete set of prices are shown for the purposes of this balancing example.
- Table A11.3: Supply and Use Tables 2011 in previous years' prices (SUTs at purchasers' prices, Taxes less subsidies on products, Trade and transport margins, SUTs at basic prices, Imports Use Table and Domestic Use Table).
- Table A11.4: Volume indices tables for Supply and Use Tables 2011 (SUTs at purchasers' prices, Taxes less subsidies on products, Trade and transport margins, SUTs at basic prices, Imports Use Table and Domestic Use Table).
- Table A11.5: Supply and Use Tables 2010 in current price - SUTs at purchasers' prices, Taxes less subsidies on products, Trade and transport margins, SUTs at basic prices, Imports Use Table and Domestic Use Table.

A11.3 Section 2 of this Annex follows the same sequence of tables but shows the corresponding "balanced SUTs system" for both price bases. The cells highlighted in yellow are those changed in order to achieve balanced SUTs.

A11.4 Section 3 of this Annex provides an overview of the numerical adjustments required to achieve the balanced system.

A11.5 The inconsistencies in the system are revealed by differences between the supply and use at the product level and discrepancies between trade and transport margins in the SUTs at purchasers' prices and the row totals of the respective valuation matrices. The same holds for taxes less subsidies on products. In general, the net operating surplus is used as a balancing item in achieving the identity that the total output equals the total input.

A11.6 If the inconsistencies are relatively small, then automated procedures can be applied to simultaneously balance the SUTs system in the different valuations. In the case of large discrepancies or for example implausible I-O ratios in volume terms or implausible movements in the price changes on a row, then further research is necessary before any automated balancing should be applied.

A11.7 In the numerical example, the estimates for **agriculture** products in current prices show a discrepancy both at purchasers' prices and at basic prices. Conversely, the estimates in previous years' prices are balanced. The latter does not mean that the previous years' prices based data are plausible. However, after examining the data on volumes and prices, at a more detailed level than presented in the example, it is concluded that the prices were too high and the volumes looked plausible. As a consequence, the estimates in current prices for the supply of agriculture products by the agriculture industry needed to be adjusted.

A11.8 The estimates for **manufacturing** products show a discrepancy both in current prices and in previous years' prices both at purchasers' prices and at basic prices. The difference in the previous years' prices based data at purchasers' prices is somewhat larger than in current prices because the initial estimate of Taxes less subsidies on products and Trade and transport margins in previous years' prices seems to be very low. The separate Use Table based on domestic output (i.e. Domestic Use Table) and imports (i.e. Imports Use table) shows a big discrepancy for this product group in the Domestic Use Table, which is counterbalanced in the Imports Use Table. In addition to the difference between supply and use of products in current prices and in previous years' prices, there is an implausible price index for exports. In this case, the estimates in previous years' prices can be adjusted in order to get plausible price indices. A second reason for the inconsistency is the delineation of exports and re-exports. At the point when products are imported, it is not always known whether or not the products will be re-exported in the same form. As a consequence, the data available for re-exports from source statistics should be a minimum and the actual estimate in the SUTs will be (much) higher as shown in this example. With the delineation problem, a small inconsistency existed which is solved by adjusting total exports.

A11.9 The balancing adjustments and approaches applied to the **valuation matrices** differ for estimates in current prices from the estimates in previous years' prices.

A11.10 The current price estimates of **trade and transport margins** (TTM) do not show an inconsistency in the purchasers' prices table. The TTM column is consistent with the output of trade. However in the basic price table, there is an inconsistency caused by the difference between the TTM matrix and the TTM column in the Supply Table at purchasers' prices. The gap is 680, which is found on the manufacturing product row.

A11.11 Similarly, for **taxes less subsidies on products** (TLS), there were some differences between the TLS column of the Supply Table and the total column of the TLS matrix. These inconsistencies appear on the product rows MAN and FBS.

A11.12 In both cases, the data in the current price valuation matrices need to be adjusted, as in most cases, the current price TLS on products are derived from government data and are therefore fixed. The same approach is less strong for TTM, whereby the output control totals generally prevails over the estimates of the valuation matrices.

A11.13 For the previous years' prices based estimates of TLS and TTM, the opposite holds because the estimates for TTM and TLS on products are compiled using the volume change of the concerning transactions, the estimates in the valuation matrices determine TTM and TLS in previous years' prices, so the TLS and TTM columns of the SUTs at purchasers' prices have to be adjusted.

A11.14Both in current prices and in previous years' prices, the **transport** products show a discrepancy. In this case the inconsistency is not caused by the valuation matrices but looking at the Imports Use table and through additional research it was identified that the estimate of import of transport services was too high.

A11.15The discrepancy in **communication** is shown in both valuation matrices in current prices and in previous years' prices. Also this is seen in the Domestic Use Table. After examining the data, it was decided that consumption of households had to be adjusted.

A11.16A similar procedure was followed for **financial and business services and other services**, in which cases it was decided to adjust intermediate consumption of TIC and consumption of households respectively. It should be noted that the discrepancy for the FBS product in the basic price table is somewhat larger than in the purchasers' price table because of the wrong estimate in the TLS matrix.

1. Unbalanced SUTs system (Table A11.1 - Table A11.5)

Table A11.1: Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	26.0	0.2	0.0	26.2	15.4	41.6	10.9	0.5	53.0
MAN	1.3	318.5	35.7	355.5	336.8	692.3	113.0	39.4	844.7
CON	0.1	88.0	4.5	92.6	1.6	94.1		8.3	102.4
TTC	0.5	15.1	231.6	247.2	73.4	320.6	-124.0	3.0	199.6
FBS	0.5	8.0	282.0	290.5	55.2	345.7		9.1	354.9
OSE	0.3	2.5	222.9	225.7	16.6	242.3	0.1	3.0	245.4
TOT	28.7	432.3	776.7	1237.7	499.1	1736.7	0.0	63.3	1800.1

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.5	17.4	1.5	24.4	5.9			0.1	-0.1	22.4	28.4	52.8	0.2
MAN	10.1	202.1	65.4	277.7	122.8		9.1	51.5	1.4	383.1	568.0	845.7	-1.0
CON	0.3	26.2	19.8	46.3	0.5		0.6	53.7		2.1	56.8	103.1	-0.7
TTC	0.6	10.8	66.2	77.5	21.4	0.9	0.5	6.7	0.0	92.3	121.8	199.3	0.3
FBS	2.1	43.5	161.8	207.3	78.0	0.0	3.6	16.8		49.5	147.8	355.2	-0.3
OSE	0.2	3.5	22.2	25.9	54.7	4.6	153.4	1.2	0.2	5.1	219.1	245.0	0.4
TIC	18.8	303.5	336.8	659.1	283.3	5.5	167.2	130.1	1.5	554.5	1142.0	1801.1	-1.0
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.3	47.2	102.2	153.7								153.7	
GVA	9.9	128.8	439.8	578.5								578.5	
TOT	28.7	432.3	776.7	1237.7	283.3	5.5	167.2	130.1	1.5	554.5	1142.0		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.5	0.5
MAN								39.4	39.4
CON								8.3	8.3
TTC								3.0	3.0
FBS								9.1	9.1
OSE								3.0	3.0
TOT								63.3	63.3

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.1	0.4					0.1	0.5	0.5	
MAN	0.2	1.7	6.4	8.3	26.8		0.4	2.2	0.0	1.7	31.1	39.4	0.0
CON		0.0	2.0	2.0	0.0		0.1	6.1		0.0	6.2	8.3	
TTC	0.0	-0.1	1.1	1.0	1.7		-0.1	0.4		-0.1	2.0	3.0	
FBS	0.0	0.0	4.4	4.4	1.6		0.1	3.0		0.0	4.7	9.1	0.0
OSE		0.0	0.1	0.1	2.3		-0.4	0.7		0.3	2.9	3.0	
TOT	0.2	1.6	14.0	15.8	32.9		0.1	12.5	0.0	2.0	47.5	63.3	0.0

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							10.9		10.9
MAN							113.0		113.0
CON									
TTC							-124.0		-124.0
FBS									
OSE							0.1		0.1
TOT							0.0		0.0

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.6	0.4	2.5	3.2			0.0	0.0	5.2	8.4	10.9	
MAN	0.9	20.5	9.2	30.6	39.1		3.1	5.1	-0.1	34.5	81.7	112.3	0.7
CON													
TTC	-1.3	-22.2	-9.6	-33.1	-42.3		-3.1	-5.1	0.1	-39.7	-90.2	-123.3	-0.7
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT					0.0			0.0		0.0	0.0	0.0	

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	26.0	0.2	0.0	26.2	15.4	41.6			
MAN	1.3	318.5	35.7	355.5	336.8	692.3			
CON	0.1	88.0	4.5	92.6	1.6	94.1			
TTC	0.5	15.1	231.6	247.2	73.4	320.6			
FBS	0.5	8.0	282.0	290.5	55.2	345.7			
OSE	0.3	2.5	222.9	225.7	16.6	242.3			
TOT	28.7	432.3	776.7	1237.7	499.1	1736.7			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.1	15.7	1.1	21.9	2.4			0.1	-0.1	17.1	19.5	41.3	0.3
MAN	9.0	179.9	49.8	238.8	56.9		5.6	44.3	1.5	346.9	455.2	694.0	-1.7
CON	0.3	26.2	17.7	44.3	0.4		0.5	47.6		2.1	50.6	94.8	-0.7
TTC	1.8	33.0	74.8	109.6	62.0	0.9	3.7	11.4	-0.1	132.1	210.0	319.7	1.0
FBS	2.1	43.5	157.4	202.9	76.4	0.0	3.5	13.8		49.5	143.1	346.1	-0.3
OSE	0.2	3.5	22.1	25.8	52.3	4.6	153.8	0.4	0.2	4.8	216.1	241.9	0.4
TLS	0.2	1.6	14.0	15.8	32.9		0.1	12.5	0.0	2.0	47.5	63.3	
TIC	18.8	303.5	336.8	659.1	283.3	5.5	167.2	130.1	1.5	554.5	1142.0	1801.1	-1.1
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.3	47.2	102.2	153.7								153.7	
GVA	9.9	128.8	439.8	578.5								578.5	
TOT	28.7	432.3	776.7	1237.7	283.3	5.5	167.2	130.1	1.5	554.5	1142.0		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					15.4				
MAN					336.8				
CON					1.6				
TTC					73.4				
FBS					55.2				
OSE					16.6				
TOT					499.1				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.8	6.4	0.5	7.7	1.2			0.0	-0.1	6.6	7.7	15.4	
MAN	1.3	98.0	20.9	120.2	24.5		1.6	19.2	-0.2	121.3	166.5	286.6	50.2
CON	0.0	0.5	0.4	0.9				0.7			0.7	1.6	
TTC	0.0	2.7	14.0	16.8	0.7			2.7	0.0	52.7	56.1	72.9	0.5
FBS	0.2	14.0	24.5	38.8	0.2			2.2		14.1	16.5	55.2	
OSE	0.0	0.5	3.9	4.5	12.0		0.0		0.1	0.0	12.2	16.6	
TLS													
TIC	2.3	122.1	64.2	188.7	38.7		1.6	24.8	-0.1	194.7	259.7	448.4	50.7

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	26.0	0.2	0.0	26.2					
MAN	1.3	318.5	35.7	355.5					
CON	0.1	88.0	4.5	92.6					
TTC	0.5	15.1	231.6	247.2					
FBS	0.5	8.0	282.0	290.5					
OSE	0.3	2.5	222.9	225.7					
TOT	28.7	432.3	776.7	1237.7					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.3	9.3	0.6	14.2	1.2			0.1	0.0	10.5	11.7	26.0	0.2
MAN	7.8	81.9	28.9	118.6	32.4		4.0	25.1	1.6	225.6	288.7	407.4	-51.9
CON	0.3	25.7	17.4	43.4	0.4		0.5	46.9		2.1	49.9	93.3	-0.7
TTC	1.8	30.3	60.7	92.8	61.3	0.9	3.7	8.6	-0.1	79.4	153.9	246.7	0.5
FBS	1.8	29.5	132.9	164.2	76.2	0.0	3.5	11.6		35.4	126.6	290.8	-0.3
OSE	0.2	3.0	18.1	21.3	40.2	4.6	153.8	0.4	0.1	4.8	203.9	225.3	0.4
TLS	0.2	1.6	14.0	15.8	32.9		0.1	12.5	0.0	2.0	47.5	63.3	
TIC	16.4	181.4	272.6	470.5	244.6	5.5	165.5	105.3	1.6	359.7	882.3	1352.8	-51.8
IMP	2.3	122.1	64.2	188.7	38.7		1.6	24.8	-0.1	194.7	259.7	448.4	
TOT	18.8	303.5	336.8	659.1	283.3	5.5	167.2	130.1	1.5	554.5	1142.0	1801.1	-51.8
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.3	47.2	102.2	153.7								153.7	
GVA	9.9	128.8	439.8	578.5								578.5	
TOT	28.7	432.3	776.7	1237.7	283.3	5.5	167.2	130.1	1.5	554.5	1142.0		
Check													

Table A11.2: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0	106.9	103.8	97.5	107.6	102.5
MAN	107.5	108.0	100.5	107.2	108.0	107.6	101.1	103.2	106.4
CON	103.4	100.5	100.5	100.5	101.6	100.5		100.1	100.4
TTC	101.1	99.2	100.3	100.2	110.7	102.4	100.8	101.4	103.4
FBS	102.9	100.9	100.4	100.4	101.0	100.5		93.6	100.3
OSE		100.2		101.0	103.4	101.1	99.1	110.2	101.2
TOT	102.2	105.8	100.5	102.4	107.3	103.7		101.6	103.7

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	105.8	109.9	98.7	108.2	100.4			94.7	568.8	97.7	98.0	102.4	0.0
MAN	114.1	110.4	105.0	109.2	102.1		99.5	99.6	85.7	106.7	104.9	106.2	0.2
CON	101.4	100.5	101.8	101.0	97.4		97.1	100.0		102.0	100.0	100.5	0.0
TTC	100.9	100.1	100.8	100.7	102.2					108.0	106.2	104.0	-0.5
FBS	101.4	100.7	100.4	100.5	101.7		101.8			99.0	100.1	100.3	0.0
OSE	102.4	101.7	104.3	103.9	102.7	103.8		101.7	99.5	101.8	100.9	101.2	0.0
TIC	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.7	103.2	103.6	-0.3
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	80.9	103.2	96.2	97.7								97.7	
GVA	91.1	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.7	103.2		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								107.6	
MAN								103.2	
CON								100.1	
TTC								101.4	
FBS								93.6	
OSE								110.2	
TOT								101.6	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	92.3	612.5	91.4	230.0	100.8					96.2	99.8	107.6	
MAN	103.7	107.3	103.9	104.6	101.7		98.7	93.8	-100.0	104.4	101.3	101.9	1.3
CON			102.2	102.1	90.7		95.1	99.6		100.0	99.4	100.1	
TTC				99.4	103.3						102.4	101.4	
FBS	123.1	100.0	102.0	102.1	105.7		103.8			44.4	86.4	93.3	0.3
OSE				241.7	109.2			101.1			108.5	110.2	
TOT	105.1	110.1	103.1	103.8	102.5		102.3	92.5	-100.0	105.0	99.8	100.7	0.8

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							97.5		
MAN							101.1		
CON									
TTC							100.8		
FBS									
OSE							99.1		
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	90.4	96.7	100.7	96.3	104.9			85.7	100.0	94.0	97.9	97.5	
MAN	113.7	102.6	102.3	102.8	97.8		97.9	97.5	93.5	99.5	98.5	99.6	1.5
CON													
TTC	105.0	102.1	102.2	102.3	98.3		97.9	97.5	93.8	98.8	98.4	99.4	1.4
FBS													
OSE					97.6					104.2	99.1	99.1	
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0	106.9	103.8			
MAN	107.5	108.0	100.5	107.2	108.0	107.6			
CON	103.4	100.5	100.5	100.5	101.6	100.5			
TTC	101.1	99.2	100.3	100.2	110.7	102.4			
FBS	102.9	100.9	100.4	100.4	101.0	100.5			
OSE		100.2		101.0	103.4	101.1			
TOT	102.2	105.8	100.5	102.4	107.3	103.7			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	107.2	111.2	98.1	109.5	94.9			95.6	725.0	98.9	98.0	103.8	0.0
MAN	114.4	111.4	105.6	110.2	105.5		100.5	100.2	85.7	107.5	106.3	107.6	-0.1
CON	101.4	100.5	101.7	101.0	98.3		97.4	100.0		102.0	100.1	100.5	0.0
TTC	103.8	101.5	101.0	101.2	99.5		98.5	97.0	93.7	105.0	102.8	102.2	0.2
FBS	101.2	100.7	100.4	100.5	101.7		101.7	100.6		99.0	100.6	100.5	0.0
OSE	102.4	101.8	104.1	103.7	102.4	103.8		102.5	99.5	101.5	100.8	101.1	0.0
TLS	105.1	110.1	103.1	103.8	102.5		102.3	92.5	-100.0	105.0	99.8	100.7	
TIC	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.7	103.2	103.6	0.1
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	80.9	103.2	96.2	97.7								97.7	
GVA	91.1	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.7	103.2		
Check													

Imports cif

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					106.9				
MAN					108.0				
CON					101.6				
TTC					110.7				
FBS					101.0				
OSE					103.4				
TOT					107.3				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	113.0	114.5	98.0	113.2	100.1			100.0	207.1	102.1	101.4	106.9	
MAN	112.6	114.4	107.2	113.1	102.0		99.6	99.5	-311.5	89.4	92.1	99.9	8.1
CON	100.0	101.0	102.0	101.4				101.8			101.8	101.6	
TTC	100.0	100.5		101.2						115.2	113.9	110.7	-0.1
FBS	97.0	101.4	100.4	100.8	106.7						101.6	101.0	
OSE	100.0	100.8	101.4	101.4	104.2				99.0	97.1	104.1	103.4	
TLS													
TIC	110.7	112.3	102.8	108.9	102.6		99.6	99.4	-100.8	96.5	97.6	102.0	5.3

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0					
MAN	107.5	108.0	100.5	107.2					
CON	103.4	100.5	100.5	100.5					
TTC	101.1	99.2	100.3	100.2					
FBS	102.9	100.9	100.4	100.4					
OSE		100.2		101.0					
TOT	102.2	105.8	100.5	102.4					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	106.2	109.0	98.2	107.6	90.0			94.6	-181.3	97.0	95.9	102.0	0.0
MAN	114.7	107.9	104.5	107.5	108.4		100.8	100.7	98.0	120.7	116.7	113.9	-6.7
CON	101.4	100.5	101.7	101.0	98.3		97.4	100.0		102.0	100.0	100.5	0.0
TTC	103.9	101.5	100.9	101.2	99.5		98.5	97.2	93.5	99.2	99.2	99.9	0.3
FBS	101.8	100.4	100.4	100.4	101.7		101.7	100.5		98.0	100.5	100.4	0.0
OSE	102.5	101.9	104.7	104.2	101.9	103.8		102.5	100.0	101.5	100.7	101.0	0.0
TLS	105.1	110.1	103.1	103.8	102.5		102.3	92.5	-100.0	105.0	99.8	100.7	
TIC	109.1	104.4	101.4	102.8	102.0	103.3	100.2	99.0	96.1	111.5	104.9	104.2	-6.4
IMP	110.7	112.3	102.8	108.9	102.6		99.6	99.4	-100.8	96.5	97.6	102.0	
TOT	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.7	103.2	103.6	-6.4
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	80.9	103.2	96.2	97.7								97.7	
GVA	91.1	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.7	103.2		

Table A11.3: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.5	0.1	0.0	25.7	14.4	40.1	11.2	0.5	51.8
MAN	1.2	295.0	35.6	331.7	311.9	643.7	111.7	38.2	793.6
CON	0.1	87.6	4.5	92.2	1.5	93.7		8.3	102.0
TTC	0.5	15.2	231.0	246.7	66.4	313.1	-123.0	3.0	193.0
FBS	0.5	8.0	280.8	289.2	54.7	343.9		9.7	353.7
OSE	0.3	2.5	220.7	223.5	16.1	239.6	0.1	2.7	242.4
TOT	28.1	408.4	772.5	1209.0	465.0	1674.0	0.0	62.4	1736.4

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.2	15.8	1.6	22.6	5.9			0.2	0.0	22.9	29.0	51.5	0.2
MAN	8.9	183.1	62.3	254.4	120.3		9.2	51.7	1.6	358.9	541.7	796.1	-2.5
CON	0.3	26.1	19.4	45.8	0.5		0.6	53.7		2.1	56.8	102.6	-0.7
TTC	0.6	10.8	65.6	77.0	21.0	0.9	0.5	6.9	0.0	85.5	114.7	191.7	1.3
FBS	2.0	43.2	161.1	206.3	76.6	0.0	3.5	17.6		50.0	147.7	354.0	-0.3
OSE	0.2	3.5	21.2	24.9	53.2	4.4	153.1	1.1	0.2	5.0	217.1	242.0	0.4
TIC	17.2	282.5	331.3	630.9	277.5	5.3	166.8	131.3	1.8	524.3	1107.0	1737.9	-1.5
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.3	45.7	106.3	157.3								157.3	
GVA	10.9	126.0	441.2	578.1								578.1	
TOT	28.1	408.4	772.5	1209.0	277.5	5.3	166.8	131.3	1.8	524.3	1107.0		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.5	
MAN								38.2	
CON								8.3	
TTC								3.0	
FBS								9.7	
OSE								2.7	
TOT								62.4	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.0	0.4					0.1	0.5	0.5	
MAN	0.2	1.6	6.2	8.0	26.4		0.4	2.3	0.0	1.6	30.7	38.7	-0.5
CON		0.0	2.0	2.0	0.1		0.1	6.1		0.0	6.3	8.3	
TTC	0.0	-0.1	1.1	1.0	1.7		-0.1	0.5		-0.1	2.0	3.0	
FBS	0.0	0.0	4.3	4.3	1.5		0.1	3.9		0.0	5.5	9.7	
OSE		0.0	0.0	0.0	2.1		-0.4	0.7		0.3	2.7	2.7	
TOT	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	-0.5

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							11.2		
MAN							111.7		
CON									
TTC							-123.0		
FBS									
OSE							0.1		
TOT							0.0		

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.7	0.4	2.6	3.1			0.0	0.0	5.6	8.6	11.2	
MAN	0.8	20.0	9.0	29.8	39.9		3.2	5.2	-0.1	34.7	82.9	112.7	-1.0
CON													
TTC	-1.2	-21.7	-9.4	-32.3	-43.1		-3.2	-5.2	0.1	-40.2	-91.7	-124.0	1.0
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.5	0.1	0.0	25.7	14.4	40.1			
MAN	1.2	295.0	35.6	331.7	311.9	643.7			
CON	0.1	87.6	4.5	92.2	1.5	93.7			
TTC	0.5	15.2	231.0	246.7	66.4	313.1			
FBS	0.5	8.0	280.8	289.2	54.7	343.9			
OSE	0.3	2.5	220.7	223.5	16.1	239.6			
TOT	28.1	408.4	772.5	1209.0	465.0	1674.0			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.8	14.1	1.1	20.0	2.5			0.1	0.0	17.2	19.9	39.8	0.2
MAN	7.9	161.6	47.1	216.6	53.9		5.6	44.2	1.7	322.6	428.0	644.7	-1.0
CON	0.3	26.1	17.4	43.8	0.4		0.5	47.6		2.1	50.6	94.4	-0.7
TTC	1.8	32.5	74.0	108.3	62.4	0.9	3.8	11.7	-0.1	125.8	204.4	312.8	0.3
FBS	2.0	43.2	156.8	202.0	75.1	0.0	3.4	13.7		50.0	142.2	344.2	-0.3
OSE	0.2	3.5	21.2	24.9	51.0	4.4	153.5	0.4	0.2	4.7	214.3	239.2	0.4
TLS	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	
TIC	17.2	282.5	331.3	630.9	277.5	5.3	166.8	131.3	1.8	524.3	1107.0	1737.9	-1.0
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.3	45.7	106.3	157.3								157.3	
GVA	10.9	126.0	441.2	578.1								578.1	
TOT	28.1	408.4	772.5	1209.0	277.5	5.3	166.8	131.3	1.8	524.3	1107.0		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					14.4				
MAN					311.9				
CON					1.5				
TTC					66.4				
FBS					54.7				
OSE					16.1				
TOT					465.0				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.7	5.6	0.5	6.8	1.2			0.0	0.0	6.4	7.6	14.4	
MAN	1.1	85.6	19.5	106.2	24.0		1.6	19.3	0.1	135.7	180.7	286.9	25.0
CON	0.0	0.5	0.3	0.9				0.7			0.7	1.5	
TTC	0.0	2.7	13.9	16.6	0.7			2.8	0.0	45.8	49.3	65.9	0.5
FBS	0.2	13.8	24.4	38.5	0.2			2.1		13.9	16.2	54.7	
OSE	0.0	0.5	3.9	4.4	11.6		0.0		0.1	0.0	11.7	16.1	
TLS													
TIC	2.1	108.7	62.5	173.3	37.7		1.6	24.9	0.1	201.8	266.2	439.5	25.5

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.5	0.1	0.0	25.7					
MAN	1.2	295.0	35.6	331.7					
CON	0.1	87.6	4.5	92.2					
TRA	0.5	15.2	231.0	246.7					
TRN	0.5	8.0	280.8	289.2					
COM	0.3	2.5	220.7	223.5					
TOT	28.1	408.4	772.5	1209.0					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.1	8.5	0.6	13.2	1.3			0.1	0.0	10.8	12.2	25.5	0.2
MAN	6.8	75.9	27.7	110.4	29.9		3.9	24.9	1.7	186.9	247.3	357.7	-26.0
CON	0.3	25.6	17.1	43.0	0.4		0.5	46.9		2.1	49.9	92.8	-0.7
TTC	1.7	29.9	60.2	91.8	61.7	0.9	3.8	8.9	-0.1	80.0	155.1	246.9	-0.2
FBS	1.8	29.4	132.4	163.5	74.9	0.0	3.4	11.6		36.1	126.0	289.5	-0.3
OSE	0.2	3.0	17.3	20.5	39.5	4.4	153.5	0.4	0.1	4.7	202.6	223.1	0.4
TLS	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	
TIC	15.1	173.7	268.8	457.6	239.8	5.3	165.2	106.4	1.7	322.5	840.8	1298.4	-26.5
IMP	2.1	108.7	62.5	173.3	37.7		1.6	24.9	0.1	201.8	266.2	439.5	
TOT	17.2	282.5	331.3	630.9	277.5	5.3	166.8	131.3	1.8	524.3	1107.0	1737.9	-26.5
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.3	45.7	106.3	157.3								157.3	
GVA	10.9	126.0	441.2	578.1								578.1	
TOT	28.1	408.4	772.5	1209.0	277.5	5.3	166.8	131.3	1.8	524.3	1107.0		
Check													

Table A11.4: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	100.8	96.1	87.8	100.8	103.5	101.8	103.6	111.9	102.2
MAN	95.4	104.4	99.4	103.8	103.3	103.6	102.7	97.4	103.1
CON	127.1	103.2	95.6	102.8	101.2	102.8		98.2	102.4
TTC	92.6	98.9	103.8	103.4	101.9	103.1	102.8	95.1	103.2
FBS	99.6	102.2	102.1	102.1	107.4	102.9		98.2	102.8
OSE	95.2	99.1	100.5	100.5	98.3	100.3	94.6	101.9	100.4
TOT	100.4	103.8	102.0	102.6	103.4	102.8	104.2	97.8	102.6

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.0	103.4	96.5	102.6	101.5			84.8	-9.1	102.0	101.1	101.8	0.5
MAN	99.5	105.6	98.5	103.6	99.4		102.8	112.5	43.1	104.3	103.4	103.5	-0.3
CON	100.7	110.7	100.2	105.9	103.3		96.0	101.3		91.6	100.9	103.1	-0.7
TTC	99.1	100.0	101.3	101.1	99.7					104.5	103.4	102.5	0.7
FBS	98.9	104.7	103.0	103.3	100.5		96.2			106.2	102.2	102.9	-0.1
OSE	99.4	101.8	101.4	101.5	101.0	99.8		98.2	72.6	103.1	100.0	100.2	0.2
TIC	100.2	105.5	101.5	103.2	100.1	99.8	99.8	105.3	42.7	104.3	102.4	102.7	0.2
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	104.4	99.9	105.9	104.0								104.0	
GVA	100.8	100.2	102.3	101.8								101.8	
TOT	100.4	103.8	102.0	102.6	100.1	99.8	99.8	105.3	42.7	104.3	102.4		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								111.9	
MAN								97.4	
CON								98.2	
TTC								95.1	
FBS								98.2	
OSE								101.9	
TOT								97.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	92.9	-40.0	134.6	-375.0	101.4					110.5	103.3	111.9	
MAN	94.3	97.2	97.6	97.5	98.2		100.8	105.1	-100.0	104.0	99.0	98.7	-1.3
CON			98.1	98.1	105.9		96.5	98.2		100.0	98.2	98.2	
TTC				92.2	98.2						96.7	95.1	
FBS	130.0	-14.3	100.4	100.7	102.9		89.0			225.0	96.3	98.2	
OSE				240.0	101.0			101.1			101.1	101.9	
TOT	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	-0.8

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							103.6		
MAN							102.7		
CON									
TTC							102.8		
FBS									
OSE							94.6		
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	101.4	104.6	95.9	102.5	101.7			82.4	-50.0	105.4	103.9	103.6	
MAN	97.9	107.5	97.8	104.1	100.7		101.5	118.6	-183.3	105.2	103.4	103.6	-0.9
CON													
TTC	99.2	107.3	97.7	104.0	100.8		101.5	118.5	-162.0	105.2	103.5	103.6	-0.8
FBS													
OSE					95.3					92.3	94.6	94.6	
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	100.8	96.1		100.8	103.5	101.8			
MAN	95.4	104.4	99.4	103.8	103.3	103.6			
CON	127.1	103.2	95.6	102.8	101.2	102.8			
TTC	92.6	98.9	103.8	103.4	101.9	103.1			
FBS	99.6	102.2	102.1	102.1	107.4	102.9			
OSE		99.1		100.5	98.3	100.3			
TOT	100.4	103.8	102.0	102.6	103.4	102.8			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.1	103.1	95.9	102.4	101.3			85.1	-7.1	100.9	99.9	101.1	0.6
MAN	99.8	105.5	98.7	103.7	99.0		103.7	112.3	45.7	104.2	103.8	103.7	-0.2
CON	100.7	110.7	100.4	106.3	103.0		96.0	101.7		91.6	101.2	103.5	-0.7
TTC	99.1	104.7	101.0	102.1	100.5		101.0	109.7	-102.6	104.7	103.5	103.0	0.1
FBS	98.7	104.7	103.1	103.4	100.5		96.4	102.0		106.2	102.5	103.0	-0.1
OSE	99.4	101.6	101.4	101.4	101.0	99.8		93.7	72.6	103.2	100.0	100.2	0.2
TLS	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	
TIC	100.2	105.5	101.5	103.2	100.1	99.8	99.8	105.3	42.7	104.3	102.4	102.7	-0.1
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	104.4	99.9	105.9	104.0								104.0	
GVA	100.8	100.2	102.3	101.8								101.8	
TOT	100.4	103.8	102.0	102.6	100.1	99.8	99.8	105.3	42.7	104.3	102.4		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					103.5				
MAN					103.3				
CON					101.2				
TTC					101.9				
FBS					107.4				
OSE					98.3				
TOT					103.4				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	100.9	106.3	88.2	104.2	105.0			78.8	-32.2	104.5	102.9	103.5	
MAN	104.1	106.6	99.7	105.2	100.4		92.0	117.4	3.1	86.4	90.0	95.1	8.3
CON	100.0	110.6	96.6	104.5				97.4			97.4	101.2	
TTC	102.3	99.0		100.2						101.7	101.4	101.1	0.8
FBS	98.8	103.5	107.7	106.1	92.1						110.8	107.4	
OSE	85.7	104.5	101.8	102.1	97.6				57.8	97.2	97.0	98.3	
TLS													
TIC	102.3	105.9	102.9	104.8	99.7		92.2	114.7	6.3	91.3	93.6	97.7	5.7

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	100.8	96.1		100.8					
MAN	95.4	104.4	99.4	103.8					
CON	127.1	103.2	95.6	102.8					
TTC	92.6	98.9	103.8	103.4					
FBS	99.6	102.2	102.1	102.1					
OSE		99.1		100.5					
TOT	100.4	103.8	102.0	102.6					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.3	101.0	103.0	101.5	98.0			86.7	19.8	98.9	98.1	99.9	0.9
MAN	99.1	104.3	98.0	102.3	98.0		109.4	108.6	79.6	122.5	116.8	111.9	-8.1
CON	100.7	110.7	100.5	106.3	103.0		96.0	101.8		91.6	101.3	103.5	-0.8
TTC	99.0	105.3	101.1	102.4	100.5		101.0	114.6	-110.0	106.6	104.2	103.5	-0.1
FBS	98.7	105.3	102.3	102.8	100.5		96.4	98.3		105.3	101.5	102.2	-0.1
OSE	100.0	101.2	101.3	101.2	102.1	99.8		93.7	95.5	103.2	100.2	100.3	0.2
TLS	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	
TIC	99.9	105.3	101.2	102.7	100.2	99.8	99.8	103.3	72.5	114.6	105.5	104.5	-8.0
IMP	102.3	105.9	102.9	104.8	99.7		92.2	114.7	6.3	91.3	93.6	97.7	
TOT	100.2	105.5	101.5	103.2	100.1	99.8	99.8	105.3	42.7	104.3	102.4	102.7	-8.0
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	104.4	99.9	105.9	104.0								104.0	
GVA	100.8	100.2	102.3	101.8								101.8	
TOT	100.4	103.8	102.0	102.6	100.1	99.8	99.8	105.3	42.7	104.3	102.4		

Table A11.5: Supply and use tables 2010 in current prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5	13.9	39.4	10.8	0.4	50.6
MAN	1.2	282.6	35.8	319.6	301.8	621.4	108.8	39.2	769.4
CON	0.1	84.9	4.7	89.7	1.5	91.2		8.4	99.6
TTC	0.6	15.4	222.6	238.5	65.1	303.6	-119.7	3.1	187.1
FBS	0.5	7.8	275.0	283.3	50.9	334.2		9.9	344.1
OSE	0.3	2.5	219.6	222.4	16.4	238.8	0.1	2.7	241.6
TOT	28.0	393.3	757.6	1178.9	449.7	1628.6	0.0	63.8	1692.3

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.1	15.3	1.6	22.0	5.8			0.2	0.2	22.5	28.6	50.6	
MAN	8.9	173.4	63.3	245.6	121.0		8.9	46.0	3.8	344.1	523.7	769.4	
CON	0.3	23.6	19.4	43.2	0.5		0.6	53.0		2.2	56.4	99.6	
TTC	0.6	10.8	64.8	76.1	21.0	0.9	0.5	6.7	0.0	81.8	110.9	187.1	
FBS	2.1	41.2	156.3	199.6	76.2	0.0	3.7	17.5		47.1	144.5	344.1	
OSE	0.2	3.4	20.9	24.5	52.7	4.5	153.6	1.2	0.3	4.9	217.0	241.6	
TIC	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.4	
MAN								39.2	
CON								8.4	
TTC								3.1	
FBS								9.9	
OSE								2.7	
TOT								63.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.0	0.4					0.1	0.5	0.4	
MAN	0.2	1.6	6.3	8.2	26.9		0.4	2.2	0.0	1.6	31.0	39.2	
CON		0.0	2.0	2.0	0.1		0.1	6.3		0.0	6.4	8.4	
TTC	0.0	-0.1	1.1	1.1	1.7		-0.1	0.5		-0.1	2.0	3.1	
FBS	0.0	0.0	4.3	4.3	1.5		0.1	4.1		0.0	5.7	9.9	
OSE		0.0	0.0	0.0	2.1		-0.4	0.7		0.3	2.7	2.7	
TOT	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							10.8		
MAN							108.8		
CON									
TTC							-119.7		
FBS									
OSE							0.1		
TOT							0.0		

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.6	0.4	2.5	3.0			0.0	0.0	5.3	8.3	10.8	
MAN	0.8	18.6	9.2	28.6	39.6		3.2	4.4	0.0	32.9	80.2	108.8	
CON													
TTC	-1.2	-20.2	-9.7	-31.1	-42.7		-3.2	-4.4	-0.1	-38.2	-88.6	-119.7	
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT					0.0			0.0		0.0	0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5	13.9	39.4			
MAN	1.2	282.6	35.8	319.6	301.8	621.4			
CON	0.1	84.9	4.7	89.7	1.5	91.2			
TTC	0.6	15.4	222.6	238.5	65.1	303.6			
FBS	0.5	7.8	275.0	283.3	50.9	334.2			
OSE	0.3	2.5	219.6	222.4	16.4	238.8			
TOT	28.0	393.3	757.6	1178.9	449.7	1628.6			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.7	13.7	1.2	19.5	2.5			0.2	0.2	17.1	19.9	39.4	
MAN	7.9	153.2	47.8	208.9	54.5		5.4	39.4	3.8	309.6	412.5	621.4	
CON	0.3	23.6	17.4	41.2	0.4		0.5	46.8		2.2	50.0	91.2	
TTC	1.8	31.1	73.3	106.2	62.1	0.9	3.7	10.7	0.1	120.1	197.5	303.6	
FBS	2.1	41.2	152.1	195.4	74.8	0.0	3.5	13.4		47.1	138.8	334.2	
OSE	0.2	3.4	20.9	24.5	50.5	4.5	154.0	0.5	0.3	4.6	214.3	238.8	
TLS	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	
TIC	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					13.9				
MAN					301.8				
CON					1.5				
TTC					65.1				
FBS					50.9				
OSE					16.4				
TOT					449.7				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.7	5.3	0.6	6.5	1.2			0.0	0.1	6.1	7.4	13.9	
MAN	1.1	80.4	19.5	101.0	23.9		1.8	16.4	1.7	157.1	200.9	301.8	
CON	0.0	0.5	0.4	0.8				0.7			0.7	1.5	
TTC	0.0	2.7	13.8	16.6	0.7			2.9	0.0	45.0	48.6	65.1	
FBS	0.2	13.3	22.7	36.3	0.2			1.7		12.8	14.6	50.9	
OSE	0.0	0.5	3.8	4.3	11.8				0.2	0.0	12.1	16.4	
TLS													
TIC	2.0	102.6	60.8	165.4	37.8		1.8	21.7	1.9	221.0	284.2	449.7	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5					
MAN	1.2	282.6	35.8	319.6					
CON	0.1	84.9	4.7	89.7					
TTC	0.6	15.4	222.6	238.5					
FBS	0.5	7.8	275.0	283.3					
OSE	0.3	2.5	219.6	222.4					
TOT	28.0	393.3	757.6	1178.9					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.0	8.4	0.6	13.0	1.3			0.1	0.1	10.9	12.5	25.5	
MAN	6.8	72.8	28.2	107.9	30.6		3.6	22.9	2.1	152.5	211.7	319.6	
CON	0.3	23.1	17.0	40.4	0.4		0.5	46.1		2.2	49.3	89.7	
TTC	1.7	28.4	59.5	89.6	61.4	0.9	3.7	7.8	0.1	75.1	148.9	238.5	
FBS	1.8	27.9	129.4	159.1	74.5	0.0	3.5	11.8		34.3	124.2	283.3	
OSE	0.2	2.9	17.1	20.2	38.7	4.5	154.0	0.5	0.1	4.5	202.2	222.4	
TLS	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	
TIC	15.1	165.0	265.6	445.7	239.4	5.3	165.5	102.9	2.4	281.5	796.9	1242.7	
IMP	2.0	102.6	60.8	165.4	37.8		1.8	21.7	1.9	221.0	284.2	449.7	
TOT	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

2. Balanced Supply and Use Tables (Table A11.6 - Table 11.10)

Table A11.6: Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.8	0.2	0.0	26.0	15.4	41.3	10.9	0.5	52.8
MAN	1.3	318.5	35.7	355.5	336.8	692.3	113.0	39.4	844.7
CON	0.1	89.0	4.5	93.6	1.6	95.1		8.3	103.4
TTC	0.5	15.1	231.6	247.2	72.9	320.1	-124.0	3.0	199.1
FBS	0.5	8.0	282.0	290.5	55.2	345.7		9.1	354.9
OSE	0.3	2.5	222.9	225.7	16.6	242.3	0.1	3.0	245.4
TOT	28.4	433.3	776.7	1238.4	498.6	1737.0	0.0	63.3	1800.3

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.5	17.4	1.5	24.4	5.9			0.1	-0.1	22.4	28.4	52.8	
MAN	10.1	202.1	65.4	277.7	122.8		9.1	51.5	1.4	382.1	567.0	844.7	
CON	0.3	26.2	19.8	46.3	0.5		0.6	54.0		2.1	57.1	103.4	
TTC	0.6	10.8	66.2	77.5	21.2	0.9	0.5	6.7	0.0	92.3	121.6	199.1	
FBS	2.1	43.5	161.5	207.0	78.0	0.0	3.6	16.8		49.5	147.8	354.9	
OSE	0.2	3.5	22.2	25.9	55.1	4.6	153.4	1.2	0.2	5.1	219.5	245.4	
TIC	18.8	303.5	336.5	658.8	283.5	5.5	167.2	130.4	1.5	553.5	1141.5	1800.3	
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.1	48.2	102.5	154.7								154.7	
GVA	9.7	129.8	440.1	579.6								579.6	
TOT	28.4	433.3	776.7	1238.4	283.5	5.5	167.2	130.4	1.5	553.5	1141.5		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.5	0.5
MAN								39.4	39.4
CON								8.3	8.3
TTC								3.0	3.0
FBS								9.1	9.1
OSE								3.0	3.0
TOT								63.3	63.3

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.1	0.4					0.1	0.5	0.5	
MAN	0.2	1.6	6.4	8.3	26.8		0.4	2.2	0.0	1.7	31.1	39.4	
CON		0.0	2.0	2.0	0.0		0.1	6.1		0.0	6.2	8.3	
TTC	0.0	-0.1	1.1	1.0	1.7		-0.1	0.4		-0.1	2.0	3.0	
FBS	0.0	0.0	4.4	4.4	1.6		0.1	3.0		0.0	4.7	9.1	
OSE		0.0	0.1	0.1	2.3		-0.4	0.7		0.3	2.9	3.0	
TOT	0.2	1.6	14.0	15.9	32.9		0.1	12.5	0.0	2.0	47.5	63.3	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							10.9		10.9
MAN							113.0		113.0
CON									
TTC							-124.0		-124.0
FBS									
OSE							0.1		0.1
TOT							0.0		0.0

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.6	0.4	2.5	3.2			0.0	0.0	5.2	8.4	10.9	
MAN	0.9	20.4	9.2	30.5	39.9		3.1	5.1	-0.1	34.5	82.5	113.0	
CON													
TTC	-1.3	-22.0	-9.6	-33.0	-43.1		-3.1	-5.1	0.1	-39.7	-91.0	-124.0	
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT					0.0			0.0		0.0	0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.8	0.2	0.0	26.0	15.4	41.3			
MAN	1.3	318.5	35.7	355.5	336.8	692.3			
CON	0.1	89.0	4.5	93.6	1.6	95.1			
TTC	0.5	15.1	231.6	247.2	72.9	320.1			
FBS	0.5	8.0	282.0	290.5	55.2	345.7			
OSE	0.3	2.5	222.9	225.7	16.6	242.3			
TOT	28.4	433.3	776.7	1238.4	498.6	1737.0			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.1	15.7	1.1	21.9	2.4			0.1	-0.1	17.1	19.5	41.3	
MAN	9.0	180.1	49.8	238.9	56.1		5.6	44.3	1.5	345.9	453.4	692.3	
CON	0.3	26.2	17.7	44.3	0.4		0.5	47.9		2.1	50.9	95.1	
TTC	1.8	32.9	74.8	109.5	62.6	0.9	3.7	11.4	-0.1	132.1	210.6	320.1	
FBS	2.1	43.5	157.1	202.6	76.4	0.0	3.5	13.8		49.5	143.1	345.7	
OSE	0.2	3.5	22.1	25.8	52.7	4.6	153.8	0.4	0.2	4.8	216.5	242.3	
TLS	0.2	1.6	14.0	15.9	32.9		0.1	12.5	0.0	2.0	47.5	63.3	
TIC	18.8	303.5	336.5	658.8	283.5	5.5	167.2	130.4	1.5	553.5	1141.5	1800.3	
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.1	48.2	102.5	154.7								154.7	
GVA	9.7	129.8	440.1	579.6								579.6	
TOT	28.4	433.3	776.7	1238.4	283.5	5.5	167.2	130.4	1.5	553.5	1141.5		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					15.4				
MAN					336.8				
CON					1.6				
TTC					72.9				
FBS					55.2				
OSE					16.6				
TOT					498.6				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.8	6.4	0.5	7.7	1.2			0.0	-0.1	6.6	7.7	15.4	
MAN	1.3	98.0	20.9	120.2	24.7		1.6	19.2	-0.2	171.3	216.7	336.8	
CON	0.0	0.5	0.4	0.9				0.7			0.7	1.6	
TTC	0.0	2.7	14.0	16.8	0.7			2.7	0.0	52.7	56.1	72.9	
FBS	0.2	14.0	24.5	38.8	0.2			2.2		14.1	16.5	55.2	
OSE	0.0	0.5	3.9	4.5	12.0		0.0		0.1	0.0	12.2	16.6	
TLS													
TIC	2.3	122.1	64.2	188.7	38.9		1.6	24.8	-0.1	244.7	309.9	498.6	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.8	0.2	0.0	26.0					
MAN	1.3	318.5	35.7	355.5					
CON	0.1	89.0	4.5	93.6					
TTC	0.5	15.1	231.6	247.2					
FBS	0.5	8.0	282.0	290.5					
OSE	0.3	2.5	222.9	225.7					
TOT	28.4	433.3	776.7	1238.4					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.3	9.3	0.6	14.2	1.2			0.1	0.0	10.5	11.7	26.0	
MAN	7.8	82.1	28.9	118.8	31.4		4.0	25.1	1.6	174.6	236.7	355.5	
CON	0.3	25.7	17.4	43.4	0.4		0.5	47.2		2.1	50.2	93.6	
TTC	1.8	30.2	60.7	92.7	61.9	0.9	3.7	8.6	-0.1	79.4	154.5	247.2	
FBS	1.8	29.5	132.6	163.9	76.2	0.0	3.5	11.6		35.4	126.6	290.5	
OSE	0.2	3.0	18.1	21.3	40.6	4.6	153.8	0.4	0.1	4.8	204.3	225.7	
TLS	0.2	1.6	14.0	15.9	32.9		0.1	12.5	0.0	2.0	47.5	63.3	
TIC	16.4	181.4	272.3	470.2	244.6	5.5	165.5	105.6	1.6	308.7	831.6	1301.8	
IMP	2.3	122.1	64.2	188.7	38.9		1.6	24.8	-0.1	244.7	309.9	498.6	
TOT	18.8	303.5	336.5	658.8	283.5	5.5	167.2	130.4	1.5	553.5	1141.5	1800.3	
OTLS	-0.7	0.2	0.3	-0.3								-0.3	
COE	2.7	60.9	254.4	318.0								318.0	
CFC	3.7	20.5	82.9	107.1								107.1	
NOS	4.1	48.2	102.5	154.7								154.7	
GVA	9.7	129.8	440.1	579.6								579.6	
TOT	28.4	433.3	776.7	1238.4	283.5	5.5	167.2	130.4	1.5	553.5	1141.5		
Check													

Table A11.7: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0	106.9	103.8	97.5	107.6	102.4
MAN	107.5	108.0	100.5	107.2	108.0	107.6	100.2	101.9	106.2
CON	103.4	100.5	100.5	100.5	101.6	100.5		100.1	100.5
TTC	101.1	99.2	100.3	100.2	110.7	102.4	100.0	101.4	104.0
FBS	102.9	100.9	100.4	100.4	101.0	100.5		93.6	100.3
OSE		100.2		101.0	103.4	101.1	99.1	110.2	101.2
TOT	102.2	105.8	100.5	102.4	107.3	103.7		100.8	103.6

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	105.8	109.9	98.7	108.2	100.4			94.7	568.8	97.7	98.0	102.4	
MAN	114.1	110.4	105.0	109.2	102.1		99.5	99.6	85.7	106.8	104.9	106.2	
CON	101.4	100.5	101.8	101.0	97.4		97.1	100.0		102.0	100.0	100.5	
TTC	100.9	100.1	100.8	100.7	102.2					108.0	106.2	104.0	
FBS	101.4	100.7	100.4	100.5	101.7		101.8			99.0	100.1	100.3	
OSE	102.4	101.7	104.3	103.9	102.7	103.8		101.7	99.5	101.8	100.9	101.2	
TIC	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.8	103.2	103.6	
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	79.8	103.2	96.2	97.7								97.7	
GVA	90.8	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.8	103.2		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								107.6	
MAN								101.9	
CON								100.1	
TTC								101.4	
FBS								93.6	
OSE								110.2	
TOT								100.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	92.3	612.5	91.4	230.0	100.8					96.2	99.8	107.6	
MAN	103.7	106.1	103.9	104.3	101.7		98.7	93.8	-100.0	104.4	101.3	101.9	
CON			102.2	102.1	90.7		95.1	99.6		100.0	99.4	100.1	
TTC				99.4	103.3						102.4	101.4	
FBS	123.1	100.0	102.7	102.8	105.7		103.8			44.4	86.4	93.6	
OSE				241.7	109.2			101.1			108.5	110.2	
TOT	105.1	108.7	103.3	103.9	102.5		102.3	92.5	-100.0	105.0	99.8	100.8	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							97.5		
MAN							100.2		
CON									
TTC							100.0		
FBS									
OSE							99.1		
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	90.4	96.7	100.7	96.3	104.9			85.7	100.0	94.0	97.9	97.5	
MAN	113.7	102.0	102.3	102.4	99.8		97.9	97.5	93.5	99.5	99.5	100.2	
CON													
TTC	105.0	101.6	102.2	101.9	100.2		97.9	97.5	93.8	98.8	99.3	100.0	
FBS													
OSE					97.6					104.2	99.1	99.1	
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0	106.9	103.8			103.8
MAN	107.5	108.0	100.5	107.2	108.0	107.6			107.6
CON	103.4	100.5	100.5	100.5	101.6	100.5			100.5
TTC	101.1	99.2	100.3	100.2	110.7	102.4			102.4
FBS	102.9	100.9	100.4	100.4	101.0	100.5			100.5
OSE		100.2		101.0	103.4	101.1			101.1
TOT	102.2	105.8	100.5	102.4	107.3	103.7			103.7

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	107.2	111.2	98.1	109.5	94.9			95.6	725.0	98.9	98.0	103.8	
MAN	114.4	111.5	105.6	110.3	104.0		100.5	100.2	85.7	107.6	106.2	107.6	
CON	101.4	100.5	101.7	101.0	98.3		97.4	100.0		102.0	100.1	100.5	
TTC	103.8	101.1	101.0	101.1	100.8		98.5	97.0	93.7	105.0	103.1	102.4	
FBS	101.2	100.7	100.4	100.5	101.7		101.7	100.6		99.0	100.6	100.5	
OSE	102.4	101.8	104.1	103.7	102.4	103.8		102.5	99.5	101.5	100.8	101.1	
TLS	105.1	108.7	103.3	103.9	102.5		102.3	92.5	-100.0	105.0	99.8	100.8	
TIC	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.8	103.2	103.6	
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	79.8	103.2	96.2	97.7								97.7	
GVA	90.8	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.8	103.2		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					106.9				
MAN					108.0				
CON					101.6				
TTC					110.7				
FBS					101.0				
OSE					103.4				
TOT					107.3				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	113.0	114.5	98.0	113.2	100.1			100.0	207.1	102.1	101.4	106.9	
MAN	112.6	114.4	107.2	113.1	102.8		99.6	99.5	-311.5	106.6	105.3	108.0	
CON	100.0	101.0	102.0	101.4				101.8			101.8	101.6	
TTC	100.0	100.5		101.2						115.2	113.9	110.7	
FBS	97.0	101.4	100.4	100.8	106.7						101.6	101.0	
OSE	100.0	100.8	101.4	101.4	104.2				99.0	97.1	104.1	103.4	
TLS													
TIC	110.7	112.3	102.8	108.9	103.2		99.6	99.4	-100.8	107.9	106.4	107.3	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	102.0	104.1		102.0					
MAN	107.5	108.0	100.5	107.2					
CON	103.4	100.5	100.5	100.5					
TTC	101.1	99.2	100.3	100.2					
FBS	102.9	100.9	100.4	100.4					
OSE		100.2		101.0					
TOT	102.2	105.8	100.5	102.4					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	106.2	109.0	98.2	107.6	90.0			94.6	-181.3	97.0	95.9	102.0	
MAN	114.7	108.1	104.5	107.6	105.0		100.8	100.7	98.0	108.5	106.9	107.2	
CON	101.4	100.5	101.7	101.0	98.3		97.4	100.0		102.0	100.0	100.5	
TTC	103.9	101.1	100.9	101.0	100.8		98.5	97.2	93.5	99.2	99.7	100.2	
FBS	101.8	100.4	100.4	100.4	101.7		101.7	100.5		98.0	100.5	100.4	
OSE	102.5	101.9	104.7	104.2	101.9	103.8		102.5	100.0	101.5	100.7	101.0	
TLS	105.1	108.7	103.3	103.9	102.5		102.3	92.5	-100.0	105.0	99.8	100.8	
TIC	109.1	104.4	101.4	102.8	101.9	103.3	100.2	99.0	96.1	104.1	102.0	102.3	
IMP	110.7	112.3	102.8	108.9	103.2		99.6	99.4	-100.8	107.9	106.4	107.3	
TOT	109.3	107.5	101.7	104.5	102.1	103.3	100.2	99.1	83.0	105.8	103.2	103.6	
OTLS	98.0	201.1	269.9	48.3								48.3	
COE	102.7	101.9	101.5	101.6								101.6	
CFC	99.1	100.6	98.4	98.8								98.8	
NOS	79.8	103.2	96.2	97.7								97.7	
GVA	90.8	102.2	99.7	100.1								100.1	
TOT	102.2	105.8	100.5	102.4	102.1	103.3	100.2	99.1	83.0	105.8	103.2		

Table A11.8: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.1	0.0	25.5	14.4	39.8	11.2	0.5	51.5
MAN	1.2	295.0	35.6	331.7	311.9	643.7	112.7	38.7	795.1
CON	0.1	88.6	4.5	93.1	1.5	94.7		8.3	102.9
TTC	0.5	15.2	231.0	246.7	65.9	312.6	-124.0	3.0	191.5
FBS	0.5	8.0	280.8	289.2	54.7	343.9		9.7	353.7
OSE	0.3	2.5	220.7	223.5	16.1	239.6	0.1	2.7	242.4
TOT	27.8	409.4	772.5	1209.8	464.5	1674.3	0.0	62.9	1737.1

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.2	15.8	1.6	22.6	5.9			0.2	0.0	22.9	29.0	51.5	
MAN	8.9	183.1	62.3	254.4	120.3		9.2	51.7	1.6	357.9	540.7	795.1	
CON	0.3	26.1	19.4	45.8	0.5		0.6	54.0		2.1	57.1	102.9	
TTC	0.6	10.8	65.6	77.0	20.8	0.9	0.5	6.9	0.0	85.5	114.5	191.5	
FBS	2.0	43.2	160.8	206.0	76.6	0.0	3.5	17.6		50.0	147.7	353.7	
OSE	0.2	3.5	21.2	24.9	53.6	4.4	153.1	1.1	0.2	5.0	217.5	242.4	
TIC	17.2	282.5	331.0	630.6	277.7	5.3	166.8	131.6	1.8	523.3	1106.5	1737.1	
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.1	46.7	106.6	158.4								158.4	
GVA	10.7	127.0	441.5	579.2								579.2	
TOT	27.8	409.4	772.5	1209.8	277.7	5.3	166.8	131.6	1.8	523.3	1106.5		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.5	
MAN								38.7	
CON								8.3	
TTC								3.0	
FBS								9.7	
OSE								2.7	
TOT								62.9	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.0	0.4					0.1	0.5	0.5	
MAN	0.2	1.6	6.2	8.0	26.4		0.4	2.3	0.0	1.6	30.7	38.7	
CON		0.0	2.0	2.0	0.1		0.1	6.1		0.0	6.3	8.3	
TTC	0.0	-0.1	1.1	1.0	1.7		-0.1	0.5		-0.1	2.0	3.0	
FBS	0.0	0.0	4.3	4.3	1.5		0.1	3.9		0.0	5.5	9.7	
OSE		0.0	0.0	0.0	2.1		-0.4	0.7		0.3	2.7	2.7	
TOT	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							11.2		
MAN							112.7		
CON									
TTC							-124.0		
FBS									
OSE							0.1		
TOT							0.0		

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.7	0.4	2.6	3.1			0.0	0.0	5.6	8.6	11.2	
MAN	0.8	20.0	9.0	29.8	39.9		3.2	5.2	-0.1	34.7	82.9	112.7	
CON													
TTC	-1.2	-21.7	-9.4	-32.3	-43.1		-3.2	-5.2	0.1	-40.2	-91.7	-124.0	
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT		0.0	0.0	0.0	0.0			0.0		0.0	0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.1	0.0	25.5	14.4	39.8			
MAN	1.2	295.0	35.6	331.7	311.9	643.7			
CON	0.1	88.6	4.5	93.1	1.5	94.7			
TTC	0.5	15.2	231.0	246.7	65.9	312.6			
FBS	0.5	8.0	280.8	289.2	54.7	343.9			
OSE	0.3	2.5	220.7	223.5	16.1	239.6			
TOT	27.8	409.4	772.5	1209.8	464.5	1674.3			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.8	14.1	1.1	20.0	2.5			0.1	0.0	17.2	19.9	39.8	
MAN	7.9	161.6	47.1	216.6	53.9		5.6	44.2	1.7	321.6	427.0	643.7	
CON	0.3	26.1	17.4	43.8	0.4		0.5	47.9		2.1	50.9	94.7	
TTC	1.8	32.5	74.0	108.3	62.2	0.9	3.8	11.7	-0.1	125.8	204.2	312.6	
FBS	2.0	43.2	156.5	201.7	75.1	0.0	3.4	13.7		50.0	142.2	343.9	
OSE	0.2	3.5	21.2	24.9	51.4	4.4	153.5	0.4	0.2	4.7	214.7	239.6	
TLS	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	
TIC	17.2	282.5	331.0	630.6	277.7	5.3	166.8	131.6	1.8	523.3	1106.5	1737.1	
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.1	46.7	106.6	158.4								158.4	
GVA	10.7	127.0	441.5	579.2								579.2	
TOT	27.8	409.4	772.5	1209.8	277.7	5.3	166.8	131.6	1.8	523.3	1106.5		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					14.4				
MAN					311.9				
CON					1.5				
TTC					65.9				
FBS					54.7				
OSE					16.1				
TOT					464.5				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.7	5.6	0.5	6.8	1.2			0.0	0.0	6.4	7.6	14.4	
MAN	1.1	85.6	19.5	106.2	24.0		1.6	19.3	0.1	160.7	205.7	311.9	
CON	0.0	0.5	0.3	0.9				0.7			0.7	1.5	
TTC	0.0	2.7	13.9	16.6	0.7			2.8	0.0	45.8	49.3	65.9	
FBS	0.2	13.8	24.4	38.5	0.2			2.1		13.9	16.2	54.7	
OSE	0.0	0.5	3.9	4.4	11.6		0.0		0.1	0.0	11.7	16.1	
TLS													
TIC	2.1	108.7	62.5	173.3	37.7		1.6	24.9	0.1	226.8	291.2	464.5	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.1	0.0	25.5					
MAN	1.2	295.0	35.6	331.7					
CON	0.1	88.6	4.5	93.1					
TRA	0.5	15.2	231.0	246.7					
TRN	0.5	8.0	280.8	289.2					
COM	0.3	2.5	220.7	223.5					
TOT	27.8	409.4	772.5	1209.8					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.1	8.5	0.6	13.2	1.3			0.1	0.0	10.8	12.2	25.5	
MAN	6.8	75.9	27.7	110.4	29.9		3.9	24.9	1.7	160.9	221.3	331.7	
CON	0.3	25.6	17.1	43.0	0.4		0.5	47.2		2.1	50.2	93.1	
TTC	1.7	29.9	60.2	91.8	61.5	0.9	3.8	8.9	-0.1	80.0	154.9	246.7	
FBS	1.8	29.4	132.1	163.2	74.9	0.0	3.4	11.6		36.1	126.0	289.2	
OSE	0.2	3.0	17.3	20.5	39.9	4.4	153.5	0.4	0.1	4.7	203.0	223.5	
TLS	0.2	1.5	13.6	15.3	32.1		0.1	13.5	0.0	1.9	47.6	62.9	
TIC	15.1	173.7	268.5	457.3	240.0	5.3	165.2	106.7	1.7	296.5	815.3	1272.6	
IMP	2.1	108.7	62.5	173.3	37.7		1.6	24.9	0.1	226.8	291.2	464.5	
TOT	17.2	282.5	331.0	630.6	277.7	5.3	166.8	131.6	1.8	523.3	1106.5	1737.1	
OTLS	-0.7	0.1	0.1	-0.5								-0.5	
COE	2.6	59.8	250.6	313.0								313.0	
CFC	3.7	20.4	84.3	108.4								108.4	
NOS	5.1	46.7	106.6	158.4								158.4	
GVA	10.7	127.0	441.5	579.2								579.2	
TOT	27.8	409.4	772.5	1209.8	277.7	5.3	166.8	131.6	1.8	523.3	1106.5		
Check													

Table A11.9: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	99.9	96.1	87.8	99.9	103.5	101.1	103.6	111.9	101.8
MAN	95.4	104.4	99.4	103.8	103.3	103.6	103.6	98.7	103.3
CON	127.1	104.3	95.6	103.9	101.2	103.8		98.2	103.4
TTC	92.6	98.9	103.8	103.4	101.1	102.9	103.6	95.1	102.4
FBS	99.6	102.2	102.1	102.1	107.4	102.9		98.2	102.8
OSE	95.2	99.1	100.5	100.5	98.3	100.3	94.6	101.9	100.4
TOT	99.6	104.1	102.0	102.6	103.3	102.8	104.2	98.6	102.6

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.0	103.4	96.5	102.6	101.5			84.8	-9.1	102.0	101.1	101.8	
MAN	99.5	105.6	98.5	103.6	99.4		102.8	112.5	43.1	104.0	103.2	103.3	
CON	100.7	110.7	100.2	105.9	103.3		96.0	101.9		91.6	101.4	103.4	
TTC	99.1	100.0	101.3	101.1	98.8					104.5	103.2	102.4	
FBS	98.9	104.7	102.8	103.2	100.5		96.2			106.2	102.2	102.8	
OSE	99.4	101.8	101.4	101.5	101.8	99.8		98.2	72.6	103.1	100.2	100.4	
TIC	100.2	105.5	101.4	103.2	100.2	99.8	99.8	105.6	42.7	104.1	102.3	102.6	
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	99.7	102.0	106.2	104.7								104.7	
GVA	98.6	101.0	102.4	102.0								102.0	
TOT	99.6	104.1	102.0	102.6	100.2	99.8	99.8	105.6	42.7	104.1	102.3		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								111.9	
MAN								98.7	
CON								98.2	
TTC								95.1	
FBS								98.2	
OSE								101.9	
TOT								98.6	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	92.9	-40.0	134.6	-375.0	101.4					110.5	103.3	111.9	
MAN	94.3	97.2	97.6	97.5	98.2		100.8	105.1	-100.0	104.0	99.0	98.7	
CON			98.1	98.1	105.9		96.5	98.2		100.0	98.2	98.2	
TTC				92.2	98.2						96.7	95.1	
FBS	130.0	-14.3	100.4	100.7	102.9		89.0			225.0	96.3	98.2	
OSE				240.0	101.0			101.1			101.1	101.9	
TOT	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							103.6		
MAN							103.6		
CON									
TTC							103.6		
FBS									
OSE							94.6		
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	101.4	104.6	95.9	102.5	101.7			82.4	-50.0	105.4	103.9	103.6	
MAN	97.9	107.5	97.8	104.1	100.7		101.5	118.6	-183.3	105.2	103.4	103.6	
CON													
TTC	99.2	107.3	97.7	104.0	100.8		101.5	118.5	-162.0	105.2	103.5	103.6	
FBS													
OSE					95.3					92.3	94.6	94.6	
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	99.9	96.1		99.9	103.5	101.1			
MAN	95.4	104.4	99.4	103.8	103.3	103.6			
CON	127.1	104.3	95.6	103.9	101.2	103.8			
TTC	92.6	98.9	103.8	103.4	101.1	102.9			
FBS	99.6	102.2	102.1	102.1	107.4	102.9			
OSE		99.1		100.5	98.3	100.3			
TOT	99.6	104.1	102.0	102.6	103.3	102.8			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.1	103.1	95.9	102.4	101.3			85.1	-7.1	100.9	99.9	101.1	
MAN	99.8	105.5	98.7	103.7	99.0		103.7	112.3	45.7	103.9	103.5	103.6	
CON	100.7	110.7	100.4	106.3	103.0		96.0	102.3		91.6	101.8	103.8	
TTC	99.1	104.7	101.0	102.1	100.2		101.0	109.7	-102.6	104.7	103.4	102.9	
FBS	98.7	104.7	102.9	103.2	100.5		96.4	102.0		106.2	102.5	102.9	
OSE	99.4	101.6	101.4	101.4	101.8	99.8		93.7	72.6	103.2	100.2	100.3	
TLS	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	
TIC	100.2	105.5	101.4	103.2	100.2	99.8	99.8	105.6	42.7	104.1	102.3	102.6	
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	99.7	102.0	106.2	104.7								104.7	
GVA	98.6	101.0	102.4	102.0								102.0	
TOT	99.6	104.1	102.0	102.6	100.2	99.8	99.8	105.6	42.7	104.1	102.3		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					103.5				
MAN					103.3				
CON					101.2				
TTC					101.1				
FBS					107.4				
OSE					98.3				
TOT					103.3				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	100.9	106.3	88.2	104.2	105.0			78.8	-32.2	104.5	102.9	103.5	
MAN	104.1	106.6	99.7	105.2	100.4		92.0	117.4	3.1	102.3	102.4	103.3	
CON	100.0	110.6	96.6	104.5				97.4			97.4	101.2	
TTC	102.3	99.0		100.2						101.7	101.4	101.1	
FBS	98.8	103.5	107.7	106.1	92.1						110.8	107.4	
OSE	85.7	104.5	101.8	102.1	97.6				57.8	97.2	97.0	98.3	
TLS													
TIC	102.3	105.9	102.9	104.8	99.7		92.2	114.7	6.3	102.6	102.4	103.3	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	99.9	96.1		99.9					
MAN	95.4	104.4	99.4	103.8					
CON	127.1	104.3	95.6	103.9					
TTC	92.6	98.9	103.8	103.4					
FBS	99.6	102.2	102.1	102.1					
OSE		99.1		100.5					
TOT	99.6	104.1	102.0	102.6					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	102.3	101.0	103.0	101.5	98.0			86.7	19.8	98.9	98.1	99.9	
MAN	99.1	104.3	98.0	102.3	98.0		109.4	108.6	79.6	105.5	104.6	103.8	
CON	100.7	110.7	100.5	106.3	103.0		96.0	102.4		91.6	101.9	103.9	
TTC	99.0	105.3	101.1	102.4	100.1		101.0	114.6	-110.0	106.6	104.0	103.4	
FBS	98.7	105.3	102.1	102.6	100.5		96.4	98.3		105.3	101.5	102.1	
OSE	100.0	101.2	101.3	101.2	103.1	99.8		93.7	95.5	103.2	100.4	100.5	
TLS	96.4	99.7	98.3	98.4	98.7		79.8	98.2	-100.0	103.5	98.7	98.6	
TIC	99.9	105.3	101.1	102.6	100.2	99.8	99.8	103.6	72.5	105.3	102.3	102.4	
IMP	102.3	105.9	102.9	104.8	99.7		92.2	114.7	6.3	102.6	102.4	103.3	
TOT	100.2	105.5	101.4	103.2	100.2	99.8	99.8	105.6	42.7	104.1	102.3	102.6	
OTLS	137.2	-84.9	-30.6	55.5								55.5	
COE	100.1	100.0	101.0	100.8								100.8	
CFC	101.6	100.9	101.4	101.3								101.3	
NOS	99.7	102.0	106.2	104.7								104.7	
GVA	98.6	101.0	102.4	102.0								102.0	
TOT	99.6	104.1	102.0	102.6	100.2	99.8	99.8	105.6	42.7	104.1	102.3		

Table A11.10: Supply and use tables 2010 in current prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5	13.9	39.4	10.8	0.4	50.6
MAN	1.2	282.6	35.8	319.6	301.8	621.4	108.8	39.2	769.4
CON	0.1	84.9	4.7	89.7	1.5	91.2		8.4	99.6
TTC	0.6	15.4	222.6	238.5	65.1	303.6	-119.7	3.1	187.1
FBS	0.5	7.8	275.0	283.3	50.9	334.2		9.9	344.1
OSE	0.3	2.5	219.6	222.4	16.4	238.8	0.1	2.7	241.6
TOT	28.0	393.3	757.6	1178.9	449.7	1628.6	0.0	63.8	1692.3

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	5.1	15.3	1.6	22.0	5.8			0.2	0.2	22.5	28.6	50.6	
MAN	8.9	173.4	63.3	245.6	121.0		8.9	46.0	3.8	344.1	523.7	769.4	
CON	0.3	23.6	19.4	43.2	0.5		0.6	53.0		2.2	56.4	99.6	
TTC	0.6	10.8	64.8	76.1	21.0	0.9	0.5	6.7	0.0	81.8	110.9	187.1	
FBS	2.1	41.2	156.3	199.6	76.2	0.0	3.7	17.5		47.1	144.5	344.1	
OSE	0.2	3.4	20.9	24.5	52.7	4.5	153.6	1.2	0.3	4.9	217.0	241.6	
TIC	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR								0.4	
MAN								39.2	
CON								8.4	
TTC								3.1	
FBS								9.9	
OSE								2.7	
TOT								63.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.0	0.0	0.0	0.0	0.4					0.1	0.5	0.4	
MAN	0.2	1.6	6.3	8.2	26.9		0.4	2.2	0.0	1.6	31.0	39.2	
CON		0.0	2.0	2.0	0.1		0.1	6.3		0.0	6.4	8.4	
TTC	0.0	-0.1	1.1	1.1	1.7		-0.1	0.5		-0.1	2.0	3.1	
FBS	0.0	0.0	4.3	4.3	1.5		0.1	4.1		0.0	5.7	9.9	
OSE		0.0	0.0	0.0	2.1		-0.4	0.7		0.3	2.7	2.7	
TOT	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR							10.8		
MAN							108.8		
CON									
TTC							-119.7		
FBS									
OSE							0.1		
TOT							0.0		

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.4	1.6	0.4	2.5	3.0			0.0	0.0	5.3	8.3	10.8	
MAN	0.8	18.6	9.2	28.6	39.6		3.2	4.4	0.0	32.9	80.2	108.8	
CON													
TTC	-1.2	-20.2	-9.7	-31.1	-42.7		-3.2	-4.4	-0.1	-38.2	-88.6	-119.7	
FBS													
OSE					0.1					0.0	0.1	0.1	
TOT					0.0			0.0		0.0	0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5	13.9	39.4			
MAN	1.2	282.6	35.8	319.6	301.8	621.4			
CON	0.1	84.9	4.7	89.7	1.5	91.2			
TTC	0.6	15.4	222.6	238.5	65.1	303.6			
FBS	0.5	7.8	275.0	283.3	50.9	334.2			
OSE	0.3	2.5	219.6	222.4	16.4	238.8			
TOT	28.0	393.3	757.6	1178.9	449.7	1628.6			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.7	13.7	1.2	19.5	2.5			0.2	0.2	17.1	19.9	39.4	
MAN	7.9	153.2	47.8	208.9	54.5		5.4	39.4	3.8	309.6	412.5	621.4	
CON	0.3	23.6	17.4	41.2	0.4		0.5	46.8		2.2	50.0	91.2	
TTC	1.8	31.1	73.3	106.2	62.1	0.9	3.7	10.7	0.1	120.1	197.5	303.6	
FBS	2.1	41.2	152.1	195.4	74.8	0.0	3.5	13.4		47.1	138.8	334.2	
OSE	0.2	3.4	20.9	24.5	50.5	4.5	154.0	0.5	0.3	4.6	214.3	238.8	
TLS	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	
TIC	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR					13.9				
MAN					301.8				
CON					1.5				
TTC					65.1				
FBS					50.9				
OSE					16.4				
TOT					449.7				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	0.7	5.3	0.6	6.5	1.2			0.0	0.1	6.1	7.4	13.9	
MAN	1.1	80.4	19.5	101.0	23.9		1.8	16.4	1.7	157.1	200.9	301.8	
CON	0.0	0.5	0.4	0.8				0.7			0.7	1.5	
TTC	0.0	2.7	13.8	16.6	0.7			2.9	0.0	45.0	48.6	65.1	
FBS	0.2	13.3	22.7	36.3	0.2			1.7		12.8	14.6	50.9	
OSE	0.0	0.5	3.8	4.3	11.8				0.2	0.0	12.1	16.4	
TLS													
TIC	2.0	102.6	60.8	165.4	37.8		1.8	21.7	1.9	221.0	284.2	449.7	

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	25.3	0.2	0.0	25.5					
MAN	1.2	282.6	35.8	319.6					
CON	0.1	84.9	4.7	89.7					
TTC	0.6	15.4	222.6	238.5					
FBS	0.5	7.8	275.0	283.3					
OSE	0.3	2.5	219.6	222.4					
TOT	28.0	393.3	757.6	1178.9					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR	4.0	8.4	0.6	13.0	1.3			0.1	0.1	10.9	12.5	25.5	
MAN	6.8	72.8	28.2	107.9	30.6		3.6	22.9	2.1	152.5	211.7	319.6	
CON	0.3	23.1	17.0	40.4	0.4		0.5	46.1		2.2	49.3	89.7	
TTC	1.7	28.4	59.5	89.6	61.4	0.9	3.7	7.8	0.1	75.1	148.9	238.5	
FBS	1.8	27.9	129.4	159.1	74.5	0.0	3.5	11.8		34.3	124.2	283.3	
OSE	0.2	2.9	17.1	20.2	38.7	4.5	154.0	0.5	0.1	4.5	202.2	222.4	
TLS	0.2	1.5	13.8	15.5	32.5		0.1	13.8	0.0	1.8	48.2	63.8	
TIC	15.1	165.0	265.6	445.7	239.4	5.3	165.5	102.9	2.4	281.5	796.9	1242.7	
IMP	2.0	102.6	60.8	165.4	37.8		1.8	21.7	1.9	221.0	284.2	449.7	
TOT	17.1	267.7	326.4	611.2	277.2	5.3	167.2	124.6	4.3	502.5	1081.2	1692.3	
OTLS	-0.5	-0.1	-0.3	-1.0								-1.0	
COE	2.6	59.8	248.1	310.5								310.5	
CFC	3.7	20.2	83.1	107.0								107.0	
NOS	5.1	45.8	100.4	151.3								151.3	
GVA	10.8	125.7	431.2	567.8								567.8	
TOT	28.0	393.3	757.6	1178.9	277.2	5.3	167.2	124.6	4.3	502.5	1081.2		
Check													

3. Balancing adjustments incorporated in the Supply and Use Tables (Table A11.11 - Table A11.14)

No change made in Table A11.10, thus no Table A11.15.

Table A11.11 Supply and use tables 2011 in current prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.3			0.3		0.3			0.3
MAN									
CON		-1.0		-1.0		-1.0			-1.0
TTC					0.5	0.5			0.5
FBS									
OSE									
TOT	0.3	-1.0		-0.8	0.5	-0.3			-0.3

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.2
MAN										1.0	1.0	1.0	-1.0
CON								-0.3			-0.3	-0.3	-0.7
TTC					0.2						0.2	0.2	0.3
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TIC			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-1.0
OTLS													
COE													
CFC													
NOS	0.3	-1.0	-0.3	-1.1								-1.1	
GVA	0.3	-1.0	-0.3	-1.1								-1.1	
TOT	0.3	-1.0		-0.8	-0.2			-0.3		1.0	0.5		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC									
FBS									
OSE									
TOT									

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN		0.0		0.0								0.0	0.0
CON													
TTC													
FBS			0.0	0.0								0.0	0.0
OSE													
TOT		0.0	0.0	0.0								0.0	0.0

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC									
FBS									
OSE									
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN		0.1		0.1	-0.8						-0.8	-0.7	0.7
CON													
TTC		-0.1		-0.1	0.8						0.8	0.7	-0.7
FBS													
OSE													
TOT											0.0	0.0	0.0

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.3			0.3		0.3			
MAN									
CON		-1.0		-1.0		-1.0			
TTC					0.5	0.5			
FBS									
OSE									
TOT	0.3	-1.0		-0.8	0.5	-0.3			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.3
MAN		-0.1		-0.1	0.8					1.0	1.8	1.7	-1.7
CON								-0.3			-0.3	-0.3	-0.7
TTC		0.1		0.1	-0.6						-0.6	-0.5	1.0
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TLS		0.0	0.0	0.0								0.0	
TIC			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-1.1
OTLS													
COE													
CFC													
NOS	0.3	-1.0	-0.3	-1.1								-1.1	
GVA	0.3	-1.0	-0.3	-1.0								-1.0	
TOT	0.3	-1.0		-0.7	-0.2			-0.3		1.0	0.5		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC					0.5				
FBS									
OSE									
TOT					0.5				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN					-0.2					-50.0	-50.2	-50.2	50.2
CON													
TTC													0.5
FBS													
OSE													
TLS													
TIC					-0.2					-50.0	-50.2	-50.2	50.7

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.3			0.3					
MAN									
CON		-1.0		-1.0					
TTC									
FBS									
OSE									
TOT	0.3	-1.0		-0.8					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.2
MAN		-0.1		-0.1	1.0					51.0	52.0	51.9	-51.9
CON								-0.3			-0.3	-0.3	-0.7
TTC		0.1		0.1	-0.6						-0.6	-0.5	0.5
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TLS		0.0	0.0	0.0								0.0	
TIC			0.3	0.3				-0.3		51.0	50.7	51.0	-51.8
IMP					-0.2					-50.0	-50.2	-50.2	
TOT			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-51.8
OTLS													
COE													
CFC													
NOS	0.3	-1.0	-0.3	-1.1								-1.1	
GVA	0.3	-1.0	-0.3	-1.0								-1.0	
TOT	0.3	-1.0		-0.8	-0.2			-0.3		1.0	0.5		
Check													

Table A11.12: Price indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.0			0.0		0.0			0.0
MAN							0.9	1.3	0.2
CON		0.0		0.0		0.0			0.0
TTC					-0.1	0.0	0.8		-0.5
FBS									
OSE									
TOT	0.0	0.0		0.0	0.0	0.0		0.8	0.0

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.0
MAN										0.0	0.0	0.0	0.2
CON								0.0			0.0	0.0	0.0
TTC					0.0						0.0	0.0	-0.5
FBS			0.0	0.0								0.0	0.0
OSE					0.0						0.0	0.0	0.0
TIC			0.0	0.0	0.0			0.0		0.0	0.0	0.0	-0.3
OTLS													
COE													
CFC													
NOS	1.1	0.0	0.0	0.0								0.0	
GVA	0.3	0.0	0.0	0.0								0.0	
TOT	0.0	0.0		0.0	0.0			0.0		0.0	0.0		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN								1.3	
CON									
TTC									
FBS									
OSE									
TOT								0.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN		1.3		0.3								0.1	1.3
CON													
TTC													
FBS			-0.7	-0.7								-0.3	0.3
OSE													
TOT		1.3	-0.2	-0.1								0.0	0.8

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN							0.9		
CON									
TTC							0.8		
FBS									
OSE									
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN		0.6		0.4	-2.0						-1.0	-0.6	1.5
CON													
TTC		0.6		0.4	-1.9						-0.9	-0.5	1.4
FBS													
OSE													
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.0			0.0		0.0			104.2
MAN									
CON		0.0		0.0		0.0			102.0
TTC					-0.1	0.0			102.0
FBS									
OSE									
TOT	0.0	0.0		0.0	0.0	0.0			-103.7

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.0
MAN		-0.1		-0.1	1.5					0.0	0.2	0.1	-0.1
CON								0.0			0.0	0.0	0.0
TTC		0.4		0.1	-1.3						-0.4	-0.2	0.2
FBS			0.0	0.0								0.0	0.0
OSE					0.0						0.0	0.0	0.0
TLS		1.3	-0.2	-0.1								0.0	
TIC			0.0	0.0	0.0			0.0		0.0	0.0	0.0	0.1
OTLS													
COE													
CFC													
NOS	1.1	0.0	0.0	0.0								0.0	
GVA	0.3	0.0	0.0	0.0								0.0	
TOT	0.0	0.0		0.0	0.0			0.0		0.0	0.0		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC					-0.1				
FBS									
OSE									
TOT					0.0				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN					-0.8					-17.2	-13.2	-8.1	8.1
CON													
TTC													-0.1
FBS													
OSE													
TLS													
TIC					-0.5					-11.4	-8.9	-5.3	5.3

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.0			0.0					
MAN									
CON		0.0		0.0					
TTC									
FBS									
OSE									
TOT	0.0	0.0		0.0					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.0
MAN		-0.2		-0.1	3.3					12.2	9.8	6.7	-6.7
CON								0.0			0.0	0.0	0.0
TTC		0.4		0.1	-1.3						-0.5	-0.3	0.3
FBS			0.0	0.0								0.0	0.0
OSE					0.0						0.0	0.0	0.0
TLS		1.3	-0.2	-0.1								0.0	
TIC			0.0	0.0	0.1			0.0		7.4	2.9	1.9	-6.4
IMP					-0.5					-11.4	-8.9	-5.3	
TOT			0.0	0.0	0.0			0.0		0.0	0.0	0.0	-6.4
OTLS													
COE													
CFC													
NOS	1.1	0.0	0.0	0.0								0.0	
GVA	0.3	0.0	0.0	0.0								0.0	
TOT	0.0	0.0		0.0	0.0			0.0		0.0	0.0		

Table A11.13: Supply and use tables 2011 at previous years' prices

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.2			0.2		0.2			0.2
MAN							-1.0	-0.5	-1.5
CON		-1.0		-1.0		-1.0			-1.0
TTC					0.5	0.5	1.0		1.5
FBS									
OSE									
TOT	0.2	-1.0		-0.7	0.5	-0.3		-0.5	-0.8

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.2
MAN										1.0	1.0	1.0	-2.5
CON								-0.3			-0.3	-0.3	-0.7
TTC					0.2						0.2	0.2	1.3
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TIC			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-1.5
OTLS													
COE													
CFC													
NOS	0.2	-1.0	-0.3	-1.0								-1.0	
GVA	0.2	-1.0	-0.3	-1.0								-1.0	
TOT	0.2	-1.0		-0.7	-0.2			-0.3		1.0	0.5		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN								-0.5	
CON									
TTC									
FBS									
OSE									
TOT								-0.5	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN													-0.5
CON													
TTC													
FBS													
OSE													
TOT													-0.5

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN							-1.0		
CON									
TTC							1.0		
FBS									
OSE									
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN													-1.0
CON													
TTC													1.0
FBS													
OSE													
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.2			0.2		0.2			
MAN									
CON		-1.0		-1.0		-1.0			
TTC					0.5	0.5			
FBS									
OSE									
TOT	0.2	-1.0		-0.7	0.5	-0.3			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.2
MAN										1.0	1.0	1.0	-1.0
CON								-0.3			-0.3	-0.3	-0.7
TTC					0.2						0.2	0.2	0.3
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TLS													
TIC			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-1.0
OTLS													
COE													
CFC													
NOS	0.2	-1.0	-0.3	-1.0								-1.0	
GVA	0.2	-1.0	-0.3	-1.0								-1.0	
TOT	0.2	-1.0		-0.7	-0.2			-0.3		1.0	0.5		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC					0.5				
FBS									
OSE									
TOT					0.5				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN										-25.0	-25.0	-25.0	25.0
CON													
TTC													0.5
FBS													
OSE													
TLS													
TIC										-25.0	-25.0	-25.0	25.5

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.2			0.2					
MAN									
CON		-1.0		-1.0					
TRA									
TRN									
COM									
TOT	0.2	-1.0		-0.7					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.2
MAN										26.0	26.0	26.0	-26.0
CON								-0.3			-0.3	-0.3	-0.7
TTC					0.2						0.2	0.2	-0.2
FBS			0.3	0.3								0.3	-0.3
OSE					-0.4						-0.4	-0.4	0.4
TLS													
TIC			0.3	0.3	-0.2			-0.3		26.0	25.5	25.8	-26.5
IMP										-25.0	-25.0	-25.0	
TOT			0.3	0.3	-0.2			-0.3		1.0	0.5	0.8	-26.5
OTLS													
COE													
CFC													
NOS	0.2	-1.0	-0.3	-1.0								-1.0	
GVA	0.2	-1.0	-0.3	-1.0								-1.0	
TOT	0.2	-1.0		-0.7	-0.2			-0.3		1.0	0.5		
Check													

Table A11.14: Volume indices for supply and use tables 2011

Supply Table at basic prices, transf. to purchasers' prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.9			0.9		0.6			0.5
MAN							-0.9	-1.3	-0.2
CON		-1.2		-1.1		-1.1			-1.0
TTC					0.8	0.2	-0.8		0.8
FBS									
OSE									
TOT	0.9	-0.2		-0.1	0.1	0.0		-0.8	0.0

Use Table at purchasers' prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.5
MAN										0.3	0.2	0.1	-0.3
CON								-0.6			-0.5	-0.3	-0.7
TTC					1.0						0.2	0.1	0.7
FBS			0.2	0.1								0.1	-0.1
OSE					-0.8						-0.2	-0.2	0.2
TIC			0.1	0.0	-0.1			-0.2		0.2	0.0	0.0	0.2
OTLS													
COE													
CFC													
NOS	4.7	-2.1	-0.3	-0.7								-0.7	
GVA	2.2	-0.8	-0.1	-0.2								-0.2	
TOT	0.9	-0.2		-0.1	-0.1			-0.2		0.2	0.0		
Check													

Taxes less subsidies on products

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN								-1.3	
CON									
TTC									
FBS									
OSE									
TOT								-0.8	

Use Table for taxes less subsidies on products

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN													-1.3
CON													
TTC													
FBS													
OSE													
TOT													-0.8

Trade and transport margins

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN							-0.9		
CON									
TTC							-0.8		
FBS									
OSE									
TOT									

Use Table for trade and transport margins

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN													-0.9
CON													
TTC													-0.8
FBS													
OSE													
TOT													

Supply Table at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.9			0.9		0.6			
MAN									
CON		-1.2		-1.1		-1.1			
TTC					0.8	0.2			
FBS									
OSE									
TOT	0.9	-0.2		-0.1	0.1	0.0			

Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.6
MAN										0.3	0.2	0.2	-0.2
CON								-0.6			-0.6	-0.3	-0.7
TTC					0.3						0.1	0.1	0.1
FBS			0.2	0.1								0.1	-0.1
OSE					-0.8						-0.2	-0.2	0.2
TLS													
TIC			0.1	0.0	-0.1			-0.2		0.2	0.0	0.0	-0.1
OTLS													
COE													
CFC													
NOS	4.7	-2.1	-0.3	-0.7								-0.7	
GVA	2.2	-0.8	-0.1	-0.2								-0.2	
TOT	0.9	-0.2		-0.1	-0.1			-0.2		0.2	0.0		
Check													

Imports CIF

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR									
MAN									
CON									
TTC					0.8				
FBS									
OSE									
TOT					0.1				

Imports Use Table

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													
MAN										-15.9	-12.4	-8.3	8.3
CON													
TTC													0.8
FBS													
OSE													
TLS													
TIC										-11.3	-8.8	-5.6	5.7

Supply Table for domestic output at basic prices

	AGR	MMC	SER	DP	IMP	SUPbp	TTM	TLS	SUPpp
AGR	0.9			0.9					
MAN									
CON		-1.2		-1.1					
TTC									
FBS									
OSE									
TOT	0.9	-0.2		-0.1					

Domestic Use Table at basic prices

	AGR	MMC	SER	TIC	FCH	FCN	FCG	GFCF	INV	EXP	TOTfin	TOTpp	Check
AGR													0.9
MAN										17.1	12.3	8.1	-8.1
CON								-0.7			-0.6	-0.3	-0.8
TTC					0.3						0.1	0.1	-0.1
FBS			0.2	0.2								0.1	-0.1
OSE					-1.0						-0.2	-0.2	0.2
TLS													
TIC			0.1	0.1	-0.1			-0.3		9.2	3.2	2.1	-8.0
IMP										-11.3	-8.8	-5.6	
TOT			0.1	0.0	-0.1			-0.2		0.2	0.0	0.0	-8.0
OTLS													
COE													
CFC													
NOS	4.7	-2.1	-0.3	-0.7								-0.7	
GVA	2.2	-0.8	-0.1	-0.2								-0.2	
TOT	0.9	-0.2		-0.1	-0.1			-0.2		0.2	0.0		

Chapter 12. Transforming the Supply and Use Tables into Input-Output Tables

A. Introduction

12.1 This Chapter describes the methods for transforming SUTs into IOTs (Product by Product and Industry by Industry). The compilation of IOTs is quite different in nature from the compilation of the SUTs and is better described as an analytical step or transformation rather than a compilation process.

12.2 Section B provides an overview of the IOTs and a description of the terminology used for IOTs. Section C focuses on the transformation of SUTs into IOTs. In particular, it describes the tables that form the starting point for the compilation of IOTs, and covers some issues related to when it is necessary to have a **square versus rectangular SUTs** for the compilation of IOTs, and how to deal with secondary production in IOTs. Section D describes the I-O framework; it describes the theoretical models for the compilation of IOTs; and it provides numerical examples of transformation of SUTs into IOTs based on the different theoretical models. Section E provides an empirical application of the transformation models. It also discusses general issues on IOTs such as the relationship between types of tables, technology and share markets, the link between IOTs and official statistics and the requirements of IOTs. Annex A and B to this Chapter elaborate more on the mathematical derivation of different IOTs and cover how to handle negatives in the IOTs. Annex C to this Chapter provides a list of references for the treatment of secondary production.

B. Overview of the relationship between IOTs and SUTs

12.3 The SUTs form a central part of the National Accounts and they provide a framework to bring together various data and, through balancing, ensure the coherency and consistency of various parts of the National Accounts. The SUTs thus serve many purposes, in particular, statistical and analytical, not just for producers but also for a range of different users, and the analytical dimension is especially enhanced when the SUTs are transformed into IOTs. For analytical purposes, the assumptions about the relationships between inputs and outputs are required irrespective of whether the products have been produced by the primary industry or by other industries as their secondary output.

12.4 The SUTs constitute the basis for compiling IOTs and it is recommended that the SUTs are compiled first, and then the IOTs. This approach best utilises data collected from businesses and other sources in order to compile SUTs and then - via a range of assumptions - move to the basis of the IOTs. The domestic output part of the Supply Table and the intermediate use part of the Use Table are always product by industry tables and often **rectangular** whereby many more products than industries are distinguished. IOTs, on the other hand, always reflect the same number of industries (Industry by Industry IOTs) or the same number of products (Product by Product IOTs).

12.5 Table 12.1 shows the general structure of a Product by Product IOT at basic prices. A similar table can be compiled for an Industry by Industry IOT where the first quadrant contains an Industry by Industry rather than a Product by Product matrix. In practice, the IOTs can have different presentations such as input-output table with net exports. However, the fundamental elements of the general structure remain the same. The different presentations of IOTs and the components are covered later in this Chapter. 8.21. In addition, a reminder, that for the ease of exposition and not to overload the presentation of the SUTs and IOTs, the **adjustment items** are not included in the numerical examples in this Handbook. This issue is explained further in Chapter 8, paragraphs 8.18 - 8.21.

Table 12.1 Product by Product Input-Output Table at basic prices

		PRODUCTS							FINAL USE								Output at basic prices
		Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS: Agriculture	(1)	Intermediate consumption of domestic products at basic prices							Final use of domestic products at basic prices								
PRODUCTS: Manufacturing	(2)																
PRODUCTS: Construction	(3)																
PRODUCTS: Trade, transport and communication	(4)																
PRODUCTS: Finance and business services	(5)																
PRODUCTS: Other services	(6)																
Total at basic prices	(7)																
Imports	(8)	Intermediate consumption of imported products							Final use of imported products								
Taxes less subsidies on products	(9)	Taxes less subsidies on products							Taxes less subsidies on products								
Total at purchasers' prices	(10)																
GVA: Compensation of employees	(11)	GVA at basic prices															
GVA: Other taxes less subsidies on production	(12)																
GVA: Consumption of fixed capital	(13)																
GVA: Net operating surplus/Net mixed income	(14)																
GVA	(15)																
Input at basic prices	(16)																

= empty

12.6 In classical I-O theory, the impact analysis (for example, the effect on GVA of an increase in household final consumption) requires that the output side and the input side are classified in identical ways (either by products or by industries). This allows the direct and indirect effects to be traced through the system - any output will require inputs, which in turn, require further outputs, etc. As the basis of the Use Table is a product by industry matrix, it is not possible to directly link the required outputs to the required inputs, and thus it is necessary to transform either the product dimension into an industry dimension or vice versa, which is done by applying the information available in the Supply Table. Although the impact analysis can also be undertaken by iterative procedures based on the Supply Table and Use Table datasets directly, this approach basically also implies relying on one of the transformation models discussed later in this Chapter. Thus compiling IOTs is an analytical step and various assumptions have to be made and sometimes adjustments are required for the transformation of SUTs into IOTs.

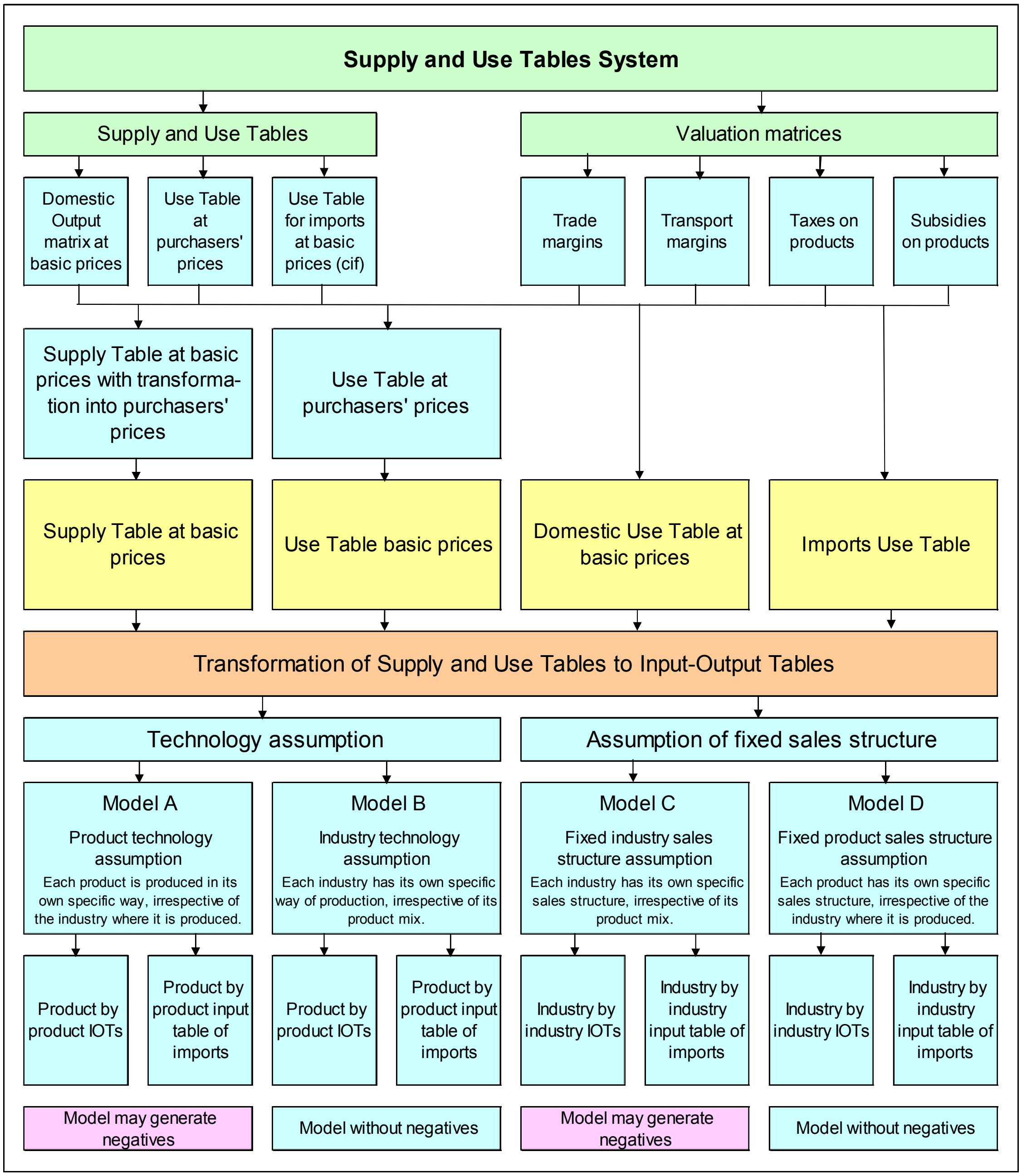
12.7 In the main, the construction of IOTs is a matter of how the treatment of secondary products is undertaken. Many units may produce only one group of products, which are the primary products of the industry to which they are classified. However, some units produce products that are not among the primary products of the industry to which they belong. As a result, there will be many non-diagonal entries in the Supply Table. The treatment of secondary products rest upon the separation of outputs or inputs associated with secondary products, so that they can be added to the outputs or inputs of the industry in which the secondary product is the characteristic or principal output or alternatively to create industry adjusted product groups.

12.8 As an analytical tool, I-O based data are conveniently integrated into macroeconomic models in order to analyse the links between final uses and levels of industrial output. I-O analysis can also serve various analytical purposes such as impact analysis, productivity analysis, employment effects, analysis of the inter-dependence of structures and analysis of price change. Analytical uses of IOTs are illustrated in Chapter 19 and Chapter 20 of this Handbook.

12.9 The SUTs at basic prices with a split of the Use Table between use of domestically produced products and use of imported products constitute the starting point for the transformation of SUTs to IOTs. Thus in essence, this provides the starting point as shown in Figure 2.2, for the bottom left-hand side of the "H-Approach" for IOTs in current prices and for the bottom right-hand side of the "H-Approach" for IOTs in previous years' prices.

12.10 Figure 12.1 provides an overview of the various tables that feed into the transformation of SUTs into IOTs and the various types of IOTs linked to the different model assumptions. It is worth noting that for the industry by industry IOTs the corresponding import flow tables does not necessarily need to be transformed to industry by industry format, but can be retained in the SUTs format as product by industry table.

Figure 12.1 Transformation of SUTs to IOTs



1. Terminology used with reference to IOTs

12.11 Over many years, the terminology and the understanding around Symmetric Input-Output Tables and the Supply and Use Tables have evolved. In particular, the use of the term 'symmetric' is often misunderstood. In fact the term 'symmetric' is correct in the sense that the IOTs are square tables (thus allowing, for example, for matrix inversion and the generation of multipliers) and the way the Industry by Industry Tables or Product by Product Tables are presented. However, conceptually, it is incorrect to use the term 'symmetric' in the sense that the transformations reflect "Industry-adjusted products" by Industry IOTs or product by "Product-adjusted industries" IOTs, in essence, no symmetry exists in the dimension of the matrix (see Box 12.1 for more detail).

12.12 In addition, in mathematical terms, IOTs are not symmetric matrices, that is, the table element (i,j) is not equal to element (j,i). In other words, the use of steel by the manufacturing industry of basic metals is not the same as the use of basic metals by the steel industry. Thus in this Handbook, and for future guidance, it is recommended to use the term “Input-Output Tables” (IOTs) and not “Symmetric Input-Output Tables”.

12.13 It is also worth noting, that in the transformations used in Model A and Model B as shown in Figure 12.1 **where technology assumptions are applied, there is no technology involved in the meaning of physical production processes but merely economic transactions measured in monetary terms**. With the transformations, the institutional characteristics of the industries remain.

12.14 Box 12.1 provides further clarification on some key misunderstandings regarding I-O related terminology.

Box 12.1 Clarification of IOTs terminology

The terminology used to this day for IOTs can be traced back to Chapter 3 of the 1968 SNA. However, as the understanding has evolved some clarifications are important to be made in two specific areas to ensure correct understanding and correct use of specific terminology.

The first area relates to the use of the term “**technology assumptions**”. This term was previously also applied to the assumptions used for compiling Industry by Industry IOTs from SUTs. Based on the work of Konijn and Steenge (1995), it was clarified that only the much weaker sales structure assumptions were necessary and those actually used in this case. This aspect was further elaborated in Thage (2002) and the new terminology with a clear distinction between technology assumptions and sales structure assumptions. These contributed to the understanding of the real differences between Product by Product IOTs and Industry by Industry IOTs, and became the new standard terminology with the introduction of the Eurostat Manual on Supply, Use and Input-Output Tables (2008), the 2008 SNA and the ESA 2010 (Eurostat, 2013b).

The second area relates to the use of the terms **“Product by Product” IOTs** and **“Industry by Industry” IOTs**. The same term is used to characterize both rows and columns, although their implications are very different. Starting with the Use Table for intermediate consumption, the products are indicated in the rows and industries indicated in the columns.

- “Product by Product” IOTs are compiled by adjusting the columns (using technology assumptions) but in this process the industries remain as industries with all the characteristics of the producing units, transforming intermediate and primary inputs into output, including all the institutional characteristics. The industries are not transformed into products.
- “Industry by Industry” IOTs are compiled by adjusting the rows (using sales structure assumptions) but in this process the products remain as products, now just composed in a different way. The products are not transformed into industries.

Therefore, a more precise terminology reflecting the actual procedures would require the use of different terms representing meaning of the rows and the columns of the IOTs. This can be summarized as follows:

- References to “**Product by Product”** should be **Product by “Product-adjusted industries**”, whereby the “industry” is retained.
- References to “**Industry by Industry”** should be “**Industry-adjusted products**” **by Industry**, whereby the “product” is retained.

Even though these terms are conceptually correct, they are currently not used. In general, it is important to remember that “Product by Product” and “Industry by Industry” references are short-hand versions of a more descriptive terminology, and what this implies for the understanding of the contents of the tables.

C. Conversion of SUTs to IOTs

1. Starting point for the transformation

12.15 The starting point for the transformation of SUTs to IOTs consists of the set of the following tables:

- Supply Table at basic prices;
- Use Table at basic prices;
- Domestic Use Table (DUT) at basic prices; and
- Imports Use Table (IUT) at basic prices.

12.16 Although the Use Table is initially compiled at purchasers' prices, the transformation of the Use Table to basic prices is viewed as a step towards the compilation of IOTs, which are usually compiled at basic prices and not purchasers' prices. Intermediate uses and final uses calculated at basic prices are one step further removed from basic statistics collected and actual observations in the economy thus needing the compilation of valuation matrices as described in Chapter 7 of this Handbook.

12.17 The structure and data contents of producing unbalanced SUTs in current prices, including the DUT and IUT, are covered in detail in Chapters 3 to 8. These chapters cover all the building blocks required in producing the set of tables necessary to compile IOTs. Various issues of particular relevance when compiling IOTs from SUTs, such as statistical units, redefinitions and the relationship between products and industries are further elaborated in this Chapter.

12.18 The recommended approach to the compilation of IOTs is thus to prepare separate IOTs for domestic output and imported products which are derived from the Domestic Use Table and the Imports Use Table of the SUTs system. The statistical requirements for such a separation are considerable but the results allow considerable flexibility in the treatment of imports and allow a clear analysis of the changes in the impact of the use of supplies from resident producers and from non-resident suppliers.

12.19 A simple numerical example of IOTs obtained using different models is presented in this Chapter. The starting point for the various IOTs is the SUTs in Table 12.2 which include a Supply Table at basic prices, a Domestic Use Table at basic prices and an Imports Use Table. Note that in the Domestic Use Table, the imports are still included in the table but shown in a single row so that the resulting table still adds up to the Supply Table.

Table 12.2 Numerical example of rectangular SUTs for the transformation

Supply Table at basic prices

		Industries			Output	Imports	Total supply
		Agricul-ture	Manufacturing and construction	Services			
Products	Agriculture	25.77	5.15	7.04	37.96	15.38	53.35
	Manufacturing	1.26	313.51	35.72	350.50	399.47	749.97
	Construction	0.09	89.00	4.49	93.58	1.56	95.15
	Trade, transport and communication	0.53	15.08	231.60	247.21	72.93	320.13
	Finance and business services	12.49	8.05	262.96	283.49	55.24	338.74
	Other services	0.30	2.51	222.86	225.67	16.64	242.31
Total		40.45	433.31	764.66	1 238.41	561.23	1 799.64

Domestic Use Table at basic prices

		Industries			Final use			Total use
		Agricul-ture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	4.35	9.28	0.61	13.18	0.08	10.47	37.96
	Manufacturing	7.78	82.09	28.90	31.15	26.74	173.83	350.50
	Construction	0.30	25.71	17.39	0.89	47.20	2.10	93.58
	Trade, transport and communication	1.80	30.22	60.71	68.96	8.57	76.95	247.21
	Finance and business services	1.82	29.48	132.56	73.04	11.63	34.97	283.49
	Other services	0.17	3.03	18.14	202.77	0.55	1.02	225.67
Prim	Imports	2.54	123.74	78.29	75.33	36.50	244.82	561.23
	GVA	21.70	129.78	428.07				579.54
Total		40.45	433.31	764.66	465.33	131.27	544.17	

Imports Use Table at basic prices

		Industries			Final use			Total use
		Agricul-ture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	0.77	6.40	0.48	1.25	0.03	6.45	15.38
	Manufacturing	1.49	99.62	34.95	61.07	30.80	171.55	399.47
	Construction	0.00	0.52	0.35		0.69		1.56
	Trade, transport and communication	0.04	2.69	14.05	0.73	2.72	52.70	72.93
	Finance and business services	0.23	13.99	24.54	0.22	2.16	14.10	55.24
	Other services	0.01	0.52	3.93	12.06	0.10	0.02	16.64
Total		2.54	123.74	78.29	75.33	36.50	244.82	561.23

2. Square versus rectangular SUTs

12.20 A square Supply Table is required when the assumptions for the transformation into IOTs are based on product technology assumption (Model A) and fixed industry sales structure model (Model C) which require the calculation of an inverse matrix based on the Supply Table. In most countries, the SUTs are rectangular, where there are many more products than industries, and this requires an aggregation of the product dimension so the number of industries will determine the dimension of the resulting square SUTs.

12.21 In the case of the industry technology assumption (Model B), square matrices are not required but applying the formula directly to the existing dimensions of the SUTs will result in square IOTs with as many rows and columns as the number of products which will usually not make much sense, and the aggregation loss of information will not depend on whether the aggregation is made before or after application of the formula.

12.22 Only in the case of the fixed product sales structure assumption (Model D), there is a clear gain relative to minimising the aggregation loss of information by using the formula directly on the SUTs rectangular matrices, resulting in Industry by Industry IOTs with as many rows and columns as the number of industries, see Thage (2005) and (2011).

12.23 In the cases where aggregation by product is necessary to obtain a square SUTs system, each product has to be assigned to a primary producer. The existing link between CPC and ISIC provides a guide for the assignment of products to industries. In general, several products will have to be assigned to the same industry. This implies that, in the product technology assumption (Model A), these products are assumed to share the same input structure. The assignment of products to industries can then be used to aggregate the Supply Table to obtain a square table. For the product technology assumption (Model A), it is not strictly required to aggregate the Use Table at this stage. However, to ultimately obtain square IOTs, an aggregation of the Use Table will be necessary at some point. It may therefore also be done before the calculation of the IOTs.

12.24 Table 12.3 shows a numerical example of a square SUTs constructed from the rectangular SUTs shown in Table 12.2.

Table 12.3 Numerical example of square SUTs for the transformation

Supply Table at basic prices

		Industries			Output	Imports	Total supply
		Agricul-ture	Manufacturing and construction	Services			
Products	Agriculture	25.77	5.15	7.04	37.96	15.38	53.35
	Manufacturing and construction	1.35	402.51	40.21	444.08	401.04	845.12
	Services	13.32	25.64	717.41	756.37	144.81	901.18
Total		40.45	433.31	764.66	1 238.41	561.23	1 799.64

Domestic Use Table at basic prices

		Industries			Final use			Total use
		Agricul-ture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	4.35	9.28	0.61	13.18	0.08	10.47	37.96
	Manufacturing and construction	8.08	107.80	46.29	32.04	73.94	175.94	444.08
	Services	3.78	62.72	211.40	344.77	20.75	112.95	756.37
Prim	Imports	2.54	123.74	78.29	75.33	36.50	244.82	561.23
	GVA	21.70	129.78	428.07				579.54
Total		40.45	433.31	764.66	465.33	131.27	544.17	

Imports Use Table

		Industries			Final use			Total use
		Agricul-ture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	0.77	6.40	0.48	1.25	0.03	6.45	15.38
	Manufacturing and construction	1.49	100.14	35.30	61.07	31.49	171.55	401.04
	Services	0.28	17.20	42.52	13.02	4.98	66.81	144.81
Total		2.54	123.74	78.29	75.33	36.50	244.82	561.23

3. Secondary production

12.25 The existence of cell entries reflecting secondary production in the square based Supply Table is the only reason for the difference between Product by Product and Industry by Industry IOTs. The secondary production thereby creates the need to choose between the alternative product technology assumptions and market share assumptions. In the case of no secondary production, the Domestic Use Table would represent an IOT.

12.26 The 2008 SNA (paragraph 28.46) distinguishes between three types of secondary products:

- *subsidiary products* are those products that are technologically unrelated to the primary product.
- *by-products* are those products that are produced simultaneously with another product but which can be regarded as secondary to that product, for example, gas produced by blast furnaces.
- *joint products* are those products that are produced simultaneously with another product but which cannot be said to be secondary, for example, beef and hide produced by slaughtering animals.

12.27 The importance of secondary production is closely connected to the type of economic unit (for example, **establishments versus enterprises**) used when collecting data from businesses and compiling the SUTs. Most often the compiler may not be in a position to distinguish between the three types of secondary products. Therefore, the four standard models for compiling IOTs from SUTs do not make such a distinction, whereas it may play a role when compiling Product by Product IOTs based on the assumption of hybrid technology.

12.28 In most economies, there are probably limited cases of pure subsidiary, by-products or joint production. In most cases, there are some joint costs and some costs that can be attributed to the distinctive outputs.

12.29 In practice, where certain kinds of secondary production would potentially create problems in the resulting IOTs no matter which transformation formula is used, then a priori redefinitions (for example, breakdowns of vertically integrated economic units) may be possible solutions. Such very special features of production structure will usually be well known by the compilers and could be taken into account on an ad hoc basis. The handling of secondary production in SUTs is covered in more detail in Chapter 5.

4. Main theoretical models used for the derivation of IOTs

12.30 There are four main transformation methods to derive IOTs from SUTs. As shown in Figure 12.1, and summarized in Figure 12.2, the four basic transformation models are based on the following assumptions:

- Product technology assumption (Model A)

  Each product is produced in its own specific way, irrespective of the industry where it is produced.

- Industry technology assumption (Model B)

  Each industry has its own specific way of production, irrespective of its product mix.

- Fixed industry sales structure assumption (Model C)

  Each industry has its own specific sales structure, irrespective of its product mix.

- Fixed product sales structure assumption (Model D)

  Each product has its own specific sales structure, irrespective of the industry where it is produced.

12.31 The main distinction concerning assumptions is between “technology assumptions” and “sales structure assumptions”. Product by Product IOTs are based on technology assumptions while the Industry by Industry IOTs are derived from sales structure assumptions.

12.32 A “technology” assumption is a strong assumption in the sense that it is based on production theory that cannot be underpinned by observed statistical data. The “sales structure” assumptions are weaker assumptions as, in general, they only utilise observed sales structures for the actual year. Thus, from a statistical perspective, the two types of IOTs thus reflect quite different approaches.

12.33 A further distinction relates to the fact that Model B and Model D represent relatively simple breakdowns and subsequent aggregations that in practice can be implemented without any reference to mathematical models. Whereas Model A and Model C can only be implemented by a mathematical transformation that makes each resulting element in the IOTs in principle depend on all elements of the SUTs.

12.34 In general, **Model A** (using the product technology assumption) and **Model D** (using the fixed product sales structure assumption) are **widely used by NSOs**, whereas Model B and Model C are considered less realistic but for formal reasons presented as they can be derived as mathematically analogously to the two other models.

Figure 12.2 Basic transformation models

		Product by Product Input-Output Table	Industry by Industry Input-Output Table
Technology	Product technology	**Model A** Each product is produced in its own specific way, irrespective of the industry where it is produced. *Negative elements may occur*	
	Industry technology	**Model B** Each industry has its own specific way of production, irrespective of its product mix. *No negative elements*	
Sales structure	Fixed industry sales structure		**Model C** Each industry has its own specific sales structure, irrespective of its product mix. *Negative elements may occur*
	Fixed product sales structure		**Model D** Each product has its own specific sales structure, irrespective of the industry where it is produced. *No negative elements*

12.35 It is important to note that the assumptions made for the IOTs (whether technology assumptions or sale structure assumptions) relate to the situation in the particular year for which the IOTs are compiled. They do not imply any assumptions about constant input proportions or market shares over time. In fact, when IOTs are compiled on an annual basis (or every five years), the time series of these tables can be used to examine the dynamic changes of the input structures in models dealing with the structural development of the economy.

12.36 The task confronting compilers of the rectangular SUTs is to reorganise already highly aggregated data and, when compiling the IOTs, compilers have to first deal with a **disaggregation** of the SUTs data under certain assumptions and subsequently with an **aggregation** to derive an IOT. When compared to the real world and the magnitude of products and production processes, even the detailed basic statistics already represent a major aggregation.

12.37 In the various transformation models, each of the "products" and "industries" includes many different underlying products and production processes. If, for example, the **product technology** is assumed, this also implies the assumption that the underlying product composition of the output from any secondary producer is identical to the underlying product composition of the primary producer. Looking below the applied level of aggregation, it is thus implicitly assumed that an **industry technology** will apply for the underlying products in order to implement the product technology. This illustrates the inter-connections between the various types of assumptions when the real world complexities are taken into account.

D. The I-O framework

12.38 The I-O framework is presented in Box 12.2 with a definition of variables and a summary of the main transformation models is given in Box 12.3. The information contained in SUTs can be rearranged in the I-O framework as shown in Box 12.2. In Box 12.2 and Box 12.3, the capital letters denote matrices and the small letters vectors. Transpose matrices are written as matrices with the attachment of a superscript (T). Vectors are written as column vectors and row vectors are written as transposed column vectors by the attachment of a superscript (T). In addition, the superscript ^ is used to denote the diagonalization of a vector.

12.39 The benefit of the I-O framework is that all information of the SUTs and IOTs can be integrated into one matrix. The first two rows of the "Integrated I-O framework" in Box 12.2 refer to products. In particular, the first row shows the use of domestic products as intermediate output by industries (the matrix U_d) and final uses (the matrix Y_d). The matrix U_d has products in the rows and industries in the columns. Similarly, the second row of the "Integrated I-O framework" shows the use of imported products as intermediate output by industries (U_m) and final uses (Y_m). The matrix U_m has products in the rows and industries in the columns.

12.40 The typical element of the matrix U_d, say, in rows i and column j, represents the amount of product i used up in the production of industry j. The row sums of this matrix represent the total intermediate use of the various products in production. The column sums represent the intermediate use of all products by the various industries. The matrix Y_d has again products in the rows and final uses categories in the columns. Each element of the corresponding summation vector represents the net final use of a particular domestic product for consumption, capital formation and net exports.

12.41 The third row (and column) of the "Integrated I-O framework" in Box 12.2 relates to industries. Whereas the column sums of V give the domestic output of the various products, the row sums of V give the domestic output of the various industries. These row totals are the elements of the vector of industry outputs (g). The column totals are the elements of the transposed vector of industry output (g^T). The third column of the "Integrated I-O framework shows the total costs to produce the industry outputs. The column sums of U_d and U_m, which represent the cost of intermediate inputs, and the elements of the row vector W, which represent the cost of primary input (value added) determine the value of industry output.

12.42 The fifth row and column of the "Integrated I-O framework" relate to total input and total output of products and industries, but also to total value added and net final expenditures. The system is balanced if total input of products (x^T and m^T) equals total output of products (x and m) and total input of industries (g^T) equals total output of industries (g). If this is the case, total value added (w) equals total net final expenditure (y).

12.43 In the following, each of the mathematical models defined in Box 12.3, will be implemented by numerical examples starting from the same SUTs, either rectangular as given by Table 12.2 or aggregated to a square version as shown in Table 12.3.

1. Treatment of imports of goods and services in IOTs

12.44 It should be noted that the DUT at basic prices of these SUTs also include the uses of imports which, however, in these tables are separated from the domestic output, and grouped together in a single row and classified as a primary input, indicating that the supply and use of imported products does not affect the domestic production circuit.

12.45 In the IUT included in Table 12.2 and Table 12.3, the import row is broken down by products. In practice, the procedure will usually be to derive the IUT by sub-dividing each element in the total Use Table into a domestic and an imported share, and subsequently derive the single import row in the DUT as the column sums of the IUT. The choice to display uses of imports in a single row is therefore not usually an alternative to estimating the full IUT. More details covering the estimation of the IUT is covered in Chapter 8. Numerical examples are presented in the next Sections based on the mathematical models in Box 12.3. All these examples start from the same SUTs given in Table 12.2 and Table 12.3.

Box 12.2 Input-Output framework for domestic output and imports

Supply Table

	Industries	Output	Imports	Supply
Products	V^T	x	m	q
Output	g^T			

Domestic Use Table

	Industries	Final use	Use
Domestic products	U_d	Y_d	x
Imported products	U_m	Y_m	m
Gross value added	W		w
Output	g^T	y	

= empty

Integrated Supply and Use framework

	Domestic products	Industries	Final use	Total
Domestic products		U_d	Y_d	x
Imported products		U_m	Y_m	m
Industries	V			g
Gross value added		W		w
Total	x^T	g^T	y	

Input-Output Table - product by product

	Products	Final use	Use
Domestic products	S_d	Y_d	x
Imported products	S_m	Y_m	m
Gross value added	E		w
Output	x^T	y	

Input-Output Table - industry by industry

	Industries	Final use	Output
Domestic industries	B_d	F_d	g
Imports from industries	B_m	F_m	m
Gross value added	W		w
Output	g^T	y	

LEGEND

V = Make matrix - transpose of Supply matrix (industry by product)

V^T = Supply matrix (product by industry)

U = Use matrix for intermediates (product by industry)

Y = Final use matrix (product by category)

F = Final use matrix (industry by category)

S = Matrix for intermediates (Product by Product)

B = Matrix for intermediates (Industry by Industry)

E = Gross value added matrix (components by homogenous branches)

W = Gross value added matrix (components by industry)

$\hat{g}$ = Diagonal matrix of industry output

$\hat{x}$ = Diagonal matrix of product output

y = Row vector of final use

w = Column vector of gross value added

I = Unit matrix

x = Column vector of product output

x^T = Row vector of product output

g = Column vector of industry output

g^T = Row vector of industry output

m = Column vector of total imports

d = Index for domestic origin

m = Index for imported origin

INPUT COEFFICIENTS OF USE TABLE

$Z = U(\hat{g})^{-1}$ Input requirements for products per unit of output of an industry (intermediates)

$L = W(\hat{g})^{-1}$ Input requirements for value added per unit of output of an industry (primary input)

MARKET SHARE COEFFICIENTS OF SUPPLY TABLE

$C = V^T(\hat{g})^{-1}$ Product-mix matrix (share of each product in output of an industry)

$D = V(\hat{x})^{-1}$ Market shares matrix (contribution of each industry to the output of a product)

NOTES

Capital letters denote matrices and the small letters vectors.

Transpose matrices are written as matrices with the attachment of a superscript (T).

Vectors are written as column vectors and row vectors are written as transposed column vectors by the attachment of a superscript (T).

Use of superscript ^ as diagonalization of a vector.

Box 12.3 Basic transformations of SUTs to IOTs

Model A: Product by Product IOTs based on product technology assumption — **Negatives possible**

Each product is produced in its own specific way, irrespective of the industry where it is produced.

$T = (D^T)^{-1}$	Transformation matrix
$S_d = U_d\,T$	Domestic intermediates
$S_m = U_m\,T$	Imported intermediates
$E = W\,T$	Gross value added
$Y_d = Y_d$	Final use of domestic products
$Y_m = Y_m$	Final use of imported products

Model B: Product by Product IOTs based on industry technology assumption — **No negatives**

Each industry has its own specific way of production, irrespective of its product mix.

$T = C^T$	Transformation matrix
$S_d = U_d\,T$	Domestic intermediates
$S_m = U_m\,T$	Imported intermediates
$E = W\,T$	Gross value added
$Y_d = Y_d$	Final use of domestic products
$Y_m = Y_m$	Final use of imported products

Model C: Industry by Industry IOTs based on fixed industry sales structure assumption — **Negatives possible**

Each industry has its own specific sales structure, irrespective of its product mix.

$T = C^{-1}$	Transformation matrix
$B_d = T\,U_d$	Domestic intermediates
$B_m = T\,U_m$	Imported intermediates
$W = W$	Gross value added
$F_d = TY_d$	Final use of domestic products
$F_m = TY_m$	Final use of imported products

Model D: Industry by Industry IOTs based on fixed product sales structure assumption — **No negatives**

Each product has its own specific sales structure, irrespective of the industry where it is produced.

$T = D$	Transformation matrix
$B_d = T\,U_d$	Domestic intermediates
$B_m = T\,U_m$	Imported intermediates
$W = W$	Gross value added
$F_d = T\,Y_d$	Final use of domestic products
$F_m = T\,Y_m$	Final use of imported products

Model E: Product by Product IOTs based on a hybrid of technologies chosen to avoid negatives — **Negatives possible**

Products are produced with product technology assumption or industry technology assumption.

$V_1 = V \# H$	Matrix for product technology
$V_2 = V - V_1$	Matrix for industry technology
$C_1 = V_1^T\ (\hat{g})^{-1}$	Product mix matrix for product technology
$D_2 = V_2\ (\hat{x})^{-1}$	Market share matrix for industry technology
$R = C_1^{-1} * (I\text{-diag}(D_2^T * i)) + D_2$	Hybrid technology transformation matrix
$A = Z\,R$	Input coefficients intermediates
$R = L\,R$	Input coefficients value added
$x = (I - Z\,R)^{-1}\,y$	Output
$S = Z\,R\,\hat{x}$	Intermediates
$Y = Y$	Final use
$E = L\,R\,\hat{x}$	Gross value added

V_1 = Matrix for product technology
V_2 = Matrix for industry technology ($V - V_1$)
g_1 = Vector of industry output with product technology
i = Unit vector
H = Matrix for hybrid technology

12.46 In the numerical examples presented in the next Sections, the transformation of the SUTs into the IOTs takes place separately for the DUT (not including imports) and the IUT, following the sequence of the formulas in Box 12.3. When the **Input Table of Imports** (ITI) has been derived, it can be presented in two different ways:

- The vector of column sums of the ITI is inserted as a single row into the primary input part of the first sub-table. It would also be possible to insert the full ITI into the primary input section of this IOT. Sometimes this type of IOT is also called the national or domestic version, or described as an IOT with endogenous imports because the imports required to produce a certain final use can be calculated using an I-O model based on this type of IOT.
- The full ITI is added element by element to the domestic output part of the IOT (the first sub-table) to obtain an IOT where no distinction is made between domestically produced products and imported products. This type of IOT can also be obtained directly from the SUTs with no distinction made between domestic output and imports. This distinction is therefore not a precondition for compiling an IOT. This version of the IOT is described as an IOT with net exports, as imports are treated as a negative final use. Sometimes this type of IOT is also called the global or total version, indicating model assumptions that outputs worldwide are being produced by input structures observed for the domestic producers, or alternatively, that the domestic producers can produce import substitutes without changing their observed input structure. It may also be described as an IOT with exogenous imports as it is necessary to make independent estimates of the imports in analytical uses of an input-output model based on this type of IOT.

12.47 The results of the numerical examples for each Model (A, B, C or D) are therefore represented by two different versions of an IOT where:

- imports of goods and services are treated as a primary input (referred as "Input-Output Table"); and
- imports of goods and services are treated as a negative final use (referred as "Input-Output Table with net exports").

Both versions of these IOTs are completely self-contained and can be used for analytical applications.

12.48 For illustrative purposes, the following three tables are presented in the numerical examples of IOTs under the different models:

- the Input-Output Table (containing the imports of goods and services as primary inputs);
- the Input Table of Imports; and
- the Input-Output Table with net exports.

12.49 The sequence of three tables showing the results of the numerical examples in the next Sections should not be mistaken to imply that the first two sub-tables (Input-Output Table and Input Table for Imports) are just stepping stones to obtain the last sub-table, the Input-Output Table with net exports. In fact, the whole sequence of calculations could be reversed as the Input-Output Table with net exports can be derived directly from the SUTs without applying an Input Table for Imports and it is possible to move from the Input-Output Table with net exports to the Input-Output Table by applying the Input Table of Imports. Starting from the SUTs, the Input-Output Table with imports as primary input is seen to be more data demanding than the Input-Output Table with net exports.

12.50 An IOT is characterised by row sums being equal to column sums. This property follows directly from the mathematical formulas applied for the compilation. Furthermore, the row and column sums for the production part of an IOT must be equal to the domestic output by products for Product by Product IOTs and equal to the output by industry for Industry by Industry IOTs. The totals for output either by product or by industry in the SUTs will therefore also appear in the IOTs as is clearly demonstrated by the results of the numerical examples in the following sections.

2. Product by Product IOTs

(a) Product technology assumption (Model A)

12.51 The most frequently used method for deriving Product by Product IOTs is the method based on the product technology assumption (Model A). It is assumed that:

Each product is produced in its own specific way, irrespective of the industry where it is produced

"Product" is here to be understood as referring to the level of aggregation of products in the SUTs that will make the number of product groups equal to the number of industries. For each of these products, the same proportions of products and factor inputs are assumed to be used to produce one unit of the product disregarding in which industry the product is actually produced.

12.52 Formally, the product technology assumption seems to be the most applicable in cases of subsidiary production, since in those cases the technologies of primary and secondary products are independent. However, the product technology assumption does not exclude cases where two or more products are produced in the same process, for example, joint production. When one of the products is also produced elsewhere, **and in a different way**, then the product technology assumption is not valid.

12.53 The product technology assumption requires the use of square SUTs. The aggregation of products to arrive to a square SUTs leads to some information loss. When such aggregation has been made it also implies that each industry will usually produce several primary products, thus underlining the theoretical nature of the assumption that each aggregated product is being produced in only one way.

12.54 Mathematically, Model A can be expressed as the post-multiplication of the Use matrix with a transformation matrix. The transformation matrix in Model A is equal to:

$$T = (D^T)^{-1}$$

where D represent the market share matrix and, together with the intermediate uses, GVA and final uses of the Product by Product IOTs, can be calculated as illustrated in Box 12.3. Table 12.4 provides a numerical example of the transformation matrix for the product technology assumption applied to SUTs given in Table 12.3.

Table 12.4 Transformation matrix for the product technology assumption

		Industries		
		Agriculture	Manufacturing and construction	Services
Products	Agriculture	1.4809	-0.2117	-0.2692
	Manufacturing and construction	-0.0022	1.1075	-0.1053
	Services	-0.0274	-0.0357	1.0631

12.55 After the transformation matrix is applied to the original SUTs as illustrated in Box 12.3, the resulting Product by Product IOTs based on product technology (Model A) is obtained as shown in Table 12.5.

12.56 Note that, as the final uses are already defined in terms of products in the Use Table, the final use of domestic products and the final use of imported products remain the same in the Input-Output Table. Also, the total inputs by column in the IOTs are equal to total outputs by row in the IOTs with exports and with net exports (even though the totals are not the same in the two tables due to the different treatment of imports). The columns of IOTs now describe input structures of products. The final uses are not affected since they are already formulated in terms of products.

12.57 In Table 12.5, there are a few cell entries with negative values. Annex B to Chapter 12 describes potential causes and possible treatments of negative cell entries in the product technology classically considered. However, these negatives have a mathematical systematic cause as demonstrated by de Mesnard (2011), also covered in paragraph 12.95 in this Chapter.

Table 12.5 Product by Product IOTs based on product technology

Input-Output Table

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	6.40	9.33	-1.50	13.18	0.08	10.47	37.96
	Manufacturing and construction	10.45	116.03	35.68	32.04	73.94	175.94	444.08
	Services	-0.33	61.13	217.11	344.77	20.75	112.95	756.37
Prim	Imports	1.34	133.72	69.52	75.33	36.50	244.82	561.23
	GVA	20.10	123.88	435.56				579.54
	Input	37.96	444.08	756.37	465.33	131.27	544.17	

Input Table of Imports

		Products			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	1.11	6.91	-0.37	1.25	0.03	6.45	15.38
	Manufacturing and construction	1.01	109.33	26.58	61.07	31.49	171.55	401.04
	Services	-0.79	17.48	43.31	13.02	4.98	66.81	144.81
	Total	1.34	133.72	69.52	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net exports	
Products	Agriculture	7.52	16.24	-1.88	14.43	0.10	1.54	37.96
	Manufacturing and construction	11.47	225.36	62.26	93.11	105.44	-53.55	444.08
	Services	-1.12	78.60	260.43	357.79	25.73	34.95	756.37
	GVA	20.10	123.88	435.56				579.54
	Input	37.96	444.08	756.37	465.33	131.27	-17.05	

(b) Industry technology assumption (Model B)

12.58 The industry technology assumption is based on the assumption that:

Each industry has its own specific way of production, irrespective of its product mix.

This assumption applies best to cases of by-products or joint products, since in these cases several products are produced in a single production process.

12.59 The formula for Model B can be derived through the following transformation matrix:

$$T = C^T$$

where C is the product-mix matrix and, together with the intermediate uses and GVA of the Product by Product IOTs, is calculated as illustrated in Box 12.3. The numerical example of the transformation matrix for the industry technology assumption is shown in Table 12.6 and applied to the original matrices in the Use Table.

Table 12.6 Transformation matrix for industry technology assumption

		Products		
		Agriculture	Manufacturing and construction	Services
Industries	Agriculture	0.6372	0.0335	0.3294
	Manufacturing and construction	0.0119	0.9289	0.0592
	Services	0.0092	0.0526	0.9382

12.60 The resulting IOTs based on the industry technology assumption are presented in Table 12.7. In this case, negative cell entries cannot arise since the amounts transferred can never be larger than the amounts available in the columns of the industries. However, the lack of negatives does not imply that the results are more plausible.

Table 12.7 Product by Product IOTs based on industry technology

Input-Output Table

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	2.89	8.80	2.55	13.18	0.08	10.47	37.96
	Manufacturing and construction	6.85	102.84	52.47	32.04	73.94	175.94	444.08
	Services	5.10	69.51	203.30	344.77	20.75	112.95	756.37
Prim	Imports	3.81	119.15	81.61	75.33	36.50	244.82	561.23
	GVA	19.31	143.79	416.45				579.54
	Input	37.96	444.08	756.37	465.33	131.27	544.17	

Input Table of Imports

		Products			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	0.57	6.00	1.08	1.25	0.03	6.45	15.38
	Manufacturing and construction	2.47	94.92	39.53	61.07	31.49	171.55	401.04
	Services	0.77	18.22	41.00	13.02	4.98	66.81	144.81
	Total	3.81	119.15	81.61	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net Exports	
Products	Agriculture	3.46	14.79	3.63	14.43	0.10	1.54	37.96
	Manufacturing and construction	9.32	197.76	92.00	93.11	105.44	-53.55	444.08
	Services	5.88	87.73	244.30	357.79	25.73	34.95	756.37
	GVA	19.31	143.79	416.45				579.54
	Input	37.96	444.08	756.37	465.33	131.27	-17.05	

(c) Hybrid technology assumptions

12.61 In general, the product technology assumption is most suitable in cases of subsidiary products while the industry technology assumption applies best to cases of by-products or joint products. However, in practice secondary production can occur in different forms in a country. Thus it is possible to use hybrid assumptions of product and industry technology. The classical way is to divide the Supply Table into two parts: one which contains the primary and subsidiary products and the other which contains the by-products or joint products. The product technology is applied to the first part, and the industry technology to the second. This approach is used by for example, the United Kingdom.

12.62 The mathematical formulation under the hybrid technology assumption (Model E) is shown in Box 12.3. This formulation is based on a matrix for hybrid technology, H, which is a product-by-industry matrix of 'ones' for products that should use the product technology assumption and 'zeros' for products that should use the industry technology assumption.

12.63 Table 12.8 provides an example of this "hybrid" (or "mixed") technology model. The model gives no new theoretical viewpoint but is merely a combination of the two techniques presented above. If the matrix for hybrid technology is filled in each cell with 1s, this method coincides with the model based on product technology assumption. If negative cell entries are observed, then the challenge is to fill in as few zeros as possible until all negative values have disappeared. In a further step, there are procedures that can be used to remove negative values (see Annex B).

Table 12.8 Matrix for hybrid technology

		Industries		
		Agriculture	Manufacturing and construction	Services
Products	Agriculture	1	1	1
	Manufacturing and construction	1	1	1
	Services	1	0	0

1 = Product technology assumption

0 = Industry technology assumption

12.64 If for example, the secondary outputs of the agriculture industry and the secondary output of services by manufacturing utilised different production processes than the primary producers of these products, a possible method for resolving the problem would be to selectively apply the industry technology assumptions to these products. In Table 12.8, it is assumed that all outputs flagged with ‘ones’ are produced according to the product technology assumption. While the remaining outputs flagged with ‘zeros’ in Table 12.8 were produced according to the industry technology assumption. The numerical example of the hybrid technology transformation matrix R is shown in Table 12.9.

Table 12.9 Transformation matrix for hybrid technology assumption

		Industries		
		Agriculture	Manufacturing and construction	Services
Products	Agriculture	0.0000	-0.1770	0.1574
	Manufacturing and construction	0.0000	0.9854	-0.0057
	Services	1.0000	0.1916	0.8483

12.65 The result of the hybrid technology assumption is presented in Table 12.10.

Table 12.10 IOTs based on the hybrid technology assumption

Input-Output Table

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	0.03	0.98	13.22	13.18	0.08	10.47	37.96
	Manufacturing and construction	2.30	98.31	61.55	32.04	73.94	175.94	444.08
	Services	10.50	79.51	187.90	344.77	20.75	112.95	756.37
Prim	Imports	3.89	128.74	71.95	75.33	36.50	244.82	561.23
	GVA	21.25	136.53	421.76				579.54
	Input	37.96	444.08	756.37	465.33	131.27	544.17	

Input Table of Imports

		Products			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	0.02	5.02	2.61	1.25	0.03	6.45	15.38
	Manufacturing and construction	1.75	102.16	33.01	61.07	31.49	171.55	401.04
	Services	2.11	21.56	36.33	13.02	4.98	66.81	144.81
	Total	3.89	128.74	71.95	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net exports	
Products	Agriculture	0.05	6.00	15.83	14.43	0.10	1.54	37.96
	Manufacturing and construction	4.05	200.47	94.56	93.11	105.44	-53.55	444.08
	Services	12.61	101.07	224.23	357.79	25.73	34.95	756.37
	GVA	21.25	136.53	421.76				579.54
	Input	37.96	444.08	756.37	465.33	131.27	-17.05	

3. Industry by Industry IOTs

12.66 Industry by Industry IOTs can be derived by transferring inputs within the industry columns. The product classification of the rows is transformed into the industry classification (industry-adjusted products) of the columns.

(a) Assumption of fixed industry sales structures (Model C)

12.67 The fixed industry sales structure is based on the assumption that:

Each industry has its own specific sales structure, irrespective of its product mix

12.68 The mathematical formulation of the transformation matrix in the case of the fixed industry sales structures model is as follows:

$$T = C^{-1}$$

Where C is the product-mix matrix and together with the intermediate uses and final uses of the resulting Industry by Industry IOTs is calculated as illustrated in Box 12.3.

12.69 The numerical example of the transformation matrix for the industry sales structure assumption is shown in Table 12.11 and the resulting IOTs are presented in Table 12.12.

Table 12.11 Transformation matrix for the fixed industry sales structure assumption

		Industries		
		Agriculture	Manufacturing and construction	Services
Products	Agriculture	1.5779	-0.0193	-0.0144
	Manufacturing and construction	-0.0256	1.0807	-0.0603
	Services	-0.5523	-0.0614	1.0747

Table 12.12 IOTs based on the fixed industry sales structure assumption

Input-Output Table

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	6.65	11.66	-2.98	15.22	-1.60	11.51	40.45
	Manufacturing and construction	8.39	112.47	37.25	13.49	78.65	183.05	433.31
	Services	1.17	55.66	224.02	361.28	17.72	104.80	764.66
Prim	Imports	2.54	123.74	78.29	75.33	36.50	244.82	561.23
	GVA	21.70	129.78	428.07				579.54
Input		40.45	433.31	764.66	465.33	131.27	544.17	

Input Table of imports

		Industries			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	1.18	7.92	-0.54	0.61	-0.63	5.91	14.46
	Manufacturing and construction	1.57	107.01	35.57	65.18	33.73	181.20	424.26
	Services	-0.22	8.80	43.26	9.55	3.40	57.71	122.51
Total		2.54	123.74	78.29	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net exports	
Industries	Agriculture	7.84	19.58	-3.52	15.82	-2.24	2.96	40.45
	Manufacturing and construction	9.96	219.48	72.82	78.67	112.39	-60.02	433.31
	Services	0.95	64.47	267.28	370.83	21.12	40.00	764.66
	GVA	21.70	129.78	428.07				579.54
Input		40.45	433.31	764.66	465.33	131.27	-17.05	

12.70 The assumption of fixed industry sales structures seems to be rather unrealistic. Only in a few cases will firms supply all their products in the same proportions to their users (an example may be secondary trade activities such as software sold together with computers by a computer producing firm). In general, it seems more plausible to assume that the secondary products have different destinations than the primary products.

12.71 In Table 12.12, there are a few cell entries with negative values. These tables are Industry by Industry and the reasons for the negative cell entries are classically considered as different from those generated using the product technology. Annex B in this chapter covers the causes and treatment of negative cell entries in the product technology classically considered. However, as with Model A, these negatives have a mathematical systematic cause as demonstrated by de Mesnard (2011), also covered in paragraph 12.95 in this chapter.

(b) Fixed product sales structures assumption (Model D)

12.72 A more realistic and the most frequently used method for deriving Industry by Industry IOTs is that of a fixed product sales structure which states that:

Each product has its own specific sales structure, irrespective of the industry where it is produced.

12.73 The term "sales structure" indicates the proportions of the output of a product in which it is sold to the respective intermediate uses and final uses.

12.74 The transformation matrix for the fixed product sales structures model (Model D) is as follows:

$$T = D$$

where D is the market-share matrix and, together with the intermediate uses and final uses of the Industry by Industry IOTs can be derived using the formula shown in Box 12.3.

12.75 An important advantage of the market share method (Model D) is that IOTs can directly be derived from the rectangular SUTs without any intermediate aggregation to square SUTs, see Thage (2005). Consequently, the question of defining characteristic products and making a formal distinction between primary and secondary production does not arise. As illustrated both in the numerical examples and empirical examples in this chapter, this method reduces the aggregation loss of information. This does not exclude the introduction of special knowledge that modifies this assumption but this must already happen in the SUTs compilation system, and thus also in the basic framework of the National Accounts.

12.76 The recommended method is therefore to apply Model D directly to rectangular SUTs. To illustrate the loss of information by applying Model D to the square aggregation of the SUTs, the results of both calculations are shown in this Section.

12.77 Table 12.13 illustrates the numerical example of the transformation matrix for the fixed product sales structure assumption applied to the rectangular SUTs in Table 12.2 and the resulting Industry by Industry tables are presented in Table 12.14.

Table 12.13 Transformation matrix for the fixed product sales structure assumption for rectangular SUTs

		Products					
		Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services
Industries	Agriculture	0.6789	0.0036	0.0010	0.0021	0.0441	0.0013
	Manufacturing and construction	0.1357	0.8945	0.9510	0.0610	0.0284	0.0111
	Services	0.1853	0.1019	0.0480	0.9368	0.9276	0.9875

Table 12.14 IOTs based on the fixed product sales structure assumption derived from rectangular SUTs

Input-Output Table

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	3.07	7.99	6.53	12.70	0.73	9.44	40.45
	Manufacturing and construction	8.00	101.85	50.13	39.04	69.68	164.61	433.31
	Services	5.15	69.96	201.63	338.25	24.37	125.30	764.66
Prim	Imports	2.54	123.74	78.29	75.33	36.50	244.82	561.23
	GVA	21.70	129.78	428.07				579.54
	Input	40.45	433.31	764.66	465.33	131.27	544.17	

Input Table of imports

		Industries			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	0.54	5.33	1.57	1.10	0.23	5.73	14.50
	Manufacturing and construction	1.45	91.03	33.26	54.98	28.44	157.94	367.10
	Services	0.56	27.37	43.47	19.26	7.82	81.14	179.63
	Total	2.54	123.74	78.29	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net Exports	
Industries	Agriculture	3.60	13.32	8.09	13.80	0.96	0.68	40.45
	Manufacturing and construction	9.44	192.88	83.39	94.02	98.12	-44.55	433.31
	Services	5.70	97.33	245.10	357.51	32.19	26.81	764.66
	GVA	21.70	129.78	428.07				579.54
	Input	40.45	433.31	764.66	465.33	131.27	-17.05	

12.78 The row sums (total input) now equal the industry output levels (total output) in the IOT in Table 12.14. In the Industry by Industry IOTs based on a fixed product sales structure, the GVA is unaffected, since this part is already formulated in terms of industries.

12.79 In order to see the impact of using square SUTs instead of rectangular SUTs, IOTs are calculated based on the Square SUTs of Table 12.3 and comparing them with those obtained above. Thus Table 12.15 and Table 12.16 are the equivalent versions of Table 12.13 and Table 12.14 respectively but based on square SUTs of Table 12.3. Table 12.17 shows the absolute deviation between the two approaches and thus the effect of the loss of information suffered by moving from the rectangular SUTs to the square SUTs as data base for the transformation.

Table 12.15 Transformation matrix for the fixed product sales structure assumption for square SUTs

		Products		
		Agriculture	Manufacturing and construction	Services
Industries	Agriculture	0.6789	0.0030	0.0176
	Manufacturing and construction	0.1357	0.9064	0.0339
	Services	0.1853	0.0905	0.9485

Table 12.16 IOTs based on the fixed product sales structure assumption for square SUTs

Input-Output Table

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	3.04	7.73	4.28	15.12	0.64	9.64	40.45
	Manufacturing and construction	8.04	101.09	49.20	42.52	67.73	164.72	433.31
	Services	5.13	70.97	204.82	332.35	26.39	125.00	764.66
Prim	Imports	2.54	123.74	78.29	75.33	36.50	244.82	561.23
	GVA	21.70	129.78	428.07				579.54
	Input	40.45	433.31	764.66	465.33	131.27	544.17	

Input Table of imports

		Industries			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	0.53	4.96	1.18	1.26	0.20	6.08	14.22
	Manufacturing and construction	1.46	92.21	33.50	55.96	28.72	158.64	370.50
	Services	0.54	26.57	43.61	18.11	7.58	80.10	176.51
	Total	2.54	123.74	78.29	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net Exports	
Industries	Agriculture	3.58	12.69	5.46	16.38	0.85	1.50	40.45
	Manufacturing and construction	9.51	193.31	82.70	98.48	96.45	-47.14	433.31
	Services	5.67	97.54	248.43	350.46	33.97	28.59	764.66
	GVA	21.70	129.78	428.07				579.54
	Input	40.45	433.31	764.66	465.33	131.27	-17.05	

Table 12.17 Absolute deviation of IOTs based on rectangular SUTs less IOTs based on square SUTs for Model D

Input-Output Table

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	0.02	0.25	2.25	-2.42	0.08	-0.19	0.00
	Manufacturing and construction	-0.04	0.76	0.93	-3.48	1.94	-0.11	0.00
	Services	0.02	-1.01	-3.18	5.90	-2.03	0.30	0.00
Prim	Imports							
	GVA							
	Input	0.00	0.00	0.00	0.00	0.00	0.00	

Input Table of imports

		Industries			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Industries	Agriculture	0.01	0.37	0.39	-0.17	0.03	-0.35	0.28
	Manufacturing and construction	-0.02	-1.18	-0.24	-0.98	-0.28	-0.69	-3.40
	Services	0.01	0.81	-0.14	1.15	0.25	1.04	3.12
	Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Input-Output Table with net exports

		Industries			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net Exports	
Industries	Agriculture	0.03	0.63	2.64	-2.59	0.11	-0.82	0.00
	Manufacturing and construction	-0.06	-0.42	0.69	-4.46	1.67	2.60	0.00
	Services	0.04	-0.21	-3.32	7.05	-1.78	-1.78	0.00
	GVA							
	Input	0.00	0.00	0.00	0.00	0.00	0.00	

4. Alternative presentation of imports in the Input-Output Table

12.80 In the previous tables, imports were presented in two ways in the IOTs as either **primary input** (as shown in the first table in Table 12.16) or as a **negative final use** (as shown in the bottom table in Table 12.16). In the latter case, imports may either be netted against exports (as done in the tables above) or kept in a separate column with a negative sign. In the IOT with Net exports in Table 12.18, the net exports of the product "Agriculture", 1.54, is obtained as 10.47 (from the corresponding entry in the IOT) plus 6.45 minus 15.38 (from the corresponding entry in the Input Table for Imports).

12.81 In an alternative presentation sometimes used, the vector of imports (either classified by product or by "industry-adjusted products" depending on the type of IOT) are added to domestic output to obtain the total supply as column sums for the production part of the IOT, matching the row sums that include total uses of both domestic output and imports. However, this import row is neither intermediate consumption nor primary input but just a bookkeeping entry to balance the total use in the corresponding rows. The fourth sub-table in Table 12.18 illustrates this alternative presentation.

12.82 It should be noted that this alternative presentation can in general not be taken directly as a basis for I-O modelling such as, for example, for calculating impact multipliers. The reason is that the input coefficients adding to one including the import row will already in the first round effects imply that all categories of final uses of a particular product have identical import shares, and in the following rounds, imports of similar products will increase proportional to the increases in the domestic output, which is not realistic.

Table 12.18 Alternative presentations of Product by Product IOTs

Input-Output Table

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	6.40	9.33	-1.50	13.18	0.08	10.47	37.96
	Manufacturing and construction	10.45	116.03	35.68	32.04	73.94	175.94	444.08
	Services	-0.33	61.13	217.11	344.77	20.75	112.95	756.37
Prim	Imports	1.34	133.72	69.52	75.33	36.50	244.82	561.23
	GVA	20.10	123.88	435.56				579.54
	Input	37.96	444.08	756.37	465.33	131.27	544.17	

Input Table of Imports

		Products			Final use			Total
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	1.11	6.91	-0.37	1.25	0.03	6.45	15.38
	Manufacturing and construction	1.01	109.33	26.58	61.07	31.49	171.55	401.04
	Services	-0.79	17.48	43.31	13.02	4.98	66.81	144.81
	Total	1.34	133.72	69.52	75.33	36.50	244.82	561.23

Input-Output Table with net exports

		Products			Final use			Output
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Net Exports	
Products	Agriculture	7.52	16.24	-1.88	14.43	0.10	1.54	37.96
	Manufacturing and construction	11.47	225.36	62.26	93.11	105.44	-53.55	444.08
	Services	-1.12	78.60	260.43	357.79	25.73	34.95	756.37
	GVA	20.10	123.88	435.56				579.54
	Input	37.96	444.08	756.37	465.33	131.27	-17.05	

Input-Output Table with supply and use

		Products			Final use			Use
		Agriculture	Manufacturing and construction	Services	Final consumption expenditure	Gross capital formation	Exports	
Products	Agriculture	7.52	16.24	-1.88	14.43	0.10	16.93	53.35
	Manufacturing and construction	11.47	225.36	62.26	93.11	105.44	347.49	845.12
	Services	-1.12	78.60	260.43	357.79	25.73	179.76	901.18
	GVA	20.10	123.88	435.56				579.54
	Output	37.96	444.08	756.37	465.33	131.27	544.17	2,379.18
	Imports	15.38	401.04	144.81				561.23
	Supply	53.35	845.12	901.18	465.33	131.27	544.17	

E. Empirical application of the transformation models

12.83 As previously mentioned, Model A (Product by Product IOTs using the product technology assumption) and Model D (Industry by Industry IOTs using the fixed product sales structure assumption) are widely used by NSOs. In general, it is difficult to recommend a specific transformation model based on theoretical considerations alone. Ultimately, the choices made by the official producers of IOTs will reflect a range of issues. These will include for example, available resources, relevance and appropriateness of the source data, statistical policy related to consistency and continuity in the overall statistical system, international reporting obligations, and history and traditions.

12.84 Users of IOTs will seldom specifically state their wishes for the type of IOTs as long as the NSOs are responsible for the quality of the tables. The main concern of users will often relate to basis of the IOTs - Product by Product or Industry by Industry - rather than the type of technology or market share assumptions have been applied. This is because users will often need to combine the IOTs with other kinds of data to undertake their analysis. For many kinds of analysis, the IOTs must be combined with structural data or time series which are based on industry based classifications, for example, energy and productivity analysis. For other kinds of analysis, for example relating to prices, the matching data will usually be available and based on products.

12.85 However, it is important to note that the type of IOTs will not exclude a priori any kind of analysis. This is because the information contained in the Supply Table can be used to transform product classified information into the industry classification, and vice versa, in the same way as the transformation tables were defined to compile the four alternative transformation models (Model A, B, C and D). Therefore any input to, and output from an analysis based on IOTs can be given either a product or an industry classification as required.

12.86 When IOTs from several countries are merged together into an international model, it may be useful to have the same types of tables from all countries. The compilation of such tables is covered in Chapter 17.

12.87 Although a few countries produce both Product by Product IOTs and Industry by Industry IOTs at the same time, it is not generally recommended to do so. The existence of several types of IOTs may cause confusion amongst the users rather than being helpful. However, the compilation of alternative types of tables may serve a pedagogical purpose in illustrating that their direct contents, and in particular the impact tables, may not be that different.

1. Examples of Product by Product IOTs and Industry by Industry IOTs

12.88 If the major parts of activities are reported on the diagonal of the Supply Table, the difference between Product by Product IOTs and Industry by Industry IOTs would then be very small. In the extreme case, without secondary activities (all activities of industries are reported on the diagonal of the Supply Table), the two types of IOTs converge and the Use Table becomes an IOT.

12.89 The Supply Table shows the extent of secondary production as off-diagonal elements when it is aggregated to a square matrix. The observed extent of secondary production depends on the level of aggregation of both products and industries and secondary production, therefore it does not possess any observable characteristics of its own. The relative character of the secondary production concept also indicates that it is difficult to justify that the input structure of a particular product (say, product number 201 at a certain level of aggregation) should be of more interest than the input structure of the other 200 products produced by that industry, just because it is also produced as secondary production in another industry.

12.90 For many countries, the Supply Table is characterised by having secondary production mainly for manufacturing industries or manufacturing products. For other industries, often diagonal elements are dominant with very limited secondary production. There are two reasons for this:

- for service industries, the diagonal structure is usually simply due to the fact that limited product specifications exist, so that total output from establishments (or even legal or institutional units) must be assumed to be characteristic output of the industries in which the units are classified in the business register. The recommendation here is to collect more details on the service industries' sales by type of product – this will unveil lots of issues and improve the quality of the supply and use of products.
- establishments for industries such as agriculture, construction and trade are often defined in a more product-oriented form in the National Accounts than in the business register. Thereby, all secondary activities in these industries have already been transferred to the primary industry before the data are entered in SUTs (as also recommended in the two-step process outlined later in this section) or the data are alternatively constructed in such a way that from the outset little or no secondary production exists, for example, agricultural output as the sum of agricultural products, construction as the sum of the value of new construction and repairs etc. The real benefit here would be to have a greater breakdown of such industries with the corresponding product detail.

12.91 In practice, as much as 70 per cent (depending upon the type of economic units applied) of all economic activity may be completely unaffected by whatever transformation procedure is used to construct the IOTs. The technology or transformation problem is thus, in practice, largely limited to the manufacturing industries and their output of industrial products. Considering the simplified way the rest of the economy is handled, primarily due to lack of relevant data sources, the efforts and theoretical refinements attached to the transformation procedures for manufacturing industries should be proportionate.

12.92 The Product by Product IOTs in Table 12.19 were compiled using the product technology assumption (Model A). The first table shows the input requirements for domestically produced products for intermediate uses and final uses while the second table shows the input requirements for imported products for intermediate uses and final uses. The third table reflects the total requirements for intermediate uses and final uses disregarding origin of the products.

Table 12.19 Empirical example of Product by Product IOTs

Input-Output Table

			PRODUCTS							FINAL USE								Total output at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 316	4 344	4	101	15	19	6 800	963			123		- 42	938	1 982	8 782
	Manufacturing	(2)	1 091	42 919	6 362	7 534	4 369	2 951	65 227	12 631		327	9 426	1 122	1 393	96 280	121 178	186 405
	Construction	(3)	73	1 883	9 927	1 969	3 890	1 279	19 021	1 402			24 323		- 38	563	26 250	45 272
	Trade, transport and communication	(4)	239	13 805	2 109	18 364	5 909	2 846	43 272	55 600		4 549	9 207	239	334	21 550	91 479	134 750
	Finance and business services	(5)	370	9 320	4 530	17 653	29 781	7 564	69 219	36 524		1 006	9 781	0	- 177	11 156	58 289	127 508
	Other services	(6)	6	286	51	1 066	453	1 629	3 490	13 045	5 416	53 116	113	- 105	1	567	72 153	75 643
	Total at basic prices	(7)	4 094	72 557	22 984	46 687	44 418	16 288	207 028	120 165	5 416	58 997	52 973	1 257	1 471	131 053	371 332	578 360
	Imports	(8)	811	61 469	4 846	12 485	6 136	3 731	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293
	Taxes less subsidies on products	(9)	78	862	226	1 333	1 839	2 646	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices	(10)	4 983	134 889	28 056	60 506	52 393	22 665	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
VALUE ADDED	Compensation of employees	(11)	411	25 857	10 216	38 422	28 962	40 475	144 343									
	Other taxes less subsidies on production	(12)	- 1 446	717	545	1 762	2 267	1 014	4 858									
	Consumption of fixed capital	(13)	1 620	11 519	1 422	10 172	21 759	6 977	53 469									
	Net operating surplus	(14)	3 214	13 423	5 032	23 889	22 127	4 512	72 198									
	Gross operating surplus	(15)	4 834	24 942	6 455	34 061	43 886	11 489	125 667									
	GVA	(16)	3 799	51 516	17 216	74 245	75 115	52 978	274 868									
	Input at basic prices	(17)	8 782	186 405	45 272	134 750	127 508	75 643	578 360									

Input table of imports

			PRODUCTS							FINAL USE								Total at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	176	1 722	3	148	14	15	2 077	1 079			47		9	58	1 194	3 271
	Manufacturing	(2)	618	55 846	4 392	5 506	1 398	2 941	70 702	20 894		1 422	12 310	807	1 344	17 112	53 888	124 590
	Construction	(3)		265	204	47	44	4	563									563
	Trade, transport and communication	(4)	9	2 095	150	5 150	1 678	337	9 419	586		26	745	1	28	4 179	5 565	14 984
	Finance and business services	(5)	7	1 531	97	1 527	2 974	308	6 443	145			473				618	7 061
	Other services	(6)		10	0	108	29	127	275	384		47		118			549	824
	Total	(7)	811	61 469	4 846	12 485	6 136	3 731	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293

Input-Output Table with net exports

			PRODUCTS							FINAL USE								Total output at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure: Households	Final consumption expenditure: NPISH	Final consumption expenditure: General government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Net Exports	Total	
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 492	6 065	8	248	29	34	8 877	2 042			170		- 32	- 2 275	- 95	8 782
	Manufacturing	(2)	1 708	98 765	10 754	13 040	5 768	5 893	135 928	33 525		1 749	21 736	1 929	2 737	- 11 198	50 477	186 405
	Construction	(3)	73	2 148	10 131	2 016	3 934	1 282	19 585	1 402			24 323		- 38	0	25 687	45 272
	Trade, transport and communication	(4)	248	15 900	2 258	23 514	7 586	3 183	52 690	56 185		4 575	9 951	240	363	10 746	82 060	134 750
	Finance and business services	(5)	377	10 851	4 627	19 180	32 755	7 872	75 662	36 669		1 006	10 254	0	- 177	4 095	51 846	127 508
	Other services	(6)	6	297	51	1 174	482	1 756	3 765	13 429	5 416	53 163	113	14	1	- 257	71 878	75 643
	Total	(7)	4 905	134 027	27 830	59 173	50 554	20 019	296 507	143 252	5 416	60 492	66 548	2 182	2 852	1 110	281 852	578 360
	Taxes less subsidies on products	(8)	78	862	226	1 333	1 839	2 646	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices	(9)	4 983	134 889	28 056	60 506	52 393	22 665	303 492	166 063	5 416	61 050	69 418	2 335	2 859	1 507	308 647	612 138
VALUE ADDED	Compensation of employees	(10)	411	25 857	10 216	38 422	28 962	40 475	144 343									
	Other taxes less subsidies on production	(11)	- 1 446	717	545	1 762	2 267	1 014	4 858									
	Consumption of fixed capital	(12)	1 620	11 519	1 422	10 172	21 759	6 977	53 469									
	Net operating surplus	(13)	3 214	13 423	5 032	23 889	22 127	4 512	72 198									
	Gross operating surplus	(14)	4 834	24 942	6 455	34 061	43 886	11 489	125 667									
	GVA	(15)	3 799	51 516	17 216	74 245	75 115	52 978	274 868									
	Input at basic prices	(16)	8 782	186 405	45 272	134 750	127 508	75 643	578 360									

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12.93 Using Model A often results in observing some negative elements in the IOTs. The problem of eliminating these negatives is discussed in paragraphs 12.95 and 12.96 in this Chapter.

12.94 It is classically considered that there are many possible reasons for the negatives. A key reason generally accepted is that the assumption of a product technology does not reflect the economic reality at that level of aggregation.

12.95 However, de Mesnard (2011, p. 445) demonstrated through theory that the problem is not in the negatives that are eventually occur in the IOTs but it is in the negatives that are systematically present in the inverse matrices C^{-1} and D^{-1}. This is when there is at least one negative per row and one negative per column in each non-diagonal block of C^{-1} and D^{-1}. Hence, the negatives that appear when deriving IOTs from SUTs are structurally inevitable. Moreover, as matrices C^{-1} and D^{-1} are Markovian (i.e. they are matrices of coefficients), the negatives are forbidden, mathematically speaking. Therefore, computing these inverse matrices becomes meaningless, even if no negatives are present in the IOTs.

12.96 The simple possibility of negatives is sufficient to treat the derivation of IOTs using Model A and Model C with caution. Therefore, the traditionally proposed approaches in fixing the problem of negatives only deal with part of the problem, i.e. the impact on the non-negative entries and their plausibility is not addressed. The difficulty cannot be fully resolved by arranging the data such as the approaches to dealing with only the negatives in the product technology or by creating a mixed hypothesis as laid out in Annex B to this Chapter.

12.97 An empirical example of Industry by Industry IOTs by applying Model D for the same country and year is shown in Table 12.20.

12.98 The difference between Product by Product IOTs and Industry by Industry IOTs for some elements can be considerable, which is to be expected depending upon the reported level of industries' secondary output. The differences between using rectangular tables and square tables in Model D can be significant as shown in Table 12.17. As the column sums in the two types of tables are different, referring to product and industry totals, respectively, the elements are not directly comparable, and the effective differences between the two tables can best be studied on the background of the corresponding impact tables.

Table 12.20 Empirical example of Industry by Industry IOTs

Input-Output Table

			INDUSTRIES							FINAL USE								
									Total	Final consumption expenditure			Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total output at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services		Households	NPISH	General government						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
INDUSTRIES	Agriculture	(1)	2 374	4 384	38	209	35	42	7 083	1 320	0	4	182	0	- 37	1 315	2 784	9 867
	Manufacturing	(2)	1 220	43 620	6 818	9 290	5 744	3 623	70 315	14 707	2	614	13 684	1 129	1 403	98 097	129 635	199 950
	Construction	(3)	112	2 350	8 988	2 454	3 623	1 411	18 939	1 747	0	21	23 357	5	- 34	895	25 992	44 931
	Trade, transport and communication	(4)	344	14 918	2 466	17 970	6 739	3 475	45 912	54 542	15	4 416	8 963	220	291	20 477	88 925	134 837
	Finance and business services	(5)	367	10 175	3 912	16 397	22 678	7 131	60 660	34 641	1	847	4 505	3	- 160	8 964	48 801	109 461
	Other services	(6)	11	539	179	1 110	613	1 666	4 119	13 207	5 398	53 097	2 283	- 101	7	1 305	75 196	79 314
	Total at basic prices	(7)	4 429	75 987	22 402	47 431	39 431	17 348	207 028	120 165	5 416	58 997	52 973	1 257	1 471	131 053	371 332	578 360
	Imports	(8)	919	62 051	4 834	12 439	5 417	3 819	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293
	Taxes less subsidies on products	(9)	92	952	229	1 349	1 689	2 672	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices	(10)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	152 800	459 939	763 431
VALUE ADDED	Compensation of employees	(11)	551	30 679	10 239	37 906	22 997	41 971	144 343									
	Other taxes less subsidies on production	(12)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
	Consumption of fixed capital	(13)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
	Net operating surplus	(14)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
	Gross operating surplus	(15)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
	GVA	(16)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Input at basic prices	(17)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

Input table of imports

			INDUSTRIES							FINAL USE								
									Total	Final consumption expenditure			Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services		Households	NPISH	General government						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
INDUSTRIES	Agriculture	(1)	198	1 769	9	210	21	27	2 235	1 255		0	48	0	11	78	1 392	3 627
	Manufacturing	(2)	695	55 370	4 335	5 821	1 335	2 986	70 542	20 684		1 413	12 550	804	1 332	17 011	53 795	124 337
	Construction	(3)	1	595	215	96	52	9	969	22		0	32	1	8	79	142	1 111
	Trade, transport and communication	(4)	16	2 736	177	4 728	1 617	345	9 619	580		24	664	4	30	4 128	5 431	15 049
	Finance and business services	(5)	9	1 521	94	1 408	2 291	320	5 643	159		10	133	0	1	44	347	5 990
	Other services	(6)	0	60	4	177	100	131	472	386		47	147	116	0	9	706	1 178
	Total	(7)	919	62 051	4 834	12 439	5 417	3 819	89 479	23 087		1 495	13 575	926	1 381	21 350	61 814	151 293

Input-Output Table with net exports

			INDUSTRIES							FINAL USE								
									Total	Final consumption expenditure			Gross fixed capital formation	Changes in valuables	Changes in inventories	Net Exports	Total	Total output at basic prices
			Agriculture	Manufacturing	Construction	Trade, transport and communication	Finance and business services	Other services		Households	NPISH	General government						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
PRODUCTS	Agriculture	(1)	2 573	6 153	47	419	56	69	9 318	2 575	0	4	230	0	- 26	- 2 233	550	9 867
	Manufacturing	(2)	1 915	98 990	11 153	15 111	7 078	6 610	140 857	35 391	2	2 027	26 234	1 933	2 735	- 9 229	59 092	199 950
	Construction	(3)	113	2 945	9 204	2 550	3 676	1 420	19 908	1 769	0	21	23 389	6	- 26	- 138	25 023	44 931
	Trade, transport and communication	(4)	360	17 654	2 643	22 698	8 356	3 819	55 531	55 123	15	4 440	9 627	224	321	9 556	79 306	134 837
	Finance and business services	(5)	376	11 697	4 006	17 805	24 969	7 451	66 303	34 800	1	856	4 638	3	- 159	3 019	43 158	109 461
	Other services	(6)	12	599	182	1 287	713	1 797	4 591	13 594	5 398	53 144	2 430	16	7	135	74 724	79 314
	Total	(7)	5 348	138 038	27 236	59 870	44 849	21 167	296 507	143 252	5 416	60 492	66 548	2 182	2 852	1 110	281 852	578 360
	Taxes less subsidies on products	(8)	92	952	229	1 349	1 689	2 672	6 984	22 810		557	2 870	152	7	397	26 794	33 778
	Total at purchasers' prices	(9)	5 440	138 991	27 466	61 219	46 538	23 839	303 492	166 063	5 416	61 050	69 418	2 335	2 859	1 507	308 647	612 138
VALUE ADDED	Compensation of employees	(10)	551	30 679	10 239	37 906	22 997	41 971	144 343									
	Other taxes less subsidies on production	(11)	- 1 627	1 077	546	1 755	2 004	1 103	4 858									
	Consumption of fixed capital	(12)	1 845	12 750	1 542	10 917	18 934	7 480	53 469									
	Net operating surplus	(13)	3 658	16 453	5 138	23 040	18 989	4 921	72 198									
	Gross operating surplus	(14)	5 503	29 203	6 680	33 957	37 923	12 401	125 667									
	GVA	(15)	4 427	60 959	17 465	73 618	62 923	55 475	274 868									
	Input at basic prices	(16)	9 867	199 950	44 931	134 837	109 461	79 314	578 360									

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2. Relationship between types of table, technology and market shares

12.99 The Product by Product IOTs are closely related to a particular understanding of the concept of a "product". In economic theory, products in general are produced by means of products, labour and capital. Each product is characterised by a separate production function which describes a specific technology, and a technology is fully described in terms of a set of products and primary inputs. However, an analogy between this theoretical approach and the properties of statistical IOTs is difficult to establish, as they represent two different levels of abstraction.

12.100 At the I-O level of aggregation, there are no “homogeneous” products or production processes for individual products. The economy consists of thousands or even millions of producing units, of which hardly even two are completely identical, and there are millions of different products and even more production processes. The recommendations on how to construct IOTs are often based on numerical or mathematical examples that assume that at a high level of aggregation, the economy can be represented by a set of homogeneous products and production functions. These models may not always convey useful advice on how to solve the practical problems faced by the compiler of IOTs.

12.101 When compared to the real world, the magnitude of products and production processes, even detailed basic statistics already represent a major aggregation. Statistics on products are collected at a maximum level of detail, say around 10,000 products, and that is only in selected areas such as foreign trade statistics, and perhaps output from manufacturing industries. Furthermore, products that are identical in a physical sense are different in an economic sense when they are sold at different prices to different purchasers and possibly even for different purposes. The concept of basic prices is an attempt to define a valuation specifically for this possibility. Purchases for intermediate consumption by products are at best collected for establishments, and in most cases, the statistical coverage of purchases is irregular and/or highly aggregated.

12.102 Individual production processes are not within the realm of official statistics and thus observed data for various production technologies do not usually exist. Economic statistics deal with transactions and only exceptionally with technical transformations. Furthermore, any relevant technology description should comprise the type of capital and labour used in the production process and the intermediate inputs. In the discussion on how IOTs can be compiled, the term “**technology**” is a broader concept than in its usual sense.

12.103 Independently of the approach chosen, it is obvious that any single element in IOTs represents a unique “basket of products”. The measurable degree of “heterogeneity” of these baskets is closely related to the elementary or most detailed level of product that is identified. In many countries, the SUTs are compiled for rather aggregated product groups, often not more than a few hundred groups, and a level of 2,000-3,000 groups is very detailed in an international context. Only when there are more product groups than industries in SUTs together with the compilation of tables in volume terms, is it possible to identify the variation in the basket along a row of the Use Table. In cases where the tables are very aggregated, and therefore, the methods used in the compilation system (both in current prices and in volume terms) will result with data on the surface complying with theoretical assumption about homogeneity, as all evidence operating at such an aggregated level would have been eliminated in the compilation process.

12.104 Each establishment has its own unique institutional and organizational characteristics, which may influence the composition of its purchases as much as the underlying technical production processes do. Two establishments producing identical products may have quite different input (purchase) structures, depending on the degree of reliance on purchases of semi-fabricated products, outsourcing of certain activities, whether it owns its capital equipment and buildings rather than leasing or renting them etc., and in general on the degree of vertical integration of the various production processes.

12.105 For the proper understanding of the character of I-O data, it is essential to realise that there is no way to eliminate completely the **institutional characteristics** of an economy from SUTs or IOTs. As institutional arrangements change over time in individual countries, and may vary considerably across countries, it is obvious that the interpretation of SUTs and IOTs as a description of a technical production system has serious limitations.

12.106 Concerning the analytical properties of IOTs, it is important to note, in practice all analytical uses of IOTs must implicitly assume an industry technology, no matter how the tables have originally been compiled. In view of the limited amount of secondary activities and from an analytical point of view the distinction between a product and an industry technology is thus of limited relevance. Furthermore any Product by Product IOTs in practice are a manipulated Industry by Industry IOTs, as it still contains all the institutional establishment (or even enterprise) characteristics of the data collected and the basis of the SUTs.

3. Input-Output and official statistics

12.107 Many countries have been compiling IOTs for a considerable span of years, either every five-year or at irregular intervals, and a growing number of countries are now compiling annual SUTs and IOTs as an integrated part of their National Accounts. These experiences can also help to identify procedures that underpin recommendations on “best practices”.

12.108 It is generally accepted that the type of tables that best fulfil the standard quality criteria are Model A (Product by Product IOTs using the product technology assumption) and Model D (Industry by Industry IOTs using the fixed product sales structure assumption), see Thage (2001). These tables reflect the accumulated experience and current practice of those countries most permanently involved in the compilation of IOTs.

12.109 There is no ideal type of table against which to measure the quality of the outcome. However, the IOTs exist as an important part of official statistics and should as such fulfil central quality criteria including user needs.

12.110 The main quality characteristics of Industry by Industry IOTs and Product by Product IOTs are:

(a) Transparency

- Industry by Industry IOTs based on the fixed product sales assumption can be derived from SUTs without much further effort and in such a way that negative elements do not appear. They provide more transparency on the compilation procedure.
- Product by Product IOTs based on the product technology assumption are derived from SUTs in a complex procedure. If negative elements appear, a new balancing procedure is required. Manual balancing causes less transparency.

(b) Comparability

- Industry by Industry IOTs are closer to statistical sources, business survey results and actual observations as well as the SUTs. More direct comparability is guaranteed with National Accounts data and other industry-based statistics.
- Product by Product IOTs are further away from statistical sources and business survey results. The results have been compiled in an analytical step which creates less comparability with the sources but creates more comparability across nations – this will also depend upon each industry/product case and the level of aggregation.

(c) Inputs

- IOTs identify for each industry the input requirements from other industries. The same is true for the categories of final uses. Mixed bundles of goods and services rather than homogenous products are reported for intermediate uses and final uses.

- Product by Product IOTs have a clear input structure in terms of products for intermediate uses and GVA for the compensation of labour and capital for product defined industries.

(d) Resources and timeliness

- Industry by Industry IOTs are less resource intensive to produce and can be directly derived from SUTs at basic prices. This requires less resource and guarantees better timeliness.
- The compilation of Product by Product IOTs based on the product technology is more demanding as negatives may appear. These tables require more resource and balancing efforts. The publication of results is delayed.

(e) Analytical potential

- The specific type of IOTs (Product by Product or Industry by Industry) will not exclude any kind of analysis. This is because the information contained in the Supply Table can be used to transform product classified information into the industry classification, and vice versa, in the same way as the transformation tables were defined to compile the four alternative transformation models (Model A, B, C and D). Therefore any data input into, and output of results from, an analysis based on IOTs can be given either a product or an industry classification as needed.

(f) User friendliness

- Compiling IOTs integrated with SUTs on a regular basis despite the practical problems associated with IOTs encourages its uses.

12.111 The size of sampling and non-sampling errors associated with the primary data on which the SUTs are based, and the fact that a considerable part of the data content of the SUTs is usually obtained by survey grossing-up methods, extrapolations, estimates from a subjective-based nature and even model calculations should be borne in mind when choosing the method for constructing IOTs. Furthermore, purchases data for intermediate consumption by products are at best collected for establishments, and in most cases, the statistical coverage of purchases is irregular and/or highly aggregated. Another important source of error in the detailed output and input data is connected with the transformation from observed data on sales and purchases to the National Accounts concepts of production and intermediate consumption, and the fact that sales and purchases are not evenly distributed over the year, the challenge of measuring changes in inventories.

12.112 Thus the effects of non-sampling errors, misclassifications and biases in grossing-up methods may represent sources of errors more important than the total secondary production, at a particular level of aggregation. There are few possibilities to identify and correct such errors, when they have already passed the test of a balanced SUTs system. Compilation methods for the IOTs should therefore not assume an accuracy of the data that is not commensurate with the actual knowledge about data quality.

4. Taking account of IOTs requirements when compiling the SUTs – Redefinitions

12.113 When SUTs statistics are compiled, it is essential to take into account the desired properties and compilation methods of IOTs. By making appropriate choices of the groupings and structure of SUTs, it is possible to construct a database which is relevant and useful in the current National Accounts, and at the same time, can be transformed into IOTs with a minimum of data manipulation.

12.114 There are some procedures related to the compilation of the SUTs that are useful to observe before the transformation to the IOTs. This represents the first step of the **two-step process** or **redefinition process** which is applied in many countries with extensive experience in producing IOTs and covered in Chapter 5. There are many country-specific variants or methods, especially for countries covering only enterprise units in their economic statistics. In France, for example, the first step is carried to such an extent that the Supply Table becomes diagonal only. The second step is thus superfluous.

12.115 The *first step* of the two-step process defines the industries in SUTs (and in the activity tables of the National Accounts) in such a way that no industries have secondary production in other sections of ISIC, although this is not often fully achieved and therefore requires a second step. The ISIC Rev. 4 sections are broad industry groups such as Agriculture forestry and fishing (Section A), Mining and quarrying (Section B), Manufacturing (Section C), Construction (Section F), etc. If the establishments for which statistics are available do not automatically fulfil this condition, it is the task of the national accountants to make further breakdowns and create new establishments until this condition is fulfilled both for horizontally and vertically integrated units. Such additional breakdowns are typically made manually based on the best available information and judgement of the national accountants. Often there is limited intermediate consumption data available for establishments created this way. The redefinition can be implemented just by moving some parts of the totals for intermediate consumption between industries, thus also facilitating the subsequent compilation of the detailed input structures in the Use Table.

12.116 There are two important points to be noted concerning this procedure:

- This redefinition reflects compliance with 2008 SNA concerning the definition of units of homogeneous production (2008 SNA, paragraphs 5.52-5.54). The compliance with the SNA definition of industries is essential for the usefulness of the data classified by activity not only for I-O purposes but also for their analytical relevance. Industries should therefore ideally be defined in the same way in the production accounts, in SUTs and in IOTs.
- This method should not be seen as representing a “mixed technology” assumption. The first step is only to ascertain that the basic principles for compiling production accounts according to the SNA are being followed. In the second step, IOTs are compiled on the assumption of fixed product sales structures.

12.117 The redefinitions mainly relate to activities like agriculture, energy, construction and trade. These breakdowns and reclassifications could be seen as the use of a product technology assumption. This will not result in negative elements. Often very specific information on input structures that could not possibly be identified alone from the SUTs is used in the redefinitions.

12.118 As this redefinition takes place before the SUTs are populated, it is often not even necessary to assume a specific input structure for the redefined output as the transfers only take place between output and input totals of the industries. This facilitates the compilation of SUTs. If, for example, all construction has a priory been transferred to the construction industry there will be no need to distribute construction materials to practically all industries in SUTs – a procedure which would be both very time consuming and unreliable as source data for such inputs would usually be lacking.

12.119 The redefined industries become "pure" in the sense that they have no secondary production and all secondary output of these products have been transferred to the redefined industries. However, the redefined industries are not homogeneous in any strict meaning of this term as they may still produce many different products with separate input structures, price movements and distributions by users.

12.120 In some countries, the business registers do not contain much detail on establishments and concentrate on enterprise units. In general, data problems do, however, not exempt those compiling National Accounts from complying with the SNA rules. Experience shows that in cases where the starting point are the SUTs with enterprise defined activities, and Product by Product IOTs are calculated on the assumption of a product technology, the successive rounds of recalculations (using the negatives as indicators) lead to changes to the original SUTs that basically (at least for changes related to the elimination of the big negatives) reflect the type of redefinitions described in the first step of the two-step process. In such cases, it is a more straightforward and efficient to first do the redefinitions in the SUTs in a systematic way, as negatives that appear at a later stage will have a low signal value, and may lead to unsystematic and arbitrary adjustments in the SUTs.

12.121 If the National Accounts and SUTs are based on enterprise type units, it may not be realistic to compile redefined SUTs with a redefined industry classification that does not comply with the current National Accounts tables. When it comes to the construction of the IOTs, it is still possible to use the two step process, and first adjust the (rectangular) SUTs as outlined above, and subsequently compile Industry by Industry IOTs based on the assumption of fixed product sales structures, without first having to aggregate to square SUTs. Even though the comparability of the classifications for IOTs and National Accounts will not be perfect, the advantages of limited aggregation loss of information as well as the simplicity of the method will still be retained.

Annex A to Chapter 12. Mathematical derivation of different IOTs

A. Product by Product IOTs and Industry by Industry IOTs

A12.1 Over the past 60 years, there have been many descriptions generalising the matrix multiplication for the IOTs. For example, using Rueda-Cantuche and ten Raa (2009), the starting point for the construction of the Product by Product IOTs is the amount of product i used by industry j (to produce product k): intermediate use u_{ij}. Schematically, the transformation underlying Product by Product IOTs is:

product $i \rightarrow$ industry $j \rightarrow$ product k

A12.2 For the Industry by Industry IOTs, this will be viewed as a product i contribution to the delivery from industry j to industry k. This is:

industry $j \rightarrow$ product $i \rightarrow$ industry k

A12.3 This common framework for IOTs is made precise by indexing the so called I-O coefficients by three subscripts. The first subscript indexes the *input*, the second the *observation* unit, and the third the *output*.

A12.4 A *Product by Product input-output coefficient* a_{ijk}, is defined as the amount of product i used by industry j to make one unit of product k. Similarly, the *Industry by Industry input-output coefficient*, b_{jik}, is defined as the delivery by industry j in product market i per unit of output of industry k.

A12.5 As shown in **Figure A12.1**, in the construction of **Product by Product** IOTs industry j's secondary products v_{jk}, and their input requirements, $a_{ijk}v_{jk}$, are transferred out from industry j to industry k; the flipside of the coin is that products produced elsewhere v_{kj} as secondary and their input requirements $a_{ikj}v_{kj}$ are transferred in from industries k. Hence, the amount of product i used to make product j becomes:

$$u_{ij} - \sum_{k \neq j} a_{ijk} v_{jk} + \sum_{k \neq j} a_{ikj} v_{kj} \qquad (1)$$

A12.6 The same reasoning extends to Industry by Industry IOTs as shown in **Figure A12.2**. In constructing **Industry by Industry** IOTs, the secondary products (produced by industry j) v_{ji}, and their deliveries to industries k, $b_{jik}v_{ji}$, are transferred out from market i to industry j; here the reverse is that market product j produced elsewhere as secondary v_{ij} and their corresponding deliveries $b_{ijk}v_{ij}$ must be transferred in from markets j. Hence, the amount delivered by industry i to industry k becomes:

$$u_{ik} - \sum_{j \neq \mathrm{i}} b_{jik} v_{ji} + \sum_{\mathrm{j} \neq \mathrm{i}} b_{ijk} v_{ij} \qquad (2)$$

In addition to Figure A12.1 and Figure 12.2, see also de Mesnard (2004) for a complete economic circuit approach.

B. Product by Product IOTs

A12.7 There are alternative ways to decide how much input corresponds with output for Product by Product IOTs. Ten Raa and Rueda-Cantuche (2003) provides a range of the available methods (see Annex C in this chapter for a summary of the different types of methods). Two outstanding methods are:

- the product technology assumption (Model A); and
- the industry technology assumption (Model B).

A12.8 These are also used by a few NSOs combined into the hybrid (or mixed) technology assumption.

A12.9 These assumptions have been considered as opposite or even competing, but the reality is both technology assumptions can be derived in an unifying framework, under alternative assumptions of the variation of I-O coefficients across industries (ten Raa and Rueda-Cantuche, 2007). The product technology assumption postulates that all products have unique input structures irrespective the industry of fabrication (removal of the second subscript in (1)) and thus implies the following condition:

$$a_{ijk} = a_{ik} \text{ for all } j$$

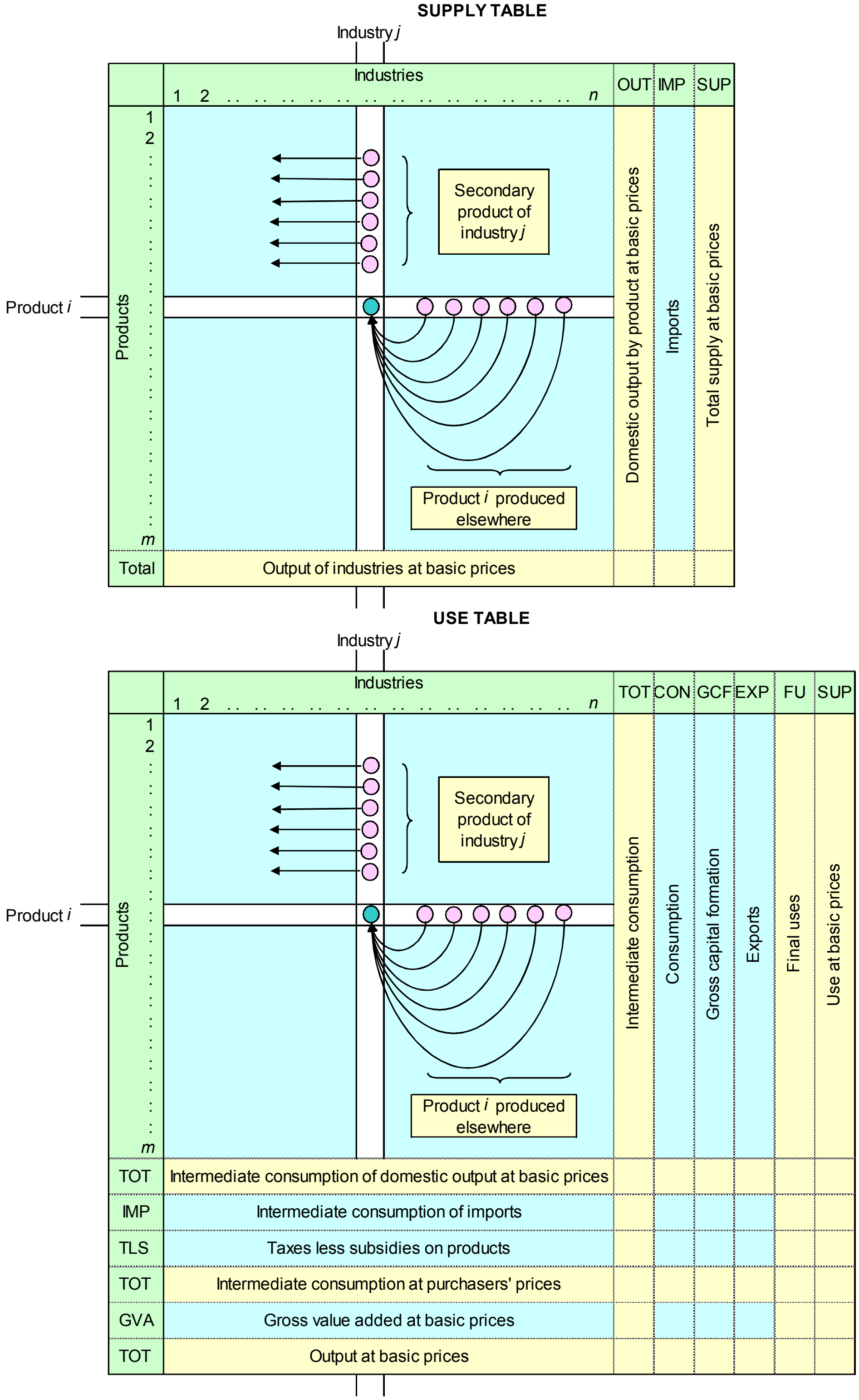
A12.10 The resulting IOTs using the product technology assumption may contain negative values when the total consumption of input i for the making of secondary outputs of industry j exceeds the total use of product i by the industry j, either for its primary or secondary products.

A12.11 On the other hand, the industry technology assumption postulates that all industries have the same input structure irrespective of the products they produce (removal of the third subscript in (1)). Therefore:

$$a_{ijk} = a_{ij} \text{ for all } k$$

A12.12 Using the industry technology assumption, the IOTs values are non-negative.

Figure A12.1 Transfers made for the Product by Product IOTs



C. Industry by Industry IOTs

A12.13 There are two main models for the construction of Industry by Industry IOTs:

- The assumption of a fixed industry sales (FI) structure postulates that each industry has its own specific sales structure, irrespective of its product mix (Model C).

- The alternative assumption of a fixed product sales (FP) structure postulates that each product has its own specific market shares (deliveries to industries) independent of the industry where it is produced. The market shares refer to the shares of the total output of a product delivered to the various intermediate and final users (Model D).

A12.14 Rueda-Cantuche and ten Raa (2009), as many others, used an encompassing framework for the construction of Industry by Industry IOTs. The fixed industry sales structure assumption postulates that all industries have unique input structures, irrespective the product market (removal of the second subscript in (2)). Consequently, fixed industry sales coefficients may be defined accordingly:

$b_{jik} = b_{jk}$ for all i

The Supply Table needs to be square and negatives may emerge from this assumption.

A12.15 Alternatively, the fixed product sales structure assumption assumes that product i's unitary deliveries to industry k must be independent of the supplier industry (j). Therefore, all products require unique industry deliveries, irrespective of the industry of fabrication (removal of the first subscript in (2)):

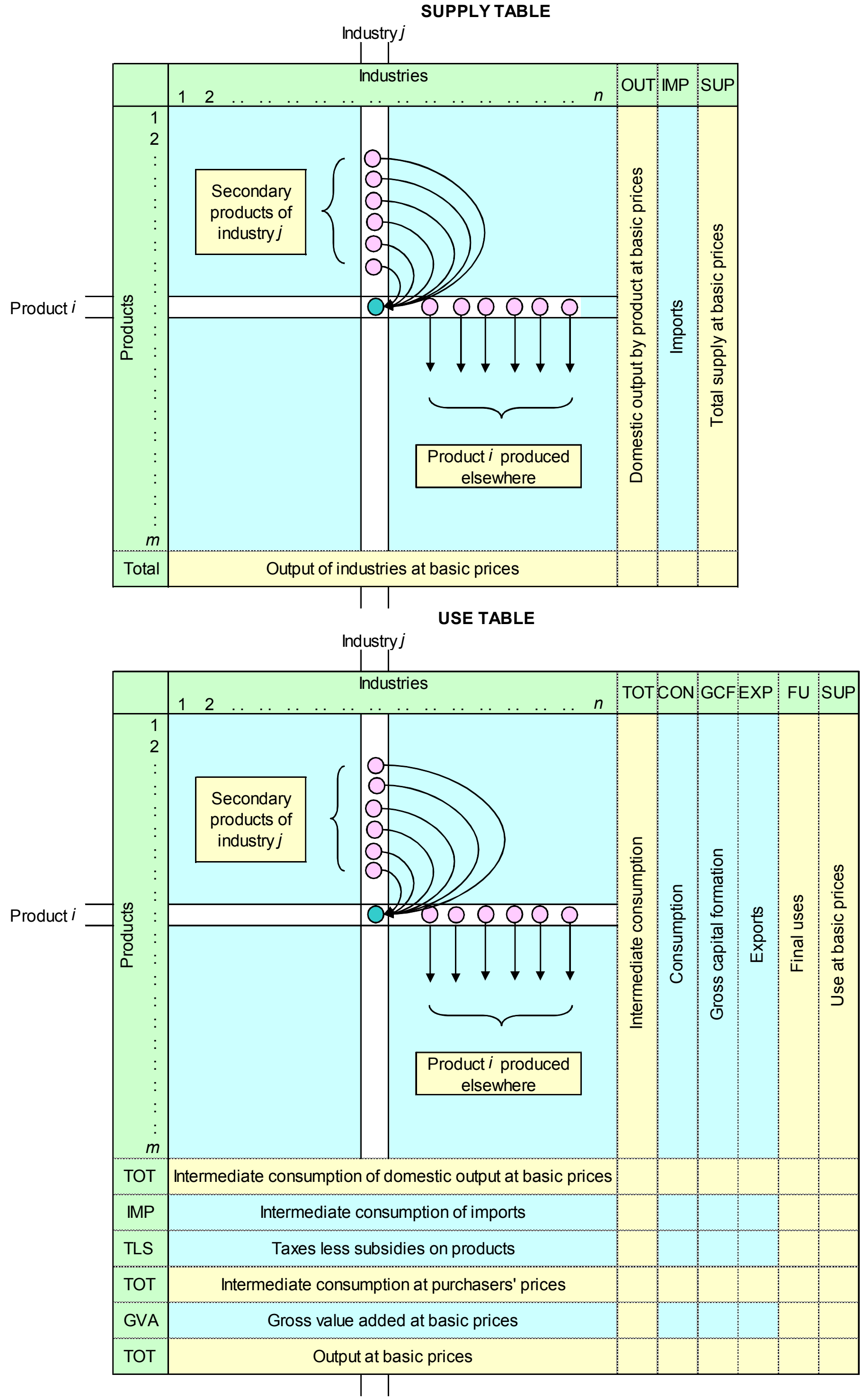
$b_{jik} = b_{ik}$ for all j

The Supply Table does not need to be square and negatives do not emerge from this assumption.

A12.16 It is reasonable to assume that secondary outputs have different destinations than the primary outputs. This is the reason why the fixed product sales structure assumption catches more attention in the literature, see Thage and ten Raa (2006) or Yamano and Ahmad (2006). Moreover, FP has no negative elements, unlike FI, because of the inversion of the Supply Table.

A12.17 Denmark, the Netherlands, Finland, Norway, Canada, the US and the OECD are examples that fully or partially adopt FP to compile Industry by Industry IOTs (Yamano and Ahmad, 2006).

Figure A12.2 Transfers made for the Industry by Industry IOTs



D. Use of a hybrid technology assumption for Product by Product IOTs

A12.18 The product and the industry technology assumptions are the two main methods to construct Product by Product IOTs from SUTs. However, although they are commonly seen in the literature as opposite, some NSOs apply a hybrid product and industry technology assumptions to produce Product by Product IOTs. In some cases, the non-negativity of one of the assumptions is enough to use it more widely than a single (non-hybrid) technology assumption. In particular, for hybrid models, the choice of products for which either the product technology assumption or the industry technology assumption will be used is mainly based on expert judgements and seldom empirical analyses.

A12.19 Rueda-Cantuche and ten Raa (2013) presented several empirical tests that provide conclusions on the choice of technology assumption for Product by Product IOTs (as in the construction of the Use Tables, the assumption that individual establishment data with a full input specification exist may not be feasible within the tests).

A12.20 Following the expression (1), these authors showed that the tests can provide acceptance and rejection regions for the competing technology assumptions allowing a hybrid technology model in which some secondary products are treated by one assumption and other products by the other assumption. These tests will enable NSOs to apply more tailored hybrid technology assumptions, which can be complemented with expert judgments in order to improve the whole compilation process.

A12.21 Overall, producers of IOTs should be cautious. The results from these tests should not lead to rejecting the product technology assumption and consider it unrealistic. On the contrary, the lack of homogeneity in the product classification is constantly biasing final acceptance/rejection decisions in favour of the competing model (industry technology).

A12.22 However, it should be noticed that detailed product data on inputs and outputs at the level of individual units are required and valued at basic prices, which is not readily available from business surveys. Businesses report data on goods and services with insufficient specification and mostly at purchasers' prices. There are many examples of partly specified inputs, for example, single aggregates for a mixed bunch of goods (food and drinks in hotels and restaurants; consumption of building materials in construction firms; office materials used in businesses, etc.) and the 'other costs' items, which may include a large variety of products. It might be common practice to use assumptions that come close to product or industry technology assumptions to complete the full specification of firms' data on inputs and outputs but it should be done preferably using actual data or structures of other firms/establishments with the same economic activity and similar number of workers.

A12.23 Besides, firms report the price paid including trade and transport margins and (if any) net taxes on products (purchasers' prices), so some adjustments need to be applied in order to get firms' input data valued at basic prices.

A12.24 These tests could lead to statistically significant conclusions on the selection of the most appropriate technology assumption but the power of the tests might be largely affected by the heterogeneity in the product classification, the insufficient detailed breakdown of products and the measurement errors by the business. These tests may be used as a guide towards the selection of one of the two technology assumptions in the construction of a hybrid technology-based Product by Product IOTs, for example, as performed by one regional statistical office (Catalonia, Spain).

Annex B to Chapter 12. Classical causes and treatment of negative cell entries in the product technology

A. Classical causes of negative elements in the product technology

B12.1 As mentioned in Chapter 12, the product technology assumption may generate negative values because of the systematic negatives in C^-1 and D^-1. We indicate here the various classical reasons that were considered for the appearance of negative elements, for example:

- there may be multiple technologies for the production of a product.
- the economic transactions may not fully record technological relations.
- the products may represent heterogeneous elements.
- there may be data errors in the SUTs.

B12.2 This Annex briefly covers these factors and proposes possible solutions. The reader is encouraged to consult ten Raa and Rueda-Cantuche (2013) for a more in-depth review of the classical issues and available solutions, including algorithmic procedures for the elimination of negatives which will not be covered in full in this Annex.

1. The product technology assumption may be incorrect

B12.3 This means there is a product that is produced in two different ways. Clearly, there are cases where this is true, for example in the chemical industry, where there are often different processes that lead to exactly the same product. Negatives could be created when one process uses inputs that are not used by another. This assumption is likely to be only valid at a very detailed level (for example, KAU or LKAU) and possibly not applicable at the level of aggregation used in SUTs.

2. Economic transactions are recorded rather than technological relations

B12.4 The SUTs record in principle all transactions between establishments/enterprises. These are the economic transactions and do not necessarily describe technology. For example, two companies employ the same process to produce a product. One of the companies sub-contracts a large part of the process, whereas the other company does the whole process in-house. The two companies will thus show different input structures in the Use Table for the same output, possibly leading to negatives.

B12.5 Another situation that could lead to negative elements is where the company operates vertically integrated production processes. For example, consider the production of cheese at a dairy farm. The milk produced at the farm and used in the production of cheese is neither recorded as an input nor as an output of the dairy farm. Hence, it looks as if the farm produces cheese without using milk. If the cheese were to be transferred to the dairy industry, and the input structure of the dairy industry were to be applied to this cheese, a negative input for milk would appear for the dairy farm.

B12.6 Non-market output creates a special problem in the application of the product technology assumption. Non-market output is valued by convention as the sum of the costs incurred in its production, with net operating surplus being zero. This is applied at the level of the producing unit and not by product. Secondary market products are valued at their market prices but the value of the total output of the unit is determined by the costs. If therefore the secondary products are transferred to the (market) industry where it is produced as primary product, a negative may arise for the net operating surplus.

3. Heterogeneity in data and classifications

B12.7 Negatives can be generated by heterogeneity in the data. Heterogeneity is unavoidable because products and industries need to be aggregated in SUTs. In the numerical example used in this chapter, the manufacturing products produced by agriculture could be totally different products than, or perhaps a subset of, the products produced by the manufacturing industry. It is clear that assuming the product technology in such a case would create problems. It is recommended therefore to apply the product technology assumption always at the most detailed level of products possible, allowing for the requirement of a square SUTs.

B12.8 The classifications play an important role here. As mentioned earlier, the international classifications may be based on a variety of criteria that are not always the ones that are appropriate for I-O analysis. An example is footwear. The CPC does not distinguish footwear of different materials. More importantly, the CPC provides a distinction of footwear by use. However, aggregating leather and plastic shoes in one column of the SUTs creates heterogeneity in the description of the production processes. This may lead to negatives when another industry produces one of the two types of shoes as secondary output.

4. Errors in the SUTs data

B12.9 Last but not least, negatives can be caused by errors in the SUTs starting point for transformation or parts of the transformation itself, in terms of the trade margins, transport margins, taxes on products and subsidies on products.

B12.10 This is an important aspect because it could give insight into the quality of the elements of the SUTs system. In this way, the compilation of the IOTs can provide a useful and powerful feedback loop for checking the plausibility of the SUTs data. This experience has shown that IOTs should be compiled simultaneously with SUTs to enable the results of the IOTs be immediately incorporated back into the SUTs. This approach may not hold when a long run of SUTs need to be revised due to methodological changes or a new ISIC or a new SNA.

B. Overall strategy for removing negatives

B12.11 As already covered, the negatives in Model A and Model C have a structural cause. If it is mandatory to use these models, there are various empirical ways in resolving these negatives.

B12.12 Ideally, all the negatives should be removed manually having identified the cause for the negatives and the SUTs/IOTs rebalanced, as appropriate. However, due to the limited resources, limited time or limited information available, alternative strategies for resolving these negatives may need to be applied. For example, Model A is applied and negative cell entries are generated and a three-step approach could be applied:

- All large, and/or any significant, negative cell entries are investigated, resolved and rebalanced – these changes could affect the SUTs or any of the steps in the transformation to the IOTs. In doing so, some positive cell entries may be identified as implausible and may also need to be changed.
- Eliminate small negatives by applying some form of automated procedure.
- Review plausibility of the results, and change, if necessary.

C. Specific approaches to dealing with negatives

B12.13 There are various ways of dealing with negatives, including:

- merging industries;
- changing the primary producer;
- applying industry technology within the product technology framework;
- introducing new products;
- correcting errors in the SUTs;
- making manual corrections to IOTs; and
- (after the above steps) the Almon Method used to remove any small negative cell entries.

1. Merging industries

B12.14 If two or more products are produced more or less simultaneously, it is often difficult to distinguish the production processes of those products. For example, two closely related industries are restaurants (ISIC Rev. 4 Group 561) and bars (ISIC Rev. 4 Group 563). Restaurants will have a lot of secondary output of beverage serving services (CPC Ver. 2.1 Group 634, the main product of bars), while bars will have a lot of secondary output of food serving services (CPC Ver. 2.1 Group 633, the main product of restaurants). It will be difficult to distinguish separate input structures for beverage serving services and food serving services, since both services are usually provided simultaneously. It is basically a form of joint production. Trying to distinguish separate input structures by applying the product technology may lead to negative elements.

B12.15 It would be better to aggregate such industries and hence the products before applying the product technology. The assumption is then that both products are produced in the same production process – this is far from ideal and not in line with recommended approach to operate at the most detailed level possible. Merging the industries removes the secondary outputs and prevents negatives, and can be a convenient solution to many cases. The apparent disadvantage of increasing the heterogeneity of the database is in fact not so important, since the input structures merged are similar anyway.

2. Changing the primary producer

B12.16 It was noted that it must be known which industry is the primary producer for each product if the product technology assumption is applied. In some cases, negatives are created because the initially chosen primary producer of a product is not the right one (for example, research and development). In such a case, the input structure of another industry might be more appropriate to use as starting point.

B12.17 It has to be noted, in most cases, there are many more products than industries, and hence there can be products for which it is not immediately obvious who the primary producer may be, especially when they are rather heterogeneous products.

3. Apply industry technology within the product technology framework

B12.18 In the case that the product technology is not valid because there are in fact two ways of producing a product, one way of resolving this problem is to apply the industry technology assumption. The industry technology assumption assumes that all products produced by the industry are produced in the same production process. Thus, for example it does not matter whether the outputs of the agriculture industry are called agricultural products or manufacturing products, they can all be treated as if they were primary products. The secondary output of manufacturing products could thus be added to the primary output. However, the same adjustments have to be made in the Use Table, that is, the corresponding amounts have to be transferred from the manufacturing products row to the agricultural products row and these amounts have to be allocated to the appropriate users. It is easy to see that this is exactly the same problem as the one that has to be solved when compiling Industry by Industry IOTs. If available, this assumption could be complemented with actual data.

B12.19 The drawback of this solution is that it leads to a reclassification of products. The heading "agricultural products" in the IOTs would no longer contain the same products as the same heading in SUTs. This could pose problems for interpretation and for users. In that case, this solution could still be applied in cases where the reclassification stays within the product groups distinguished in the most detailed published tables.

4. Introducing new products

B12.20 Another possibility is to introduce a new product. It could well be that there exist two or more ways to produce a product. If there is sufficient information on the different production processes available, this could be added to increase the homogeneity of the IOTs. The drawback of this method is the labour and data intensity. However, if all products are defined as characteristic in the industry where they are actually produced, then the product technology is in practise replaced by an industry technology.

5. Correcting errors in the SUTs

B12.21 Wherever it can be established that negatives (or other implausible results) are caused by errors, it should of course be repaired by correcting the data.

B12.22 The problem here is that IOTs are usually compiled after the "closing" of the accounts and the SUTs. This is more so in countries when IOTs are compiled less regularly, for example, once every five years. In such cases, when the compilation of the IOTs reveals problems/errors in the SUTs, these can often only be resolved at the next benchmark revision and therefore inconsistencies may have to be reflected to produce plausible IOTs.

6. Make manual corrections to IOTs

B12.23 Finally, if large negatives remain that cannot be dealt with by any of the above solutions, for example, because it would significantly affect the compatibility with the original SUTs, they could be resolved by correcting the results of the product technology manually.

B12.24 After the large negative values have been removed and perhaps after adjusting manually some clearly wrong positive elements, the remaining small negatives can also be eliminated by setting them to zero as in Armstrong (1975). The final balancing to match the totals can be done using a mathematical routine such as the RAS procedure or other methods as covered in Chapter 18 of this Handbook. This is the case when it can be considered that these negatives are the normal "noise" in the compilation process, due to unavoidable heterogeneity and statistical error within the normal confidence ranges.

7. Almon Method

B12.25 Depending upon the diversity of industries' secondary activities, Model A (Product technology assumption) may generate Product by Product IOTs with negative entries.

B12.26 Almon developed an alternative method which is consistent with the product technology assumption but calculates Product by Product IOTs from SUTs without any negative entries (Almon 2000). The most effective application of the Almond Method should be considered when all of the above procedures have been used, and the focus is only to remove the last small suite of negative entries. The Almond Method should not be used alone and directly applied to the original SUTs.

B12.27 The method applies the product technology by calculating IOTs row by row, and taking care of negatives as soon as they appear. It monitors the transformation process outlined for Model A step-by-step for each row (i.e. product), when a negative cell entry occurs, the amounts transferred are reduced until the negative value is absorbed.

B12.28 The method leaves the row totals unaffected but there is no guarantee that the column totals are maintained. It is therefore necessary to perform a RAS procedure or a similar procedure to re-balance the row and column totals.

B12.29 The fact that no negative cell entries appear also means that the negative cell entries cannot be used to analyse the quality and plausibility of the SUTs. However, the results of the Almon Method can be checked by recalculating the Use Table. In a similar way as above, this check provides information such as where the structure of SUTs or the product assumptions can be improved.

B12.30 Box B12.1 shows the application of the Almon Method in removing "small" negatives for a small numerical example.

Box B.1 Almon Method

Clopper Almon developed a procedure (Almon, 2000) to compile Product by Product IOTs from SUTs using the product technology assumption without negative cell entries.

In Scenario A, the traditional transformation of the SUTs to IOTs with the product technology assumption (Model A) does not result in negative flows. However, a marginal change in the Use Table in Scenario B does result in negative cell entries.

In Scenario A, the Almon procedure generates the same result as the traditional transformation with Model A. However, in Scenario B, it is demonstrated how negative cell entries can be avoided by using the Almon procedure.

The final result of the Almon procedure reflects the fact that rennet is only used in the cheese industry. In addition, the Almon procedure gives an indication in the sheet "New use table" how the Use Table can be revised to avoid negative cell entries in the compiled Product by Product IOTs. In fact, in the example of Almon, the "New use table" of Scenario B corresponds with the original Use Table of Scenario A.

SCENARIO A

Supply table

		Industries					
		Cheese	Ice Cream	Chocolate	Rennet	Other	*q*
Products	Cheese	70	30				100
	Ice Cream	20	180				200
	Chocolate			100			100
	Rennet				20		20
	Other					535	535
	g'	90	210	100	20	535	

Use table

		Industries						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate	4	36				60	100
	Rennet	14	6					20
	Other	28	72	30	5		400	535
	W	44	96	70	15	535		760
	g'	90	210	100	20	535	760	

Product technology assumption

Product-by-product input-output table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate		40				60	100
	Rennet	20						20
	Other	30	70	30	5		400	535
	W	50	90	70	15	535		760
	q'	100	200	100	20	535	760	

Almon procedures

Product-by-product input-output table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate		40				60	100
	Rennet	20						20
	Other	30	70	30	5		400	535
	W	50	90	70	15	535		760
	q'	100	200	100	20	535	760	

New use table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate	4	36				60	100
	Rennet	14	6					20
	Other	28	72	30	5		400	535
	W	44	96	70	15	535		760
	g'	90	210	100	20	535	760	

SCENARIO B

Supply table

		Industries					
		Cheese	Ice Cream	Chocolate	Rennet	Other	*q*
Products	Cheese	70	30				100
	Ice Cream	20	180				200
	Chocolate			100			100
	Rennet				20		20
	Other					535	535
	g'	90	210	100	20	535	

Use table

		Industries						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate	3	37				60	100
	Rennet	15	5					20
	Other	28	72	30	5		400	535
	W	44	96	70	15	535		760
	g'	90	210	100	20	535	760	

Product technology assumption

Product-by-product input-output table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate	-1.67	41.67				60	100
	Rennet	21.67	-1.67					20
	Other	30	70	30	5		400	535
	W	50	90	70	15	535		760
	q'	100	200	100	20	535	760	

Almon procedures

Product-by-product input-output table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate		40				60	100
	Rennet	20						20
	Other	30	70	30	5		400	535
	W	50	90	70	15	535		760
	q'	100	200	100	20	535	760	

New use table

		Products						
		Cheese	Ice Cream	Chocolate	Rennet	Other	*Y*	*q*
Products	Cheese						100	100
	Ice Cream						200	200
	Chocolate	4	36				60	100
	Rennet	14	6					20
	Other	28	72	30	5		400	535
	W	44	96	70	15	535		760
	g'	90	210	100	20	535	760	

Annex C to Chapter 12. Examples of reviews of approaches to the treatment of secondary products

Treatment of secondary products		
Year	**Source or author(s) as appropriate**	**Reference to specific pages**
TRANSFER OF OUTPUTS ONLY		
Transfer method		
1961	Stone	Pages 39-41
1973	United Nations	Page 25
1985	Fukui and Seneta	Page 178
1986	Viet	Pages 16-18
1990	Kop Jansen and ten Raa	Page 215
1994	Viet	Pages 36-38
Stone Method or By-product technology model		
1961	Stone	Pages 39-41
1973	United Nations	Page 26
1984	Ten Raa, Chakraborty and Small	Page 88
1985	Fukui and Seneta	Page 178
1986	Viet	Pages 15-16
1990	Kop Jansen and ten Raa	Page 215
1994	Viet	Page 38
European System of Integrated Economic Accounts (ESA) Method (EUROSTAT, 1979)		
1986	Viet	Pages 18-19
1990	Kop Jansen and ten Raa	Page 214
1994	Viet	Pages 38-40
TRANSFER OF INPUTS AND OUTPUTS		
Lump-sum or aggregation method		
1974	Office for Statistical Standards	Page 116
1985	Fukui and Seneta	Page 177
1990	Kop Jansen and ten Raa	Page 214
1994	Viet	Pages 42-43
Methods with a single technology assumption - Product technology model		
1968	United Nations	Pages 48-51
1968	van Rijckeghem	Pages 607-608
1970	Gigantes	Pages 280-284
1973	United Nations	Pages 26-32
1975	Armstrong	Pages 71-72
1984	Ten Raa, Chakraborty and Small	Page 88
1986	Viet	Page 20

1990	Kop Jansen and ten Raa	Page 215
1994	Viet	Page 41
Methods with a single technology assumption - Industry technology model		
1968	United Nations	Pages 48-51
1970	Gigantes	Pages 272-280
1973	United Nations	Pages 26-32
1975	Armstrong	Pages 71-72
1984	Ten Raa, Chakraborty and Small	Pages 88-89
1985	Fukui and Seneta	Page 178
1986	Viet	Page 21
1990	Kop Jansen and ten Raa	Page 215
1994	Viet	Pages 40-41
Methods with a single technology assumption - Activity technology model		
1994	Konijn	Pages 143-184
1995	Konijn and Steenge	Pages 426-433
Hybrid technology assumption methods - Mixed product and industry technology assumptions		
1968	United Nations	Pages 48-51
1970	Gigantes	Pages 284-290
1973	United Nations	Pages 33-34
1975	Armstrong	Pages 72-76
Hybrid technology assumption methods - Product technology assumption and by-product technology method		
1984	Ten Raa, Chakraborty and Small	Page 90

Chapter 13. Compiling Physical Supply and Use Tables and Environmentally Extended Input-Output Tables

A. Introduction

13.1 Industrial growth and a rapidly growing world population have large impacts on the global environment and allocation of material resources. Most changes in the environment are brought about by human activities and these activities result in a flow of materials. The flows of resources from the natural environment to the economy are a prerequisite of production while flows of residuals from the economy to the environment are the consequence of production and consumption. A full understanding of these processes requires a complete description of the physical dimension of the economy and its interaction with the environment.

13.2 The Physical Supply and Use Tables (PSUTs) and Environmental-Extended Input-Output Tables (EE-IOTs) are used to describe the magnitude (measured by tonnes or other physical measuring units) and the nature of materials and products flowing in the economy, within the economy and between the economy and nature. They show how the **natural resources** (natural inputs) enter, are processed and subsequently, as **products**, are moved around the economy, used and finally returned to the natural environment in the form of **residuals** (emissions, waste, waste water, etc.). The exchange of products between the domestic economy and the rest of the world is also described in the PSUTs and EE-IOTs.

13.3 The SEEA Central Framework (United Nations *et al.* 2014) contains the internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics for environmental-economic accounts. The SEEA is fully consistent with the SNA. It uses an accounting structure as well as concepts, definitions and classifications consistent with the SNA in order to facilitate the integration of environmental and economic statistics.

13.4 The SEEA Central Framework describes a set of accounts that are relevant for the analyses of the interactions between the environment and the economy. This Chapter focuses on the compilation of PSUTs and the EE-IOTs. Section B presents the structure of PSUTs and the relevant definitions and classifications of natural inputs and residuals. This section also covers the accounting and balancing identities and the principles of physical flow accounting. Section C covers the compilation steps for PSUTs and how they fit in the overall process provided in Chapter 3 of this Handbook. This section will also cover possible data sources used for the compilation of PSUTs.

13.5 Section D describes how to extend standard economic IOTs in monetary units to include information on the environment in physical units in the EE-IOTs. The section focuses on two types of EE-IOTs, namely the Single Region Input-Output Tables (SR-IOTs) and the Hybrid IOTs. The compilation steps for EE-IOTs are described in Section E. Two country examples on the compilation of PSUTs are finally presented in Section F.

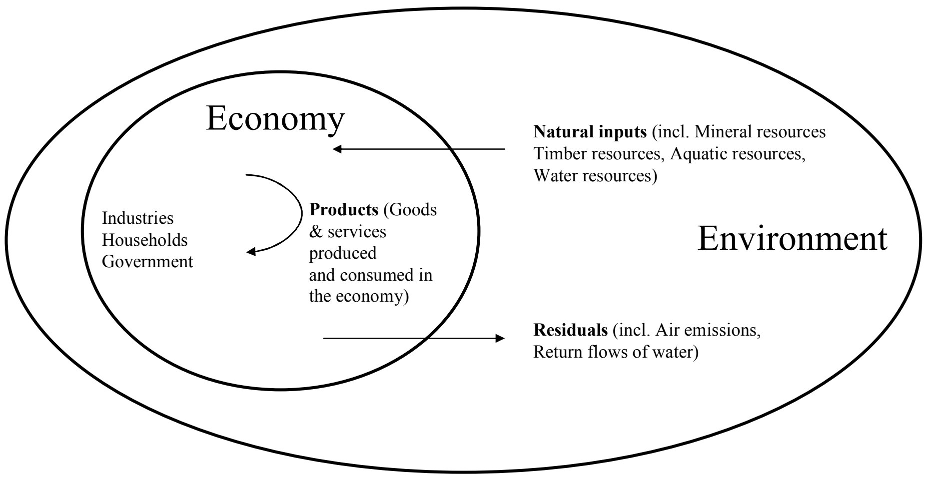
13.6 The presentation of the material in this Chapter does not necessarily reflect the order of compilation of PSUTs and EE-IOTs recommended to countries. The compilation of environmental accounts in general, and more specifically of the PSUTs and EE-IOTs, is done in a gradual manner starting with the compilation of those modules of the SEEA-2012 that reflect countries' priorities and resource availability. With the scope of the SEEA-2012, it is not possible to provide detailed practical guidance for compilation of the accounts for the various environmental domains (e.g. water, energy, forestry etc.) in this Handbook. The aim of this chapter, therefore, is more to provide the conceptual link of the PSUTs and EE-IOTs with the compilation of the SUTs and IOTs of the SNA and how to mainstream their compilation with that of SUTs and IOTs. More guidance on the compilation of the accounts can be found on the website of the United Nations at https://seea.un.org, and Eurostat at http://ec.europa.eu/eurostat/web/environment/methodology. Box 13.1 also presents a list of selected reference material.

13.7 Physical Input-Output Tables (PIOTs) are also an extension of the SUTs framework to take into account environmental considerations. They consist of a transformation of the PSUTs into PIOTs. However, because of the difficulties, conceptually and practically, with the compilation of PIOTs, the focus of SEEA (2012) has shifted more towards the compilation of EE-IOTS rather than PIOTs. A conceptual disadvantage of the PIOTs, for example, is that they do not allow for the distinction between different types of inputs and outputs. Inputs of products and natural inputs are combined together in PIOTs to generate one output which combines products and residuals. This limits the environmental analyses that can be drawn by combining physical accounts. On the practical side, the choice of the physical unit to measure the various types of products, natural inputs and residuals is also not simple. This Chapter, therefore, does not elaborate more on the compilation of PIOTs, although some countries do compile PIOTs as well as from this point in this Handbook, the focus will be mainly on EE-IOTs as opposed to PIOTs.

B. Overview of Physical Supply and Use Tables

13.8 The SEEA provides the conceptual foundation for the extensions of the SNA to include the environment. The SEEA Central Framework records flows from the environment to the economy (natural input), within the economy (product flows), and flow from the economy to the environment (residuals). Figure 13.1 provides a schematic representation of the physical flows of natural inputs, products and residuals between the environment and the economy.

Figure 13.1 Physical flows of natural inputs, products and residuals



Source: SEEA-2012 Central Framework.

13.9 PSUTs record physical flows of natural inputs, products and residuals in physical units of measurement. They are used to assess how an economy supplies and uses natural resources and examine changes in production and consumption patterns over the accounting period. In combination with data from monetary SUTs, they allow for analyses of changes in productivity and intensity in the use of natural inputs and the release of residuals. Physical flows within the environment, i.e. natural flows of materials and energy, are outside the scope of PSUTs.

13.10 For the recording of physical flows, the structure of the SUTs of the SNA is extended by additional rows and columns in order to accommodate physical flows between the economy and the environment.

13.11 As shown in Table 13.1, PSUTs consist of a pair of tables which have the same format/structure. The two tables show by row, the various physical flow types, namely natural inputs, products, and residuals. By column, they show instead the various origins and destinations supplying and using the flow items, namely industries (i.e. production activities), households (i.e. consumption activities), accumulation (changes in stocks of produced assets and product inventories), rest of the world and environment.

13.12 The physical Supply Table shows which physical flows are provided by which source (industries, households, accumulation, rest of the world, or the environment). In other words, it shows the physical flows by origin. The physical Use Table shows where the physical flows are used or received (i.e. production, consumption, accumulation activity, etc.). In other words, it shows the physical flows by its destination. The SEEA Central Framework notes that the general framework shown in Table 13.1 may be articulated fully or only partly.

Table 13.1 General Physical Supply and Use Table[7]

Simplified structure of the physical supply table

	Industries	Industries				Imports	Final consumption	Gross capital formation/Accu mulation	Environment	Total
		Agriculture, forestry, etc.	Mining and quarrying	…	Services					
Natural inputs	Mineral and energy resource Water …								Flows from the environment **(A)**	Total supply by natural inputs **(TSNI)**
Products	Agriculture, forestry, etc. Ores and minerals; etc. … Services	Output by product by Industry **(C)**				Imports by product **(D)**				Total supply by product **(TSP)**
Residuals	Solid waste Wastewater …	Residuals generated by Industry **(I)**				Residuals received from the Rest of the World **(L)**	Residuals generated by final consumtpion **(J)**	Residuals from scrapping and demolition of produced assets and emissions from controlloed landfill sites **(K)**	Residuals recovered from the environment **(M)**	Total supply by residuals **(TSR)**
Total Supply										

Simplified structure of the physical use table

	Industries	Industries				Exports	Final consumption	Gross capital formation/Accu mulation	Environment	Total
		Agriculture, forestry, etc.	Mining and quarrying	…	Services					
Natural inputs	Mineral and energy resource Water …	Extraction of Natural inputs **(B)**								Total use by natural inputs **(TUNI)**
Products	Agriculture, forestry, etc. Ores and minerals; etc. … Services	Intermediate consumption by product and by Industry **(E)**				Exports by product **(H)**	Final consumption by product and by category **(F)**	Gross capital formation/Accu mulation **(G)**		Total use by product **(TUP)**
Residuals	Solid waste Wastewater …	Collection and treatment of waste and other residuals **(N)**				Residuals sent to the Rest of the World **(P)**		Accumulation of waste in controlled landfilled **(O)**	Residual flows direct to the enviornment **(Q)**	Total use by residuals **(TUR)**
Total Use										

Empty by definition   Blank cells may contain relevant flows

13.13 As indicated in Chapter 2, the part of the PSUTs related to products provides the physical measurements of the flows that are recorded in the monetary SUTs presented in previous chapters. Many of the flows of products recorded in monetary terms relate to the use of products originating from the environment, for example, the manufacture of wood products, or to activities and expenditures associated with the environment, for example, environmental protection expenditure. It should be noted that the monetary and physical SUTs of the SEEA are compiled for either a specific underlying environmental theme or for whole suite of environmental themes. This means that the industry and product breakdown shown in the tables explicitly identify relevant industries/products for the environmental theme of interest. For example, when compiling SUTs for water in physical and monetary units, the industry breakdown will explicitly identify the industry distributing water, the industry treating wastewater and the major industries abstracting and using water. Similarly on the product side, the relevant products for water will be explicitly identified. The monetary

[7] Based on Table 3.2.1 of the SEEA-2012 Central Framework

and physical tables are therefore compiled for the same breakdown, and indicators can be calculated using consistent physical and monetary information.

(a) Natural inputs, products and residuals

13.14 The starting point to understand the PSUTs is to have a clear understanding of the terminology used for the construction of such tables. The definition of products is the same as that used within the National Accounts, namely products (goods and services) are the result of production. They are exchanged and used for various purposes; as inputs in the production of other goods and services, as final consumption or for investment (2008 SNA, paragraph 2.36). Natural inputs and residuals are not within the National Accounts boundaries. They are defined in the SEEA Central Framework in order to account for the physical inter-relations between the national economy and the natural environment.

13.15 *Natural inputs* are all physical inputs that are moved from their location in the environment as a part of the economic process or are directly used in production. They include, for example, natural timber resources and water resources that are extracted from the environment. Natural inputs should not be confused with products. In the case of mining activities, for example, natural inputs, such as gross ore, are input flows to the mining industry. They become products once they become an output by the mining industry, such as processed ore and concentrates.

13.16 The three broad classes of natural inputs are distinguished in the SEEA and listed below. Table 13.2 provides the classes of natural input as defined by the SEEA Central Framework.

i. *Natural resource inputs* are material resource extraction from the natural environment. They include materials actually used in production as well as *natural resource residuals* which are natural resource inputs that do not subsequently become products but instead immediately return to the environment.

ii. *Natural inputs of energy from renewable sources*, such as solar, hydro energy captured by economic units.

iii. *Other natural inputs* such as inputs from soil (for example, soil nutrients) and inputs from air (for example, oxygen taken up in combustion processes, CO_2 absorbed by cultivated plants).

Table 13.2 Classes of natural input

1	**Natural resource inputs**
1.1	Extraction used in production
1.1.1	Mineral and energy resources
1.1.1.1	Oil resources
1.1.1.2	Natural gas resources
1.1.1.3	Coal and peat resources
1.1.1.4	Non-metallic mineral resources (excl. coal & peat resources)
1.1.1.5	Metallic mineral resources
1.1.2	Soil resources (excavated)
1.1.3	Natural timber resources
1.1.4	Natural aquatic resources
1.1.5	Other natural biological resources (excluding timber and aquatic resources)
1.1.6	Water resources
1.1.6.1	Surface water
1.1.6.2	Groundwater
1.1.6.3	Soil water
1.2	Natural resource residuals
2	**Inputs of energy from renewable sources**
2.1	Solar
2.2	Hydro
2.3	Wind
2.4	Wave and tidal
2.5	Geothermal
2.6	Other electricity and heat
3	**Other natural inputs**
3.1	Inputs from soil
3.1.1	Soil nutrients
3.1.2	Soil carbon
3.1.3	Other inputs from soil
3.2	Inputs from air
3.2.1	Nitrogen
3.2.2	Oxygen
3.2.3	Carbon dioxide
3.2.4	Other inputs from air
3.3	Other natural inputs n.e.c.

13.17 *Residuals* refer to flows of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by the economy and households to the environment (for example, emissions to air and water) through processes of production, consumption and accumulation. The SEEA Central Framework distinguishes the following groups of residuals:

a) **Solid waste** covers discarded materials that are no longer required by the owner or user. Solid waste includes materials that are in a solid or liquid state but excludes wastewater and small particulate matter released into the atmosphere.

b) **Wastewater** is discarded water that is no longer required by the owner or user. Water discharged into drains or sewers, water received by water treatment plants and water discharged direct to the environment is all considered wastewater. Wastewater includes return flows of water which are flows of water direct to the environment, with or without treatment. All water is included regardless of the quality of the water, including returns from hydro-electric power generators.

c) **Emissions** are substances released to the environment by establishments and households as a result of production, consumption and accumulation processes. Generally, emissions are analysed by type of receiving environment (i.e. air, water and soil) and by type of substance.

- **Emissions to air** are gaseous and particulate substances released to the atmosphere by establishments and households as a result of production, consumption and accumulation processes.
- **Emissions to water** are substances released to water resources by establishments and households as a result of production, consumption and accumulation processes.
- **Emissions to soil** are substances released to the soil by establishments and households as a result of production, consumption and accumulation processes.

d) **Dissipative uses of products** covers products that are deliberately released to the environment as part of production processes. For example, fertilisers and pesticides are deliberately spread on soil and plants as part of agricultural and forestry practice, and in certain countries salt is spread on roads to improve road conditions for drivers.

e) **Dissipative losses** are material residues that are an indirect result of production and consumption activity. Examples include particulate abrasion from road surfaces, abrasion residues from car brakes and tyres, and zinc from rain collection systems.

f) **Natural resource residuals** are natural resource inputs that do not subsequently become incorporated into production processes and instead immediately return to the environment. Natural resource residuals are recorded as a generation of residuals by natural resource extracting industries and as a flow of residuals directly to the environment. Thus these flows do not become products; thus they do not enter the economy. An example of natural resource residual is cooling water which is abstracted to cool the plant such as electricity generation plants, chemical manufacturing plants, etc. Once the water cools the plant, it is returned generally into the same place in the environment. It is important to monitor these residuals because of their environmental impact.

13.18 Table 13.3 provides examples of the types of materials/components that are commonly included in the different groups of residuals for analytical purposes depending on the focus of the analysis whether it is on the purpose behind the discard (for example, solid waste), the destination of the substance (for example, emissions to air), or the processes leading to the emission (for example, dissipative losses).

Table 13.3 Typical components for groups of residuals[8]

Group	Typical components
Solid waste (includes recovered materials)*	Chemical and healthcare waste, Radioactive waste, Metallic waste, Other recyclables, Discarded equipment and vehicles, Animal and vegetal wastes, Mixed residential and commercial waste, Mineral wastes and soil, Combustion wastes, Other wastes
Wastewater*	Water for treatment and disposal, Return flows, Reused water
Emissions to air	Carbon Dioxide, Methane, Dinotrogen oxide, Nitrous oxides, Hydrofluorocarbons, Perfluorocarbons, Sulphur Hexaflouride, Carbon monoxide, Non-methane volatile organic compounds, Sulphur dioxide, Ammonia, Heavy metals, Persistent organic pollutants, Particulates (e.g. PM10, dust)
Emissions to water	Nitrogen compounds, Phosphorous compounds, Heavy metals, Other substances and (organic) compounds
Emissions to soil	Leaks from pipelines, chemical spills
Residuals from dissipative use of products	Unabsorbed nutrients from fertilisers, salt spread on roads
Dissipative losses	Abrasion (tyres/brakes), Erosion/corrosion of infrastructure (roads, etc)
Natural resource residuals	Mining overburden, felling residues, discarded catch

* This list of typical components for groups of residuals can also be applied to certain flows defined as products.

13.19 Another way in which residuals are considered is in terms of losses. This is of particular interest in the analysis of physical flows of energy and water. Four types of losses are identified according to the stage at which they occur through the production process:

(a) Losses during extraction are losses that occur during extraction of a natural resource before there is any further processing, treatment or transportation of the extracted natural resource. Losses during extraction exclude natural resources that are re-injected into the deposit from which they were extracted.

(b) Losses during distribution are losses that occur between a point of abstraction, extraction or supply and a point of use.

(c) Losses during storage are losses of energy products and materials held in inventories. They include evaporation, leakages of fuels (measured in mass or volume units), wastage and accidental damage. Excluded from the scope of inventories are non-produced assets even though they might be considered as being stored.

(d) Losses during transformation refer to the energy lost, for example in the form of heat, during the transformation of one energy product into another energy product.

(b) Accounting and balancing identities

13.20 As explained in Chapter 1 and 2, SUTs are linked together through various accounting and balancing identities. PSUTs, which represent the environmental extensions of the SNA-based SUTs in physical terms, also contain a range of important accounting and balancing identities. The starting point for the balancing of the PSUTs is the supply and use of products identity, which recognizes that, within the economy, the amount of a product supplied must be equal in physical units to that used within the economy or exported. Thus

Total supply of products (TSP) = Total use of products (TUP)

[8] Table 3.2.4 of the SEEA-2012 Central Framework

where

Total supply of products (TSP) = Domestic production (C) + imports (D)

Total use of products (TUP) = Intermediate consumption (E) + household final consumption (F) + gross capital formation (G) + exports (H)

In parentheses, reference is made to specific parts of the PSUTs illustrated in Figure 13.1.

13.21 In the PSUTs, the supply and use of products identity also holds in physical units for flows of natural inputs and residuals:

Total supply of natural inputs (TSNI) = Total use of natural inputs (TUNI)

Total supply of residuals (TSR) = Total use of residuals (TUR)

13.22 These identities also relate to the fundamental physical law underpinning the PSUTs, namely the conservation of mass and the conservation of energy. These physical identities imply the existence of material and energy balances for all individual materials within the system. It can be shown that, over an accounting period, the following is true:

Flows of materials into an economy must equal the flows of materials out of an economy plus any net additions to stock in the economy.

This is known as the I-O identity.

13.23 The *net additions to the stock* comprise additions and deductions over an accounting period in:

(a) gross capital formation in investment goods and inventories of products;

(b) physical flows of residuals to and from the rest of the world;

(c) residuals recovered from the environment (for example, oil collected following an oil spill); and

(d) the accumulation of solid waste in controlled landfill sites (excluding emissions from these sites).

13.24 Thus, the I-O identity describing the physical flows between an economy and the environment

Materials into the economy = *Materials out of the economy* + *Net additions to stock in the economy*

where

Materials into the economy = Natural inputs (A) + imports (D) + residuals received from the rest of the world (L) + residuals recovered from the environment (M)

Materials out of the economy = Residual flows to the environment (Q) + exports (H) + residuals sent to the rest of the world (P)

Net additions to stock in the economy = Gross capital formation (G) + accumulation in controlled landfill sites (O) - residuals from produced assets and controlled landfill sites (K)

13.25 This identity can be applied at the level of an entire economy and also at the level of an individual industry or household, in which case the notion of imports and exports refer to flows to and from other industries in the economy as well as to and from the rest of the world.

13.26 Natural resource residuals are recorded in the PSUTs, first as a supply from the environment and use of natural inputs by the economy (part (A) and (B) in Table 13.1) and then as returning flow to the environment (part (I) and (Q) in Table 13.1). Thus, unlike natural inputs, they do not become products and are not recorded in the block of rows for products in the PSUTs.

13.27 PSUTs can be compiled for a single specific environmental domain, such as water or energy but also for a larger set of domains. In either case, these accounting identities and a common set of accounting principles can be applied. In particular, clear boundaries in respect of the point of transition between the environment and the economy must be established.

(c) Recording principles of physical flow accounting

13.28 When compiling PSUTs there are specific recording principles that should be followed in particular regarding the gross and net recording of physical flows, the treatment of international flows of goods, and the treatment of goods for processing. These are described in turn below.

Gross and net recording of physical flows

13.29 PSUTs record flows between the environment and the economy, flows between different economic units, and, where applicable, flows within economic units. This recording of flows is referred to in the SEEA as 'gross recording'. The main advantage of a gross recording approach is that a full reconciliation of all flows at all levels of the SUTs, for example, by industry and by product, can be made.

13.30 However, recording all of these flows may hide some key relationships; hence, for analytical purposes, alternative consolidations and aggregations of flows have been developed. These alternative approaches are often referred to as 'net recordings', although the nature of the consolidations and aggregations varies and there is therefore no single application of net recording.

13.31 One example of when gross and net recording is that of PSUTs for energy. When PSUTs for energy are compiled on a gross basis, they show all flows of energy between economic units. Some of these are flows of energy products to energy producers which transform one energy product into a different energy product (for example, coal is burned to generate electricity in electric power plants) while other flows are destined to end-users (the case, for example, of delivery of electricity to households). PSUTs on the basis of net recording exclude non-consumptive energy use which is the transformation of one energy product into another product thus allowing for a greater focus on the end use of energy.

13.32 Generally, care should be taken when using and interpreting the terms "gross" and "net" and clear definitions of inclusions and exclusions should be sought and provided.

Treatment of international flows

13.33 The treatment of physical flows to and from the rest of the world needs a careful articulation. In line with the SNA, the underlying principle applied in the SEEA is that relevant flows are attributed to the country of residence of the producing or consuming unit. This differs from the territory principle of recording, which is applied in a number of statistical domains such as energy statistics and energy balances. The territory principle attributes the relevant flows to the country in which the producing or consuming unit is located at the time of the flow.

13.34 In accordance with both the 2008 SNA and the BPM 6, the residence of an institutional unit is determined by the economic territory with which it has the strongest connection (2008 SNA, paragraphs 4.10–4.15). In the majority of situations, the concepts of territory and residence are closely aligned. However, there are cases that require careful considerations in order to choose the appropriate recording. These include: international transport, tourist activity and natural resource inputs.

International transport

13.35 To ensure consistency with other parts of the accounts, the appropriate recording of international transport activity is centred on the residence of the operator of the transport equipment which is usually the location of the headquarters of the transport operator. Therefore regardless of the distances travelled, the number of places of operation, whether the transport service is supplied to non-residents or whether the transport service is between locations in different countries, all revenues, inputs (including fuel, wherever purchased) and emissions are attributed to the country of residence of the operator.

13.36 Special attention must be made to the bunkering of fuel, primarily for ships and aircrafts. The recording of bunkering of fuel is a transaction between the operator of the transport service and the owner of the fuel. Therefore, if the owner of the fuel is a resident in the rest of the world, the refuelling of a ship operated by a resident unit is considered an import independently where the refuelling takes place. In fact, there may be in practice a variety of special arrangements whereby a unit resident in a country stores fuel in another country while still retaining ownership of the fuel itself. Following the principles of the SNA and the BPM, the location of the fuel is not relevant rather the ownership of the fuel. Thus, if country A established a bunker in country B and transports fuel to that country in order to refuel a ship that it operates, then the fuel is considered to have remained in the ownership of country A and no export of fuel to country B is recorded. Thus, the fuel stored in country B is not necessarily all attributable to country B. This treatment is likely to differ from the recording utilized in international trade statistics; and adjustments to source data may therefore be needed to align the recording to this treatment.

Tourist activity

13.37 The recording of tourist activity in the PSUTs is consistent with the recording of international transport activity in that the concept of residence is central. Tourists include all those travelling outside their country of residence, including short-term students (i.e., those studying abroad for less than 12 months), people travelling for medical reasons and those travelling for business or pleasure. The consumption activity of a tourist travelling abroad is attributed to the tourist's country of residence and not to the location of the tourist when the consumption is undertaken. Thus, purchases in a country by a tourist are recorded as an export by the country visited and as an import of the country of residence of the tourist. Solid waste generated in the country by tourists should generally be attributed to local enterprises (for example, hotels and restaurants). Emissions from local transport used by tourists (for example, taxis, minibuses, nationally operated rental cars, etc.) are attributed to the local transport company. In addition, similarly to case of international transport, emissions from aircraft and other long-distance transport equipment are attributed to the country of residence of the operator. In neither case are the emissions attributed to the tourist. Emissions from cars are also attributed to the country of residence of the operator (in this case, the driver of the car), whether the car is owned by the driver or hired from a car rental firm. (SEEA-2012 Central Framework, paragraphs 3.127-3.129).

13.38 It should be mentioned however that analyses of the impact of tourism on the economy or on the environment could be done by expanding exists flows to identify the part due to the tourism activity. This is done in the Tourism Satellite Accounts (United Nations *et al*. 2010).

Natural resource inputs

13.39 Natural resource inputs are physical inputs to the economy from the environment. In line with the 2008 SNA, natural resources that are legally owned by non-residents are considered to be owned by a notional resident unit and the non-resident legal owner is shown as the financial owner of the notional resident unit. Consequently, the extraction of natural resource inputs must occur within a country's economic territory by economic units that are resident in the country.

13.40 The major exception to this kind of treatment occurs with respect to natural aquatic resources. Following accounting conventions, the harvest of aquatic resources is allocated to the residence of the operator of the vessel undertaking the harvesting rather than to the location of the resources. Thus, the amount of natural resource input that should be recorded for a country is equal to the quantity of aquatic resources caught by vessels whose operator is resident in that country, regardless of where the resources are caught. Natural resource inputs are not recorded for the harvest of aquatic resources by vessels operated by non-residents in national waters and the exports are also not recorded in this situation. In the accounts of the country to which the non-resident operator is connected, there should be entries for natural resource inputs for aquatic resources caught in non-national waters but no reduction in national aquatic resources in the asset accounts for this harvest.

Treatment of goods for processing

13.41 It is increasingly common for goods from one country to be sent to another country for further processing before being (a) returned to the original country, (b) sold in the processing country or (c) sent to other countries. In situations where the unprocessed goods are sold to a processor in a second country, there are no particular recording issues. However, in situations where the processing is undertaken on a fee-for-service basis and there is no change of ownership of the goods (i.e., the ownership remains with the original country), the financial flows are unlikely to relate directly to the physical flows of goods being processed. Further details are covered in Chapter 8.

13.42 From a monetary accounts perspective, the enterprise processing the goods assumes no risk associated with the eventual marketing of the products and the value of the output of the processor is the fee agreed for the processing. This fee is recorded as an export of a service to the first country. A consequence of this treatment is that the recorded pattern of inputs for the enterprise that is processing goods on behalf of another unit is quite different from the pattern of inputs when the enterprise is manufacturing similar goods on its own account.

13.43 Although this treatment is in line with that of the SNA and provides the most appropriate recording of the monetary flows, it does not correspond to the physical flows of goods. Consequently, a different treatment of goods for processing is recommended for PSUTs. This entails recording the physical flows of goods, both as they enter into the country of the processing unit and as they leave that country. Tracking the physical flows in this way enables a clearer reconciliation of all physical flows in the economy and also provides a physical link to the recording of the environmental effects of the processing activity in the country in which the processing is being undertaken, including, for example, emissions to air. The same considerations apply to flows of goods for repair and merchanting.

13.44 Depending on the products and industries that are of interest, reconciliation entries may be required if accounts combining physical and monetary data are to be compiled.

C. Compilation of PSUTs

13.45 The SEEA Central Framework provides the primary source for definitions, classifications and methods to be employed in developing the PSUTs. This section covers the compilation steps for PSUTs and how they fit in the overall process based on the GBSPM provided in Chapter 3 of this Handbook. This section also covers possible data sources used for the compilation of PSUTs. It should be noted there is only a limited number of countries that produce the full set of PSUTs and in turn, well-established practices across many countries do not exist. Thus this Chapter provides a general approach but national practices will have to take into account national circumstances such as data availability, resources, systems, user needs, etc. as described in Chapters 3 and 4 of this Handbook.

13.46 Generally, compilers of PSUTs are not responsible for primary data collection such as conducting surveys and censuses. Rather the role of compilers is to collate and integrate information from a range of sources to provide a coherent and consistent picture of the theme or topic that is the focus of the accounts and to ensure the PSUTs are produced alongside the corresponding SUTs and IOTs as well integrated with the "core" National Accounts. An important role of the compiler is therefore to understand the various sources of information including their scope, coverage, item definition, etc. and adjust them if necessary to fit them into the accounting framework of the SEEA.

13.47 As the source data for PSUTs come from a variety of different sources, an action plan is needed to be developed in order to collect all the necessary information to compile the PSUTs and to include activities to be developed by different stakeholders, including the different department within the National Statistics Office and other relevant agencies in charge of natural resources management such as the Ministry of Environment. This, in turn, requires institutional arrangements to clarify roles and responsibilities of each stakeholder and to facilitate the sharing of responsibilities and data among the different stakeholders.

1. List of individual components of SEEA physical flow accounts

13.48 Section B provides a comprehensive examination of the systems of physical flow accounts. In practice, the flexible and modular approach of the SEEA implementation strategy recommends that the compilation of the SEEA accounts should start with individual component accounts that have been identified as priorities. Table 13.4 provides a list of individual components of a full set of physical flow accounts in the SEEA Central Framework.

Table 13.4 List of individual components of SEEA PSUTs

PSUTs	Topics covered (reference to the SEEA-2012 Central Framework (CF) paragraph)

Full set of SUTs for materials	All resources and materials (energy, water, air emissions, water emissions, solid waste) (`CF 3.45)
Economy-wide material flow accounts (MFA)	Supply and consumption of energy; air emissions, water emissions, and solid waste (CF 3.279)
PSUTs for water	Supply (precipitation) and consumption of water (CF 3.186)
PSUTs for energy	Supply and consumption of energy (CF 3.140)
Air emissions accounts	Air emissions (CO2, pollutants) (CF 3.233)
Water emissions accounts	Water emissions (CF 3.257)
Waste accounts	Solid wastes (CF 3.268)

2. Data sources

13.49 In practice, the methods used in compiling PSUTs (whether for individual components or a full set of components) require the use of a wide range of data sources and can be constrained in large part by the nature of the data available. Using existing data sources as much as possible is therefore fundamental when building PSUTs. All available sources should be reviewed for possible use in PSUTs with or without adjustments to fit within the conceptual framework. This form the basis for the improvement of existing data source or even the development of new sources to fill the gaps. Table 13.5 identified the common national data sources for each SEEA component accounts and the corresponding PSUTs.

Table 13.5 Common national data sources and links to SEEA component accounts

Data source	SEEA component accounts and corresponding PSUTs
Environment statistics	
Emissions inventory (Pollutant release and transfer registry)	• Air emissions accounts • Water emissions account
Water statistics	• Water emissions account • Water PSUTs • Water asset accounts
Energy statistics	• Air emissions • Energy PSUTs • Mineral and energy asset accounts
Waste statistics	• Waste accounts
Other environment statistics	• Land cover accounts • Forest accounts
Economic statistics	
National accounts	• Energy PSUTs • Mineral and energy asset accounts • Environmental protection expenditures • Environmental taxes and subsidies • Environmental goods and services sector
International trade statistics	• Material flow accounts
Business statistics	• Environmental protection expenditures • Environmental goods and services sector
Government finance statistics	• Environmental protection expenditures

	• Environmental taxes and subsidies
Other (for example, administrative data)	• Mineral and energy asset accounts

13.50 A non-exhaustive list of material that is relevant for the compilation for each individual component of SEEA physical flow accounts and the corresponding PSUTs is provided in Box 13.1.

Box 13.1 Selected reference material

Reference material on several topics:
United Nations Website: https://unstats.un.org/unsd/envaccounting/default.asp
Eurostat Website: http://ec.europa.eu/eurostat/web/environment/methodology

Material flows
- Eurostat guidance developed for its environmental-economic accounting programme of work on material flow accounting.
- The forthcoming SEEA Technical Note on Material Flow Accounting.

Water
- Guidelines for the Compilation of Water Accounts and Statistics, prepared by UNSD, 2014.
- SEEA Water, 2012.
- The forthcoming SEEA Technical Note on Water Accounting.
- International Recommendations for Water Statistics, 2012.
- FAO guidance on collecting data in AquaStat – see http://www.fao.org/nr/water/aquastat/main/index.stm
- Eurostat guidance developed for its environmental-economic accounting programme of work on water-flow data.

Energy
- The forthcoming SEEA Energy.
- The forthcoming SEEA Technical Note on Energy Accounting.
- The 2014 International Recommendations for Energy Statistics.
- International Energy Agency guidance on collecting energy statistics.
- Eurostat guidance from its environmental-economic accounting programme for energy flow data.

Air emissions
- The forthcoming SEEA Technical Note on Air Emission Accounting
- IPCC guidance on the measurement of emissions in the UNFCCC;
- FAO guidance from its programme of work on measuring greenhouse gas emissions in agriculture;
- Eurostat guidance from its environmental-economic accounting programme of work on air emissions flow data.

Agricultural products and related environmental flows
- The forthcoming SEEA Agriculture, Forestry and Fisheries.
- Guidance in the FAOSTAT website.
- FAO handbooks and guidance on the collection of national agricultural production data, including the ten-year agricultural census.
- Global Strategy to Improve Agricultural and Rural Statistics.
- Eurostat information on the collection of agricultural statistics.
- Guidance on the compilation of the European Economic Accounts for Agriculture and Forestry by Eurostat.

Forestry products and related environmental flows
- The forthcoming SEEA Agriculture, Forestry and Fisheries.
- Guidance for the FAO five-year global Forest Resource Assessment.
- Guidance for the Joint Forest Sector Questionnaire.
- The 2002 European Framework for Integrated Environmental and Economic Accounting for Forests.

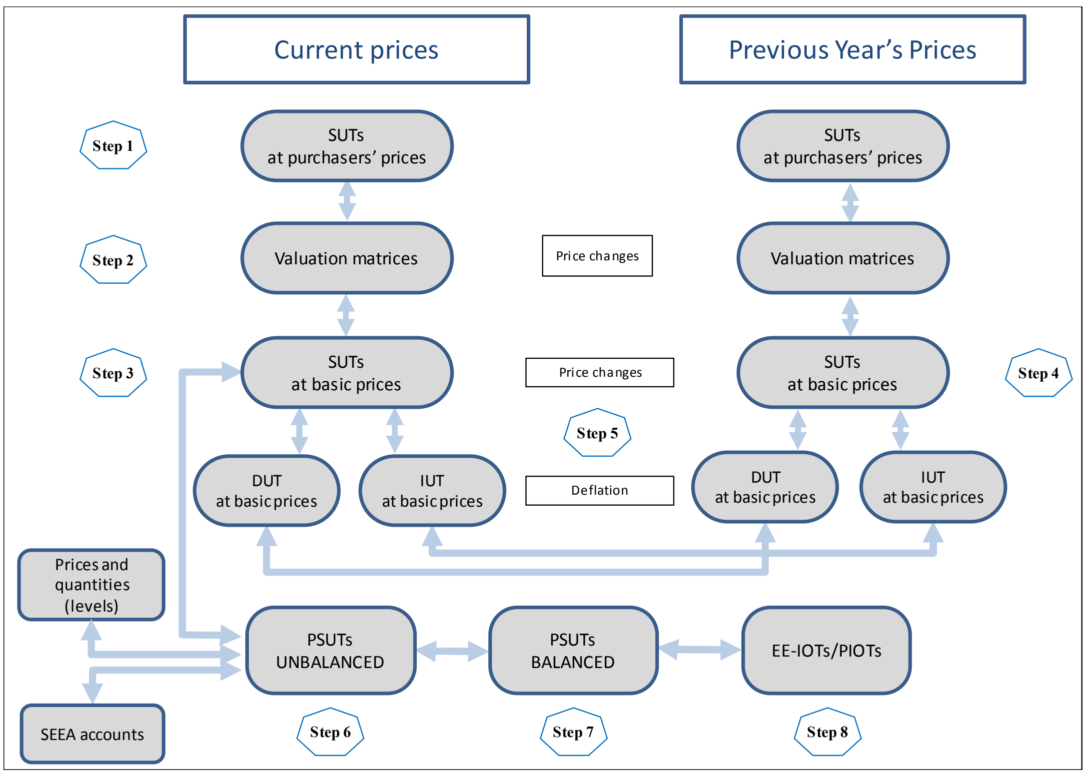
Fisheries products and related environmental flows
- The forthcoming SEEA Agriculture, Forestry and Fisheries.

- FAO guidance on collecting fisheries statistics in FishStat - http://www.fao.org/fishery/statistics/software/fishstatj/en
- The 2004 FAO handbook Integrated Environmental and Economic Accounting for Fisheries.

3. Overall strategy for the compilation of PSUTs

13.51 Figure 13.2 shows an overview of the general compilation process. Please note, Steps 6, 7 and 8 in Figure 13.2 link to, and fit in with Box G in Figure 3.4 of Chapter 3 showing the compilation schematic for SUTs and IOTs

Figure 13.2 Overview of the compilation schematic for PSUTs



13.52 Wherever possible, direct observed quantity data on natural input, product and residual flows is recommended to be used for the compilation of PSUTs. In the ideal scenario, the data are available for all parts of the SUTs and PSUTs are initially compiled unbalanced and are subsequently balanced simultaneously (or sequentially, if appropriate). In this situation, Step 5 and Step 7 in Figure 13.2 would be merged replacing the existing Step 7.

13.53 However, in practice, countries that compile SUTs and PSUTs often start with balanced SUTs. In addition, since exhaustive source data for PSUTs are generally not available (and often not compiled within the National Accounts), the SUTs compiled within the National Accounts are converted into PSUTs by applying price and quantity data as an initial estimate of PSUTs. In this situation, Figure 13.2 reflects practical considerations where Step 5 is separate from Step 7. Nonetheless, the process of compiling unbalanced PSUTs and balancing PSUTs allows for a feedback loop to the SUTs, irrespective whether the SUTs and PSUTs are balanced simultaneously (or sequentially, if appropriate).

Step 1 to Step 5

13.54 Please refer to earlier chapters for the compilation steps for the SUTs (i.e. step 1 to step 5 in Figure 13.3).

- ***Step 1: Compilation of SUTs at purchasers' price***. See Chapters 3, 4, 5 and 6.
- ***Step 2: Compilation of valuation matrices***. See Chapter 7.
- ***Step 3: Compilation of SUTs at basic prices***. See Chapter 7.
- ***Step 4: Compilation of DUTs, IUTs and SUTs at basic prices and in volume terms***. See Chapters 8 and 9.
- ***Step 5: Balance the SUTs simultaneously (or sequentially) in current prices and in volume terms***: See Chapter 11.

Step 6: Conversion of SUTs at basic prices to PSUTs

13.55 The SUTs are converted into PSUTs using information on the level of prices and data on quantities from several sources. This step generates an unbalanced set of PSUTs. Variations of this approach as presented in the case studies later in this Chapter. Information on prices can be derived from several sources. In the ideal case, business statistics provide data on output and intermediate use both in monetary and physical terms. The derivation of prices to be applied to the SUTs is straightforward. However, often these data have incomplete coverage or are very limited as well as depending upon the level of aggregation, there may be large price variations per physical unit within a product group.

13.56 If the quantities are available from basic statistics, they can be applied directly without using prices. Furthermore, the price and quantity details can provide an effective feedback loop regarding the quality of the current price values in the SUTs.

13.57 These initial estimates can be overruled if specific information for certain industries or expenditure categories is available. Examples of such sources include business surveys and household budget surveys. For example, for agriculture, food processing industries and energy industries, generally a lot of physical data and price levels are available.

13.58 A specific source for household final consumption is scanner data provided by the retail industry (for example, supermarkets). Applying the price levels derived from this source to household final consumption valued at purchasers' prices results is an alternative, and probably, a higher quality estimate of physical data.

13.59 For some "outputs", neither price levels nor quantity data can be usefully applied, for example construction, for which an 'input' method is applied, meaning that output in physical terms by definition equals the sum of inputs in physical terms.

13.60 In addition to physical data for supply and use of product, the physical flows of natural resource and residual not having a monetary value have to be included. Mainly these flows concern the flows between the economy and the environment like extraction from natural sources, air emissions, etc. Also within an economy, the flows without a monetary value can exist, for example, waste. Some of these physical flows form part of accumulation in the economy.

13.61 The physical Supply Table records natural input, product and residual flows that occur due to a decrease in stock like, for example, waste that arises from demolishing a building. Another example includes the CO2 emissions that are released from landfills. On the basis of the type of waste that is being produced, a distinction is made between waste that results from the production process and waste that results from discarding capital. On the other hand, the Use Table records addition to stock and dumping of waste in landfills. Additions to stock are not always easy to estimate and are often part of a balancing entry, like the addition of buildings and infrastructure.

Step 7: Balancing the PSUTs

13.62 Compiling PSUTs as described above may result with unbalanced PSUTs. This may reflect, for example, data from different sources, insufficient matching of prices and quantities or addressing implausible results. Additional adjustments are then necessary in order to generate balanced PSUTs.

13.63 In the balancing of PSUTs, the following identities covering the physical flows should be checked:

a) for each industry, the amount of material/resource that goes in equals the amount of material/resource that comes out; and

b) for each product, the amount that is supplied equals the amount that is used.

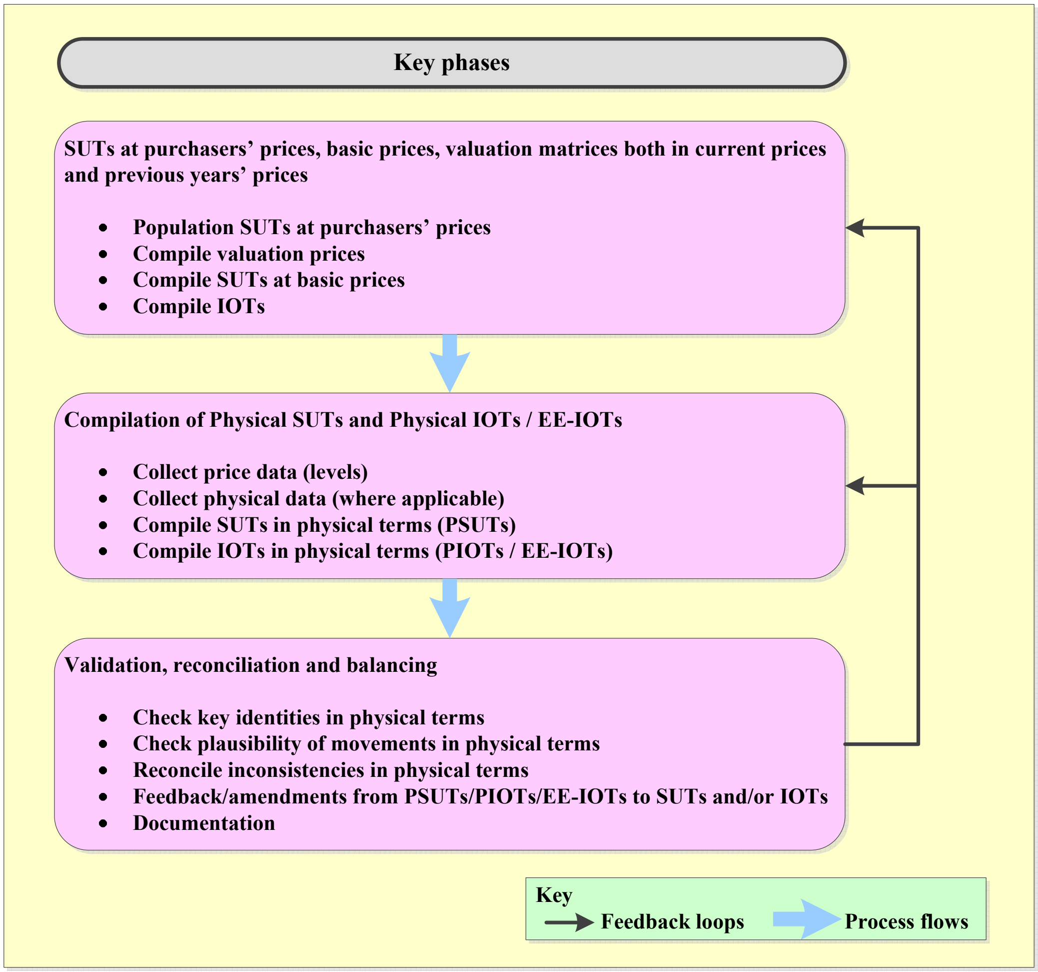
13.64 It should be mentioned that the balancing of PSUTs may often identify inconsistencies in the monetary SUTs thus providing a feedback loop into the monetary SUTs. For this reason, it is often recommended to balance the SUTs simultaneously in monetary (in current prices and in volume terms) and physical units. In this case, Step 5 and Step 7 would be merged into a new Step 7, whereby SUTs and PSUTs would be balanced at the same time.

Step 8: Transformation of PSUTs to EE-IOT or PIOTs

13.65 In general, once balanced PSUTs are available, they can be transformed into EE-IOTs or PIOTs using the same assumptions and techniques that are used to transform monetary SUTs to IOTs (Industry by Industry or Product by Product).

13.66 When the compilation of PSUTs is done simultaneously with the monetary SUTs both in current prices and in volume terms, an extensive set of feedback loops could be used to improve the monetary SUTs. Figure 13.3 shows the key feedback loops in producing and balancing the PSUTs and EE-IOTs.

Figure 13.3 Key feedback loops in producing and balancing the PSUTs and EE-IOTs



13.67 In practice, the PSUTs will be compiled using final balanced SUTs as a starting point. The option for feedback to the SUTs is then limited to the year or periods in question until the next revision cycle but it is still very useful indeed. Any inconsistencies detected in balancing the PSUTs can be used as additional information to inform the compilation and balancing of the next revision of the affected SUTs. In some countries, this may have to wait for the next benchmark revision year.

D. Environmentally-Extended Input-Output Tables

13.68 The EE-IOTs are integrated datasets that combine information from standard monetary IOTs and information on environmental flows, such as flows of natural inputs and residuals which are measured in physical units. This section focuses on two types of EE-IOTs, namely the SR-IOTs and the Hybrid IOTs. Reference to the Multi-Regional Input-Output Tables (MR-IOTs) will be made in this Chapter as well as expanded in Chapter 17. The intent of this section is to introduce the main types of EE-IOTs, to show key parts of their compilation, and to discuss some of the measurement issues associated with them.

1. SR-IOTs

13.69 The SR-IOTs consist of an extension of monetary IOTs to include environmental flows in physical units. These tables are called 'single region' as they are compiled for a (single) territory (which can be either a country or a group of countries) and where the Rest of the World include all other territories/countries. This is in contrast with MR-IOTs, where the tables consist of sets of IOTs for more than one country and are combined in such a way that intra-country relationships are explicitly identified. Chapter 17 of this Handbook elaborates on MR-IOTs.

13.70 Table 13.6 shows a simplified version of SR-IOTs. It gives a detailed description of domestic production processes and transactions within a single country (or region). An IOT is usually structured as a Product by Product IOTs or Industry by Industry IOTs. Table 13.6 shows an Industry by Industry table of j industries. The rows show the outputs of an industry while the columns provide information about the inputs required in the production process of an industry.

Table 13.6 A Single Region Input-Output Table (SR-IOT) with environmental data

Data in monetary terms								
		Industries			Final use			Total output
		1	…	*j*	Final consumption	Gross capital formation	Exports	
Industries	1							
	…		Z		C	f	e	$q+m$
	j							
Value added			v					
Total inputs			q		c_{tot}	f_{tot}	e_{tot}	

Data in physical (non-monetary) terms								
Natural inputs / residuals			r					r_{tot}

Notations:

- Z: Matrix of intermediate consumption (j by j matrix)
- c: Final consumption
- f: Gross capital formation
- e: Exports
- v: Value added
- q: outputs of domestic industries
- m: denotes the use of imported goods and services
- r: Environmental flows (i.e. natural inputs or residual flows) taken from SEEA
- subscript j denotes industry
- subscript tot denotes totals.

13.71 The output of the industries is the sum of intermediate consumption (Z) (which is a j by j matrix) and final use categories such as final consumption (c), gross capital formation (f) (including changes in inventories), and exports (e). Note that for all these categories this is the sum of domestically produced goods and services and imported products. i.e. $Z = Z_d + Z_m$, $c = c_d + c_m$, $f = f_d + f_m$, $e = e_d + e_m$ (subscript d denotes the use of domestically produced inputs and m the use of imported goods and services). The inputs for each domestic industry comprise the intermediate inputs (Z) and value added categories (v). Since the inputs into an industry must equal the outputs, the column sums are thus equal to the outputs (q) of domestic industries while the row sums are equal to domestic output plus the imported products ($q + m$). All the variables with the subscript tot are vectors that show the totals for those respective row or columns.

13.72 The intermediate input matrix, Z, of IOTs is therefore a square matrix (i.e. it contains the same number of rows and columns).

13.73 The IOT is then augmented with environmental data by industry (denoted by the vector r in Table 13.6) which may be taken from the relevant SEEA accounts. In most applications these data relate to flows of natural inputs and residuals. The conceptual foundation for environmental extensions to SNA based IOTs, represented by the EE-IOTs is described in the *System of Environmental-Economic Accounting 2012 - Applications and Extensions* (United Nations *et al*. 2017).

13.74 Having PSUTs available greatly facilitate the compilation of EE-IOTs as the environmental information is already organized into an accounting framework consistent with the framework of the IOTs in terms of concepts, definitions and classifications. However, extending the monetary IOTs with available environmental statistics (adjusted when necessary, for the concepts and classifications of the SEEA) may be a starting point toward the compilation of environmental-economic accounts in countries starting with the implementation of the SEEA.

13.75 IOTs can be constructed as Industry by Industry IOTs or Product by Product IOTs. When a Product by Product based structure is used for IOTs, adjustments to the environmental data are necessary since data on environmental flows are most commonly collected and classified by industry. The adjustment of environmental flow data in terms of industries and products will also arise when SUTs form the basis for the representation of flows within the economy. SUTs are generally structured with columns representing industries and rows representing products with substantially more products than industries. Examples of EE- SUTs are emerging in the literature and may be beneficial for some analysis since they provide additional detail by product.

2. Hybrid IOTs

13.76 Hybrid IOTs consists in IOTs augmented with data in physical units for the input and output of selected industries. Table 13.7 shows a hybrid IOT where data for the industry J (shaded area in Table 13.7) are also measured in physical terms. Many studies, for example, have analysed energy using IOTs where the output of the energy industries is measured in gigajoules or another energy unit. The source data from this type of data could, for example, be from the PSUTs for energy. Note that because the columns contain a mix of entries in different units (some monetary and some physical), it is not possible to aggregate entries within a column. However, summation across each row is possible.

Table 13.7 A Single Region Input-Output Table (SR-IOT) in hybrid units

		Industries	Final use			Total output
		1 … *J*	Final consumption	Gross capital formation	Exports	
Industries	*1* … *J*	Z	C	F	e	$q+m$
	J (physical units)	$z_{phisical}$				z_{tot}
Value added		v				

13.77 For environmental analysis, it remains relevant to extend the hybrid IOTs using information on flows of natural inputs and residuals as in the case of the SR-IOTs. The advantage of using physical units within the core IOTs is that, in many cases, this provides a better description of the technological relationships for industries that have a reasonably large share of physical rather than service-based flows. Hence, when applying the analytical techniques, there is likely to be a better estimation of the direct and indirect environmental pressures across the economy. It is important to note that the mathematical specifications of the I-O model apply irrespective of the units of the rows of the hybrid IOTs. The details of these types of models (for energy) are provided in Chapter 9 of Miller and Blair (2009).

13.78 This type of EE-IOTs incorporates elements of life cycle analysis and process analysis since it is possible to reflect the chain of flows between economic units in physical terms in the context of an economy wide set of flows.

E. Compilation of EE-IOTs

13.79 The compilation of the EE-IOTs, in particular SR-IOTs, consists of two parts:

i. Monetary IOTs (Upper block of Table 13.6)

ii. Environmental data by industry. In most applications these data relate to flows of natural inputs and residuals (lower block of Table 13.6)

Table 13.8 Industry by Industry IOTs (Upper block of Table 13.6)

Data in monetary terms									
		Industries			Final use			Total output
		1	…	*j*	Final consumption	Gross capital formation	Exports	
Industries	*1*							
	…		Z		c	f	e	$q+m$
	j							
Value added			v					
Total inputs			q		c_{tot}	f_{tot}	e_{tot}	

13.80 The monetary IOTs (Table 13.8) are derived from the SUTs following the steps described in the previous chapters of this Handbook.

Table 13.9 Environmental data by industry (Lower block of Table 13.6)

<table>
<tr><th colspan="9">Data in physical (non-monetary) terms</th></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Industries</td><td colspan="3">Final demand</td><td rowspan="2">Total output</td></tr>
<tr><td>1</td><td>...</td><td>j</td><td>Final consumption</td><td>Gross capital formation</td><td>Exports</td></tr>
<tr><td>Natural inputs / residuals</td><td></td><td></td><td>r</td><td></td><td></td><td></td><td></td><td>r_{tot}</td></tr>
</table>

13.81 The environmental data is organized by industry in Table 13.9. Example for such data items are resource use and emission per industry. In most applications these data relate to flows of natural inputs and residual. Please refer to the earlier section for the common national data sources and relevant materials for each SEEA component accounts of physical flows.

13.82 The environmental data do not necessarily have to be derived from PSUTs. Usually, the information on environmental flows will not be strictly aligned to the measurement boundaries of the SEEA. Care should therefore be taken to record appropriately, with adjustment as necessary, entries for purchases abroad by tourists and re-exports. Careful attention should also be paid to the general issue of recording data on a residence basis rather than on a territory basis. Having balanced PSUTs behind the information in Table 13.9 helps to guarantee the reliability of the information and the consistency between monetary and physical data (ensured by the balancing feedback loops).

13.83 In addition to the materials listed in Box 13.1, a number of databases have been developed that incorporate physical flows and environmental information. They require the integration of data from various data domains as envisaged in the EE-IOTs: the World Input-Output Database 2012 (Groningen University); the EXIOPOL and CREEA projects funded by the European Union.

13.84 There are a number of measurement issues that are important to recognise when compiling the EE-IOTs. In the 2008 SNA, imports and exports are defined on the basis of ownership rather than physical flows. However, in physical terms a difference in the recording of some flows of products (for example, goods sent abroad for processing) may need to be taken into account (see Chapter 3 of the SEEA Central Framework for more details of the treatment in physical terms). Consequently, analysis seeking to utilise information in both monetary and physical terms may require adjustment to either data set to ensure an alignment in the treatment of certain flows.

13.85 Basic environmental statistics may not strictly align to the measurement boundaries of the SEEA. Care should therefore be taken to appropriately record, and adjust if necessary, entries for purchases abroad by tourists, re-exports and the general issue of recording data on a residence basis rather than on territory. (See for further details, Section 3.3 of the SEEA 2012- Central Framework).

F. Country examples

13.86 This Section presents two country examples in the compilation of PSUTs in Denmark and in the Netherlands. An example of the compilation of EE-IOTs can be found in Chapter 19 Section D.

1. Danish PSUTs

13.87 In Statistics Denmark, the compilation of the SUTs is an integrated part and the backbone of the annual Danish National Accounts in current prices and in previous years' prices. Every year, as part of the final annual National Accounts, the SUTs are constructed using a classification level including 117 industries, 135 groups of final use, and approximately 2,350 products, of which approximately 1,800 can be characterised as goods (physical products).

13.88 The PSUTs follow as closely as possible, where applicable, the layout, classifications and definitions, etc. and methods used for the Danish SUTs (and IOTs). Furthermore, in order to ensure the correspondence between the SUTs (and IOTs) and the PSUTs and to speed up the data handling and construction of the tables, the IT-system and database used for balancing and preparing of the monetary tables have been extended to include also the physical information.

13.89 The accounts for waste and water are produced independent of the SUTs. The monetary and physical energy accounts are produced as part of the SUTs process and enter directly into the National Accounts SUTs and the PSUT, respectively. The emissions accounts are subsequently based on PSUTs for energy with some additions for non-energy related air emissions. It should be noted that Statistics Denmark also produce PIOTs after the PSUTs are produced whereby all the physical accounts fit directly into an EE-IOTs framework.

13.90 The PSUTs are integrated with, and builds partly on, the existing Danish environmental-economic accounts for Economy Wide Material Flows (EW-MFA), energy and air emission.

13.91 The EW-MFA accounts are based on information from resource extraction statistics, fisheries statistics, agricultural statistics, etc. and foreign trade statistics. All information is available in tonnes.

13.92 The system of PSUTs is constructed as a further layer to the SUTs. This means that the same classifications of industries and products are used for the physical flows. For the final uses, a slightly different classification is used, For example, the physical flows are less relevant for some consumption groups, whilst, on the other hand, it may be more appropriate to classify Households final consumption expenditures according to whether the consumption involves durable goods or not.

13.93 For the Danish PSUTs, more than 100 types of natural resources (various types of biomass and minerals) and 40 types of residuals (types of solid waste and air emissions) were added to the classification of materials/products giving a total of approximately 2,000 items along the materials/products dimension of the system.

13.94 Figure 13.4 shows the complete system of monetary and physical flow data including monetary data on products, and physical data on natural inputs, products and residuals. The top (black) layers are monetary data including, on the supply side, basic prices only, and, on the use side, basic prices, trade margins, taxes, and purchasers' prices. The bottom (red) layer is physical data measured in tonnes. For products, there is a one to one correspondence between the monetary data and the physical data.

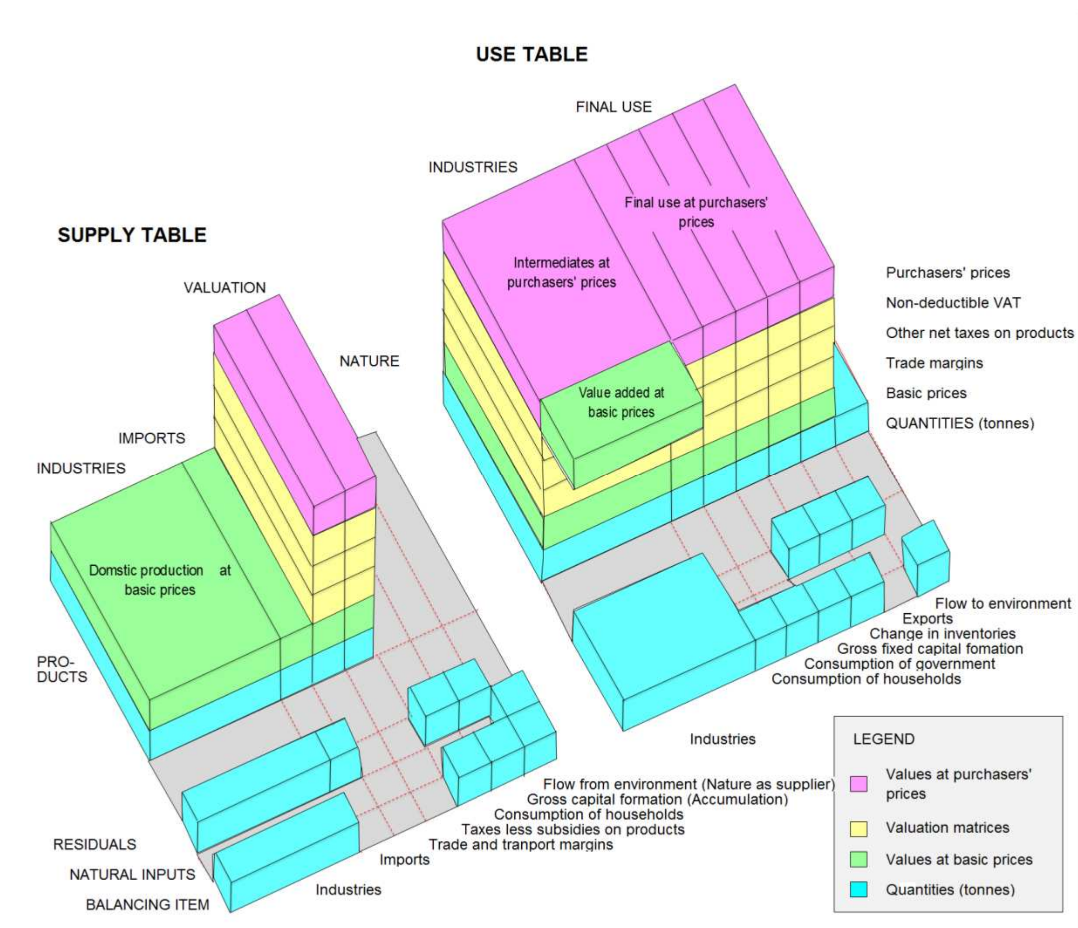
13.95 In front of the physical layer of products, the data for natural resources are added. The environment is added as the supplier of natural resources, while the industries (intermediate consumption) are the only users.

13.96 The residuals are represented behind the layer of products. The supply comes from industries and the households. It should be noted that unlike in the SUTs, the households are now also represented on the supply side since they also generate residuals. The users of residuals are both industries and the environment. Residuals like waste for incineration go into the waste treatment industry, while air emissions go into the environment.

13.97 In practice, all monetary and physical data illustrated in Figure 13.4 are stored and managed in a file using a common system of transaction codes and classifications. Each flow is identified first by a "product" code for the natural resource, product or residual. This code is followed by a transaction code (covering which type, origin or destination), classification (which industry, etc.) and then the data for basic prices, wholesale and retail margins, taxes (excluding VAT) less subsidies on products, VAT, purchasers' prices and finally the quantity (tonnes).

13.98 The Danish energy accounts present the supply and use of 40 types of energy products. The supply and use of products are broken down by domestic industries, households, imports and exports, etc. The Danish energy accounts are made up using various measuring units: monetary units (Danish Krone, DKK), natural physical units (tonnes, cubic metres, etc.) and energy units (petajoule, PJ). Tonnes are used for the purpose of the PSUTs.

Figure 13.4 The Danish SUTs framework extended with physical flows



13.99 Data on energy related air emissions of carbon and sulphur are drawn from the Danish air emission accounts. The air emission accounts show the energy related and other types of air emissions of various substances from industries and households. The CO2 and SO2 air emissions are converted into carbon and sulphur based on the molecule weights. This procedure is used since the oxygen used for the combustion of energy is not included on the input side of the PSUTs system.

13.100 In addition to the economic-environmental accounts, a number of other data sources are used:

- Waste statistics (physical data) broken down by waste fractions.
- Water statistics (physical data).
- Foreign trade statistics.
- Production statistics (physical and monetary data).
- Agricultural, Forestry and Fishery Statistics (physical data).
- SUTs from the National Accounts (monetary data).
- Assumptions used in transforming the SUTs to IOTs.

13.101 As a general rule, water is not included in the Danish PSUTs. However, in order to balance inputs and outputs, it is necessary to account for the inclusion of water into some products, for example, beverages, on the input side and evaporation, etc. of water from products, for example, from slaughtered animals, on the output side. Water supplied to production in agriculture, horticulture, forestry and fishery is implicitly included when calculating the input of natural resources from the harvested biomass weight. Information on the quantities of water added to products is otherwise obtained by including existing structural information, and by estimations carried out during the general balancing process.

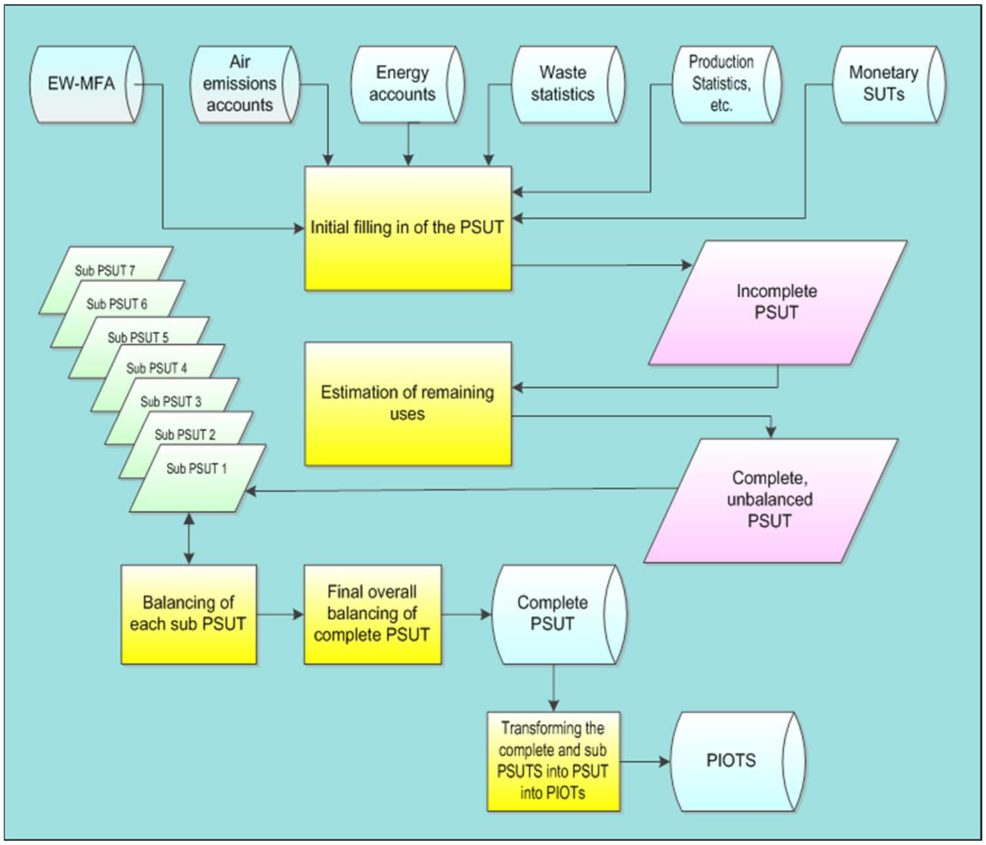
13.102 The foreign trade statistics includes very detailed data on the imports and exports of products. The information is available in both monetary values and quantities measured in tonnes and sometimes also additional physical units (cubic metres etc.).

13.103 The compilation of domestic production in tonnes broken down by industries is primarily based on Statistics Denmark's production statistics for the manufacturing industries. Whilst agricultural, forestry and fishery statistics are used for the corresponding primary industries. In the case of a number of items in the product balances, there is no information in the product statistics on the weight in tonnes, and this is therefore estimated indirectly. In those cases where alternative quantitative information has been given in, for example, cubic metres or pieces, a conversion is made from conversion factors like specific gravity or weight per piece. In other cases, the quantities are estimated on the basis of value and corresponding unit volume price. As there is price and quantitative information available for exports in almost all product balances based on the foreign trade statistics, the unit volume prices are typically calculated on the basis of the proportionality between the basic price and the weight of the exported item.

13.104 Thus, all cells for resource flows, all cells for imports and exports and domestic production and most cells for residual flows can initially be filled out by using the physical data sources as described above. In contrast, apart from a few exceptions, it is not possible to fill out the various domestic uses of products from the basic data. The exceptions include for example, agricultural products and energy products, where good data on the uses can be found in many cases.

13.105 Figure 13.5 shows the various stages in transforming basic data and statistics into PSUTs.

Figure 13.5 From source data to PSUTs



Balancing the PSUTs

13.106 It is a fundamental principle of accounting that the flow of materials (natural resources, products and residuals) into a single industry or the households must be precisely matched by a corresponding accumulation and/or flow from the industry or household group.

13.107 Although the initial filling out and estimations ensures that for each product the total supply equals total use, there is no guarantee that the mentioned material balance for industries and households exist.

13.108 For each of the 117 industries and the households represented in the PSUTs, it is therefore necessary to adjust the inputs or outputs until a complete balance between material inputs and outputs (including accumulation) is obtained.

13.109 The balancing is undertaken, inter alia, in the light of information on the technical production conditions in the industries obtained from different technical reports and additional statistical information. In addition to this, it is necessary, in a very large number of cases, to use estimates and common sense considerations.

13.110 The reconciliation of the inputs and outputs in the Danish PSUTs system is done for 11 sub-groups of materials (natural resources, products and residuals) corresponding to relatively similar or coherent groups of materials, for which there is an apparent connection between inputs and outputs. The groups are: energy, agricultural products, etc., glass, metallic minerals, construction minerals, plastic, wood and paper, rubber, chemical products and fertilizers, lubricants and oil waste, and other materials.

13.111 The 11 individual sub-PSUTs systems are reconciled before a final reconciliation of the total PSUTs takes place because it is easier and more logical to focus on inputs and outputs of products that are physically connected through the production processes. For example, when the sub-PSUTs for energy reviewed, these will include input flows of natural gas, crude oil and biomass used for energy production, all energy products and energy related residuals, while all other products are excluded. The energy related residual flows comprise air emission of carbon and sulphur, other energy related air emissions and solid waste of fly ash and, for instance, desulphurization products, etc.

13.112 For other groups except energy, there is in practise some links to the other groups, for example, inputs of chemical products and fertilisers are used in relation to the production of animal and crop products. The existence of these links between the different groups means that it is not possible to make a complete balance within one single group, and instead an interim balancing item is introduced for each sub-group in the system (except for energy). If positive for an industry, this artificial residual represents a net input of materials belonging to other groups into the industry. If it is negative, this means that the industry delivers products of the specific material type to be used as inputs for the production of products of another material type.

13.113 If the balancing of the 11 sub-groups is made fully correct, the individual balancing items will cancel each other when they are added up. In practice, this is not the case, since the balancing items will also include uncertainties and inconsistencies introduced during the initial phases and balancing processes. Thus, it is necessary to make a final balancing to ensure that the artificial residuals sum to zero.

13.114 Table 13.10 shows a numerical example of PSUTs for Denmark for the year 2009 (note the data in Table 13.10 are preliminary data). The Supply Table shows that 106.4 million tonnes of natural inputs were extracted from the environment in Denmark. All these inputs were used by Danish industries. 288.3 million tonnes of products were supplied, of which 223.4 and 64.9 million tonnes were Danish output and imports, respectively. The 288.3 million tonnes of products were used as follows: 160.1 million tonnes were used for intermediate consumption by industries, 26.9 million tonnes were used by household consumption, 57.3 million tonnes were used for GCF and 44.0 million tonnes were exported. Industries generated 43.1 million tonnes of residuals and households 26.9 million tonnes of residuals.

Table 13.10 Physical SUTs in Denmark

Physical Supply Table — 1.000 tonnes

	Industries	Housholds	Govern-ment	Accu-mulation	Rest of the world	Environ-ment	Total supply
Natural inputs						104 965	104 965
Products	232 603				62 901		295 505
Residuals	48 732	18 867					67 600
Total	281 336	18 867			62 901	104 965	468 069

Physical Use Table — 1.000 tonnes

	Industries	Housholds	Govern-ment	Accu-mulation	Rest of the world	Environ-ment	Total supply
Natural inputs	104 965						104 965
Products	176 370	18 867		61 958	38 309		295 505
Residuals						67 600	67 600
Total	281 335	18 867		61 958	38 309	67 600	468 069

Denmark 2009 = Grey cells are null by definition.

13.115 The Use Table shows that all these residuals go to the environment. Following the SEEA Central Framework conventions, residuals that are sent to controlled landfills should be recorded as accumulation in the economy but for this simplified Danish SUTs such a recording is not used.

13.116 Table 13.10 also shows that the basic bookkeeping identities covered above are all fulfilled. For each of the items accumulation, for the rest of the world and the environment, there is no balance between supply and use of products but when all three items are considered together, the total supply equals total use. This indicates in 2009, Danish imports exceeded Danish exports and that the extraction of natural inputs from the environment exceeded the amount of residuals that were returned to the environment. Thus the exchange of materials between the Danish economy and the rest of the world plus nature showed a surplus at 57.3 million tons of material. This amount is exactly equal to the accumulation of materials in the economy as shown in the column for accumulation.

2. PSUTs in the Netherlands

13.117 The PSUTs compiled by Statistics Netherlands are fully in line with the standards set out by SEEA. The starting point for the PSUTs is the balanced SUTs as compiled as part of the National Accounts. With the physical flows having a monetary value, the flows not having a monetary value are added like natural inputs, waste and emissions. The integration of all physical flows in the PSUTs generates a consistent and coherent set of data which is also consistent with the monetary information contained in the monetary SUTs of the SNA. As a consequence, the economic variables like labour and GVA can be analysed in combination with the physical data shown in the PSUTs. Statistics Netherlands regularly compiles SUTs, IOTs and PSUTs. However, PIOTs are not compiled.

Structure of the PSUTs for the Netherlands

13.118 The PSUTs follows as close as possible the structure and classifications of the SUTs. An important difference between the SUTs and PSUTs is that the PSUTs also include the physical flows not having a monetary value. In the Supply Table, air emissions and waste is recorded (the former under the heading balancing item in the example below). In the Use Table, the recycled waste and extraction from the environment are taken in account. Also a balancing item is introduced in order to achieve the material balance at the industry level which consists of items such as emissions other than CO2, the supply and use of water, etc.

13.119 Table 13.11 shows an example of the SUTs for the Netherlands for 2010 and Table 13.12 shows the corresponding PSUTs for the same year.

Table 13.11 SUTs for the Netherlands, 2010

Supply Table at basic prices — Million Euro

			INDUSTRIES					Total supply at basic prices
			Agriculture	Manufacturing and construction	Services	Total	Imports	
			(1)	(2)	(3)	(4)	(5)	(6)
PRODUCTS	Agriculture	(1)	25 299	153	41	25 493	13 900	39 393
	Manufacturing	(2)	1 230	282 553	35 780	319 563	301 843	621 406
	Construction	(3)	70	84 922	4 676	89 668	1 521	91 189
	Trade, transport and communication	(4)	565	15 375	222 573	238 513	20 319	258 832
	Finance and business services	(5)	477	7 803	274 997	283 277	50 908	334 185
	Other services	(6)	312	2 531	219 567	222 410	16 366	238 776
	Total	(7)	27 953	393 337	757 634	1 178 924	404 857	1 583 781
	CIF/FOB adjustments on imports	(8)					- 3 272	- 3 272
	Direct purchases abroad by residents	(9)						
	Total	(10)	27 953	393 337	757 634	1 178 924	401 585	1 580 509

Use Table at basic prices — Million Euro

			INDUSTRIES				FINAL USE							Total use at basic prices
			Agriculture	Manufacturing and construction	Services	Total	Final consumption expenditure			Gross fixed capital formation	Changes in inventories	Exports	Total	
							Households	NPISH	General government					
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PRODUCTS	Agriculture	(1)	4 679	13 686	1 152	19 517	2 461			161	168	17 086	19 876	39 393
	Manufacturing	(2)	7 921	153 180	47 758	208 859	54 468		5 373	39 357	3 775	309 574	412 547	621 406
	Construction	(3)	292	23 573	17 370	41 235	399		522	46 786		2 247	49 954	91 189
	Trade, transport and communication	(4)	1 790	31 077	73 293	106 160	62 054	860	3 725	10 673	77	75 283	152 672	258 832
	Finance and business services	(5)	2 052	41 219	152 096	195 367	74 771	5	3 546	13 442		47 054	138 818	334 185
	Other services	(6)	169	3 429	20 925	24 523	50 518	4 451	153 957	461	285	4 581	214 253	238 776
	Total at basic prices	(7)	16 903	266 164	312 594	595 661	244 671	5 316	167 123	110 880	4 305	455 825	988 120	1 583 781
	Taxes *less* subsidies on products	(8)	222	1 493	13 791	15 506	32 523		109	13 769	3	1 845	48 249	63 755
	Total	(9)	17 125	267 657	326 385	611 167	277 194	5 316	167 232	124 649	4 308	457 670	1 036 369	1 647 536
	CIF/FOB adjustments on exports	(10)										- 3 272	- 3 272	- 3 272
	Direct purchases abroad by residents	(11)												
	Purchases on the domestic territory by non-residents	(12)												
	Total at purchasers' prices	(13)	17 125	267 657	326 385	611 167	277 194	5 316	167 232	124 649	4 308	454 398	1 033 097	1 644 264
GVA	Compensation of employees	(14)	2 603	59 807	248 061	310 471								310 471
	Other taxes *less* subsidies on production	(15)	- 537	- 106	- 337	- 980								- 980
	Consumption of fixed capital	(16)	3 660	20 186	83 136	106 982								106 982
	Net operating surplus	(17)	5 102	45 793	100 389	151 284								151 284
	GVA	(18)	10 828	125 680	431 249	567 757								567 757
	Total	(19)	27 953	393 337	757 634	1 178 924	277 194	5 316	167 232	124 649	4 308	454 398	1 033 097	2 212 021

= Grey cells are null by definition.

Netherlands 2010

Table 13.12 Physical SUTs for the Netherlands, 2010

Physical Supply Table — Million kilogram

			INDUSTRIES Agriculture (1)	Manufacturing and construction (2)	Services (3)	Total (4)	Households (5)	Accumulation (6)	Imports (7)	Flow from environment (8)	Total (9)
PRODUCTS	Agriculture	(1)	43 592	31		43 623			26 779		70 402
	Manufacturing	(2)	182	334 216	16 345	350 743			328 027		678 770
	Construction	(3)									
	Trade, transport and communication	(4)									
	Finance and business services	(5)									
	Other services	(6)									
	Total	(7)	43 774	334 247	16 345	394 366			354 806		749 172
	Waste	(8)	74 596	50 944	5 136	130 676	9 297	6 059	15 350		161 382
	Extraction	(9)								143 679	143 679
	Balancing item	(10)	75 143	258 891	88 265	422 299	85 219			282 455	789 973
	Total	(11)	193 513	644 082	109 746	947 341	94 516	6 059	370 156	426 134	1 844 206

Physical Use Table — Million kilogram

			INDUSTRIES Agriculture (1)	Manufacturing and construction (2)	Services (3)	Total (4)	Households (5)	Accumulation (6)	Exports (7)	Re-Exports (8)	Flow to environment (9)	Total (10)
PRODUCTS	Agriculture	(1)	5 957	41 879	1 875	49 711	2 437	216	10 197	7 841		70 402
	Manufacturing	(2)	17 955	292 152	47 582	357 689	31 280	7 573	184 069	98 159		678 770
	Construction	(3)										
	Trade, transport and communication	(4)										
	Finance and business services	(5)										
	Other services	(6)										
	Total	(7)	23 912	334 031	49 457	407 400	33 717	7 789	194 266	106 000		749 172
	Waste	(8)	76 602	68 068		144 670		1 495	15 217			161 382
	Extraction	(9)	38 778	101 095	3 806	143 679						143 679
	Balancing item	(10)	54 221	140 888	56 483	251 592	60 799	101 610			375 972	789 973
	Total	(11)	193 513	644 082	109 746	947 341	94 516	110 894	209 483	106 000	375 972	1 844 206

= Grey cells are null by definition.

Netherlands 2010

Transformation from SUTs to PSUTs

13.120 The starting point for the compilation of PSUTs (in kilogram) is the balanced SUTs valued at basic prices. In addition to the data used for the SUTs, there are several data sources available covering prices and quantities. The most important sources are:

- Foreign trade statistics
- Data on output of manufacturing
- Data on intermediate use from business statistics (limited)
- Scanner data of supermarkets
- Price information from branch organizations and dedicated research institutes (mainly agriculture)
- Quantity data on energy and related products from the energy accounts.

13.121 Following the approach of Konijn, de Boer and van Dalen (1995), the initial estimates for the physical use of products are compiled applying import prices to monetary Use Table. The physical supply is initially estimated applying export prices to the monetary Supply Table. The justification for this choice is that a large share of domestic production of goods is exported and vice versa, a large share of use of goods is imported.

13.122 If specific data are available these initial estimates are overruled in the next step. The business statistics dedicated to the composition of output provide information on prices and quantities of the supply of goods for manufacturing at the 3-digit level or 4-digit level of NACE Revision 2. This information is especially useful in the cases where the products are not homogeneous, and therefore, the prices can differ among industries. Also, the differences in quality of the products may lead to differences in prices. For example, meat produced by slaughterhouses will probably be of different quality than meat produced by the food processing industry. As a consequence, there will be a difference in price levels between the meat products produced by the two industries.

13.123 For a limited number of industries, the price information for the intermediate inputs is available which is used for overruling the initial physical estimates based on import prices. Further additional price information collected by branch organizations and research institutes is used. The most important examples cover price data for agricultural products. Together with harvest estimates, this provides a sound base for estimating the physical flows in this area.

13.124 Scanner data provided by supermarkets are a valuable source of information for the transformation of, or part of, the consumption of households into physical units.

13.125 In addition to the price information, the observed physical information is used in compiling the PSUTs. This mainly covers the data on agriculture and energy (crude oil, fuel, natural gas, electricity, etc.). The latter are derived from energy accounts.

13.126 Applying this information on balanced SUTs results in PSUTs for all relevant products, however these PSUTs are not balanced.

13.127 In addition to the physical flows for supply and use of products, the physical flows for materials not having a monetary value are included. These mainly concern flows between the economy and the environment like air emissions, extraction of natural resources, the input of oxygen in combustion processes and waste. Adding these flows will create the possibility for analysing the balance of physical input and physical output on the industry level. Emission and waste statistics are the main sources for making initial estimates for these physical flows. The items mentioned only cover parts of the non-monetary flows. For example, the extraction of water by the production of beverages is missing. When the PSUTs are balanced, the adjustments for these missing items are made.

Accumulation

13.128 On the supply side, the material flows are incorporated resulting from the reduction of physical stocks of products. Examples include the physical residuals becoming available with the demolition of machines and buildings and air emissions from controlled landfills. Based on the type of waste, a split is made between waste resulting from a production process and waste resulting from scrap of capital goods, etc.

13.129 On the use side, the additions to the capital stock (GFCF, both monetary and physical) and the accumulation of waste in landfills are taken into account. The estimates of the accumulation part of the PSUTs are not straightforward and therefore a less reliable part of the PSUTs.

Balancing the PSUTs

13.130 The initial estimates of the PSUTs are not balanced – neither the product level (row wise) nor the industry level (column wise). There are several causes of the inconsistencies between supply and use of products in the PSUTs. As previously mentioned the products which are not homogeneous can give rise to inconsistencies because the prices may differ significantly between the various producing and using industries. The assumption that output is mainly exported and (intermediate) use is mainly imported is not always valid. When significant parts of domestic output are domestically used, inconsistencies are likely to appear. Finally, there may be examples of inaccurate source data.

13.131 The balancing of the PSUTs has three steps:

- Detection and balancing of large inconsistencies at the product level.
- Detection and balancing of large discrepancies between input and output in physical terms by industry.
- Automated balancing of small inconsistencies.

13.132 During the balancing at the product level, large inconsistencies between supply and use on a product level are resolved by analysing the link between the physical volumes of outputs compared to the physical volumes of inputs. For example, the number of cattle entering the slaughterhouses and the volume of meat produced. In this stage, the input from the branch specialists is used for judging the plausibility of the results.

13.133 In the balancing of the input and output in physical terms by industry, the material flows to and from the environment are taken into account. In the Supply Table, the CO_2 and water emissions in combustion processes are taken into account. In the Use Table, the oxygen necessary for combustion is recorded. A specific estimate is made for Nitrogen (N_2) extracted from the air in producing ammonia is made. The estimates for the other emissions to the air or water are not made because they are relatively small compared to CO_2-emissions. The above mentioned items, excluding CO_2-emissions resulting from combustion, are recorded as part of the balancing item with the industries in the PSUTs.

13.134 In addition to the above mentioned flows, the balancing item consists of the water content of products. The production of beverages has relatively low intermediate input of raw materials because the main input is water which is extracted from the environment.

13.135 The opposite can also happen that the water content is reduced in the production process. In the PSUTs for the Netherlands, separate estimates are made for the water content of products, and, in this way, the estimates by industry are made whether on the balance the water is supplied to or extracted from the environment. This information is used to judge the plausibility of the balancing items by industry.

13.136 In many cases, a balancing item is necessary for those types of industries where services are produced but a considerable part of inputs are goods, for example, restaurants and pubs. A meal in a restaurant is recorded as a service while the inputs are goods and services.

13.137 In the construction industry, the physical estimate of output is relatively low because no direct estimate is made of the physical value of dwellings, buildings, roads, etc. as a consequence of a lack of data. The physical output for construction is accounted for in the balancing item in the Supply Table.

13.138 As a consequence, the 'theoretical' contents of the balancing item can vary greatly between industries.

13.139 The remaining small inconsistencies are balanced using an automated balancing procedure similar to the approach used for balancing the SUTs as covered in Chapter 11 of this Handbook.

Chapter 14. Supply and Use Tables and Quarterly National Accounts

A. Introduction

14.1 The previous Chapters of this Handbook focused mainly on the compilation of annual SUTs. However, the SUTs can also play an important role in the compilation of Quarterly National Accounts (QNA) to ensure the consistency and coherence of the estimation of the accounts.

14.2 Although the ideal scenario is that SUTs are compiled and published on a quarterly basis and benchmarked with the annual SUTs, this is often difficult to implement, for example, due to data availability, human and financial resources and time constrains. Nonetheless, quarterly SUTs provide a key tool for the compilation of QNA or as a minimum a validation tool of the QNA.

14.3 For both quarterly and annual SUTs, the integrated approach to balance in current prices and in volume terms as well as at basic prices and at purchasers' prices will achieve a high degree of consistency and coherence.

14.4 This Chapter provides an overview of ways in which SUTs can be used to improve the QNA. Since there are various scenarios that can be used in practice, this Chapter focuses only on three main situations which represent using SUTs in various degrees in the compilation of the QNA.

14.5 A progressive approach could be implemented whereby the annual SUTs are first used to improve the QNA, then quarterly supply and use of products based models are put in place to edit and validate the QNA, and finally, quarterly balanced SUTs are compiled and published when appropriate data sources and validation processes are developed.

14.6 Section B of this Chapter provides a general overview of the QNA and the main differences between the compilation of Annual National Accounts (ANA) and the QNA (for example, data sources, revisions, timings, level of detail, etc.) and the issue of benchmarking the QNA with the ANA. Section C describes in more detail the uses of SUTs in the compilation of the QNA. References sources that provide additional detail include: Eurostat (2013a) *Handbook on Quarterly National Accounts* and the IMF (2017) *Quarterly National Accounts Manual*.

B. Quarterly National Accounts

14.7 The QNA constitute a system of integrated quarterly time series coordinated through an accounting framework. The QNA adopt the same principles, definitions, and structure as applied in the ANA. In principle, the QNA cover the entire sequence of accounts and balance sheets in the System of National Accounts. In practice, the constraints of data availability, time, and resources mean that the QNA are usually less complete than the ANA.

14.8 The main purpose of the QNA is to provide a picture of current economic developments much quicker than the ANA and more comprehensive than that provided by individual short-term indicators. Thus, the QNA can be seen as positioned between the ANA and specific short-term indicators in many of these purposes. The QNA are commonly compiled by combining ANA data with short-term source statistics and ANA estimates (for example, benchmarked to annual estimates).

14.9 In general, the same principles for designing sources and methods apply to both the ANA and the QNA. However, the QNA data sources are generally more limited in detail and coverage than those available for the ANA because of issues of data availability, collection cost, and timeliness and this may affect the level of detail of the QNA. Some compilation issues that are more pertinent to the compilation of either the short-term indicators or the QNA include:

- monthly or quarterly type adjustments (for example, working days, trading days, moving holidays, leap years, etc.);
- seasonal adjustment (for example, handling annual sale periods, use of ARIMA models, trend cycle estimation);
- quarterly chain-linked volume estimates;
- deriving estimates of quarterly variables consistent with annual benchmarks;
- smoothing; and
- forecasting and now-casting.

14.10 In addition, the compilation of the QNA is not to be considered in isolation but as a consistent and coherent part of the ANA process and part of a time series. This implies that additional work in the compilation of the QNA is needed to benchmark the QNA with the ANA, from the one side, and to revise previous quarters as more information becomes available, from the other. Issues with the data sources and benchmarking are further addressed below.

1. Data sources

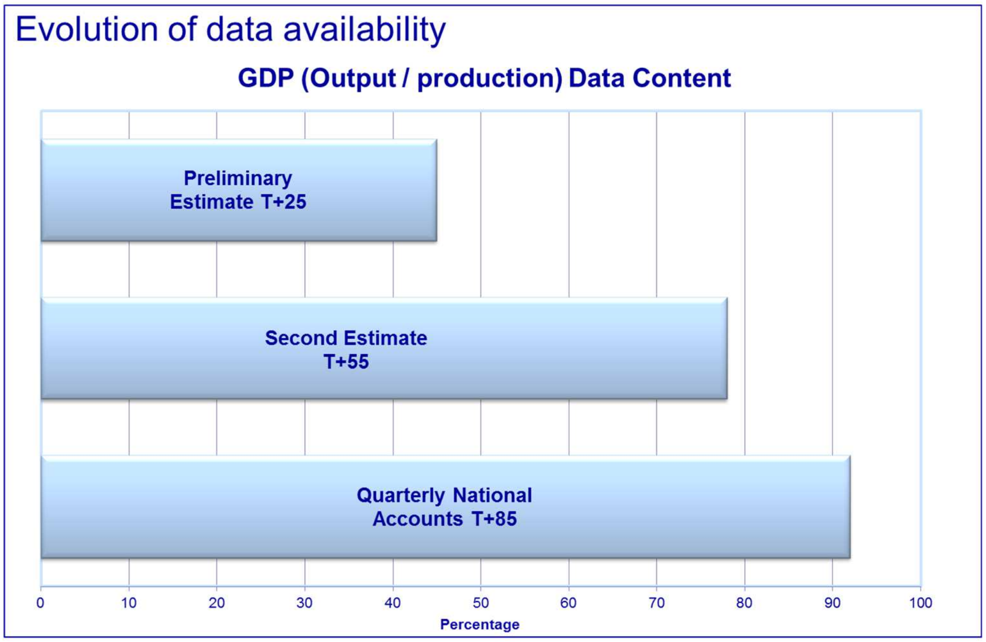
14.11 Ideally, the same data sources used for the annual estimates of GDP should be used for the quarterly estimates. However, this is often not possible because the data are not available on a quarterly basis (i.e. detail breakdowns not available) or less timely, and, when available, the higher frequency data may be less accurate and reliable.

14.12 For example, the present practice in the UK, the early GDP data releases follow:

- 1st (Preliminary) Estimate of UK GDP is released around 25 days after the quarter.
- 2nd Estimate of UK GDP is released around 55 days after the quarter.
- 3rd Estimate of UK GDP is released around 85 days after the quarter together with the full Quarterly National Accounts, Balance of Payments and the institutional sector non-financial and financial accounts.

14.13 The 1st Estimate of UK GDP contains a mix of collected data (for example, via business surveys and administrative data) and data based on forecasts/now-casts to complete the picture. Here the short-term indicators play a key role. The 1st Estimate is heavily based on the Production (Output) approach to measuring GDP using proxies to estimate output and an assumption that GVA moves in line with output in the short-term. At this stage, there is very limited data underlying the Expenditure approach to measuring GDP. With the move to the 2nd Estimate and through to the 3rd Estimate, more and more data becomes available replacing the earlier forecasts of missing data for both approaches. By the time the 3rd Estimate is produced, there is also some data available for the Income approach to measuring GDP.

Figure 14.1 Quarterly GDP Production (Output) aggregate - Data availability and estimation in the United Kingdom



14.14 Figure 14.1 shows how the quarterly data underlying the Production (Output) based aggregate evolve over time, whereby the collected data replaces early forecasts/now-casts of missing data. Similarly, Figure 14.2 shows how the underlying components of the Expenditure approach to measuring GDP evolve over time.

Figure 14.2 Quarterly GDP Expenditure components - Data availability and estimation in the United Kingdom

Expenditure GDP	1st Estimate 25 days	2nd Estimate 55 days	3rd Estimate 85 days	1st Annual Sum of four quarters	2nd Annual Benchmarking and annual SUTs
Households + NPISHs		45%	85%	100% R	100% B
General Government		60%	60%	100% R	100% B
GFCF + Valuables		55%	80%	100% R	100% B
Changes in inventories		65%	85%	100% R	100% B
Net Exports of Goods		100%	100%	100% R	100% B
Net Exports of Services		60%	80%	100% R	100% B
Total	Limited data	60%	80%	100% R	100% B

R = Revised
B = Benchmarked

14.15 Many countries have monthly and quarterly surveys collecting a wide-range of economic information but generally not with the same level of detail or coverage of the corresponding annual surveys. Various totals may be collected but no breakdowns, for example, total turnover may be collected but not with a product breakdown. Thus the structure of the last annual SUTs (preferably in volume terms) or the last dataset collected helps to provide the ratios/percentages to breakdown the totals to be taken forward in the compilation process prior to any quarterly balancing process.

14.16 Similarly, administrative data, where available, can also be used in the QNA. However, some administrative data may not be timely enough for the QNA such as, for example, labour costs or self-employment incomes.

14.17 The QNA may therefore be less accurate than the more comprehensive ANA for various reasons including the following:

- less information is available on a quarterly basis than on an annual basis and there is more reliance on proxy indicators;
- the basic quarterly statistics are often less robust than the annual equivalents (for example, the annual data may be available through annual audited accounts);
- smaller sample sizes in the quarterly business surveys;
- greater sample and non-sample errors in the data sources; and
- balancing is not completed through quarterly SUTs, whereas the SUTs framework may be applied annually.

14.18 It is therefore important to have a framework that allows for the confrontation of the different data sources and their reconciliation. The SUTs framework allows for the analysis and reconciliation of data inconsistencies. In turn, for example, produce a coherent picture of GDP and its components.

2. Data reconciliation, benchmarking and revisions

14.19 An important step in the compilation of the QNA is benchmarking the QNA with the ANA when the latter becomes available. This is a necessary step to ensure that the QNA are consistent with the annual accounts and they are coherent with the short-term evolution of quarterly indicators. Benchmarking refers to the procedures used to maintain consistency among the time series available at different frequencies (in this case annual and quarterly) for the same target variable.

14.20 The need to synchronise the implementation of major revisions including benchmarking were briefly covered in Chapter 11. Whereby, in particular, such events should be implemented, compiled and balanced through a SUTs framework both in current prices and in volume terms as well as at basic prices and at purchasers' prices.

14.21 Since quarterly data sources are not of the same quality as the equivalent of the annual data sources (due to reasons already mentioned above such as smaller survey samples, coverage, etc.), benchmarking usually consists of adjusting quarterly data to match annual (or quinquennial) benchmarks. Once the QNA are benchmarked with the ANA, the QNA and the ANA are consistent in the sense the annual accounts are the sum (or the average) of the quarterly accounts.

14.22 Before the benchmarking exercise is undertaken, a separate reconciliation exercise should be considered requiring dedicated resource and time. This involves reconciling the data for the same respondent aligning the short-term/quarterly survey source and the annual source. For example, the annual growth rate and current price level, for say, turnover, should be aligned. The same reconciliation principle before benchmarking applies to all other variables (for example, GFCF, purchases of goods and services, etc.) where such a link exists across short-term/quarterly and annual surveys. In a sense, this reconciliation process improves the quality of source data, and in turn, removes the full impact of the automatic benchmarking focus and may help to reduce future revisions. Through this investigative and reconciliation approach, it may mean that the short-term/quarterly survey source estimate(s) should be changed, or the annual survey estimate(s) changed or a combination of both. This process will imply the highest quality source estimate will be used for benchmarking, and in turn, it may be different from what would have been generated via a direct benchmarking approach without this reconciliation step.

14.23 In the QNA, benchmarking serves two purposes:

- quarterly distribution (or interpolation) of annual data to construct time series of benchmarked QNA estimates ("back series"); and
- quarterly extrapolation to derive the QNA estimates for quarters for which annual national accounts benchmarks are not yet available ("forward series").

14.24 Various techniques are used to benchmark the QNA to the ANA. They include, for example, pro rata benchmarking methods, the proportional Denton Methods, the proportional Cholette-Dagum method with first-order autoregressive (AR) error (which cover the Chow-Lin methods (Chow and Lin, 1971) and its variants as particular cases), etc. The IMF Quarterly National Accounts Manual (IMF 2017) provide a detailed review of these methods. The forthcoming Handbook on Backcasting (United Nations, *forthcoming*) provides guidance on backcasting time series in National Accounts.

14.25 It should be noted that there is a high priority need to capture rapid changes in the economy within quarterly periods (or annual periods) which may go unnoticed in the annual or five-yearly structural statistics. For example, with the impact of globalization, new industries/products, rapid technological change, etc., it is recommended that data on sales and purchases are collected more regularly via business surveys. This will ensure structural change is picked up quickly and less reliance on modelled results which will depict smooth series. More data collected will help to avoid key structural changes being missed within a year. Even traditional industries like electricity, gas, oil, etc. change their input structures rapidly. For example, changes such as privatization (for example, leading to the non-consolidation of electricity and gas industries separating functions like generation, transmission, distribution and supply), use of environmentally more friendly inputs (for example, the electricity industry using gas or nuclear fuel as opposed to coal), contracting-out processes (for example, billing services), etc. Much more detail should be collected say, annually, and maybe only control totals quarterly, which assume the same structural breakdowns as the last annual picture.

14.26 In general, the incorporation of new annual data for one year requires the revision of previously published quarterly data for several years in order to avoid introducing distortions in the series. Similarly, the annual benchmarks of previously published QNA estimates can generate revisions to the quarterly data. In principle, previously published QNA estimates for all preceding and following years may have to be adjusted to maximally preserve the short-term movements. In practice, however, with most benchmarking methods, the impact of new annual data will gradually be diminishing and zero for sufficiently distant periods. It is also worth noting that the first estimates of the ANA tend to be based on the annualized quarterly accounts, which through say, the seasonal adjustment process, can change previously published quarterly estimates.

14.27 Ideally, revisions to quarterly indicators should be incorporated in the QNA series as soon as possible to reflect the most up-to-date short-term information available. This is particularly relevant for the forward series, which should immediately incorporate revisions to preliminary values of the indicators for the previous quarters on the basis of more up-to-date and comprehensive source data. If revisions to preliminary information in the current year are disregarded, the QNA may easily lead to biased extrapolations for the subsequent periods. For the back series, revisions to previous years of the indicator should be reflected in the QNA series at the time when revisions to new or revised ANA benchmarks are incorporated and should be implemented through the SUTs framework.

14.28 The benchmarking (and revisions) of the QNA with the ANA is an important aspect to consider for the compilation of quarterly SUTs. Indeed quarterly SUTs, when compiled, should also be benchmarked with the annual SUTs in order to provide a consistent set of information on a quarterly and annual basis. Techniques for the benchmarking and revisions are very much similar to those used for the QNA.

C. SUTs and QNA

14.29 Quarterly GDP is typically calculated by aggregating a limited number of components, derived either from the production side (i.e. GVA of economic activities plus net taxes on products), from the expenditure side (i.e., consumption plus capital formation plus net exports), or from income side (even though this is less common). In most countries, the production approach is chosen as the preferred approach for deriving the official quarterly GDP measure. The production-based GDP is then used as a predetermined variable in the expenditure decomposition. This situation generally leads to two consequences: one is to derive one of the expenditure items residually (such as changes in inventories or household consumption), the other is to present statistical discrepancies as a residual item between the production-based GDP and the sum of the expenditure components. Either way, the inconsistencies between expenditure and production components are not properly investigated and addressed. As a result, the quality of the quarterly GDP estimate may be undermined.

14.30 One way to achieve consistent quarterly GDP data at a detailed product level is to compile quarterly SUTs. A set of SUTs is considered the best framework for GDP compilation in the 2008 SNA, at any frequency. Some countries with sophisticated National Accounts systems derive the official quarterly GDP from quarterly SUTs (for example, the Netherlands compile quarterly SUTs). In effect, the main advantage of using the SUTs framework is to help fill data gaps of specific items with missing information, which could be a very complicated task in a QNA system based on aggregate variables. However, developing a quarterly SUTs system may be too demanding in terms of resources. Countries should be aware that preconditions for a successful development of quarterly SUTs are to have a well-established system of annual SUTs, sophisticated staff with significant SUTs and National Accounts skills and expertise, and willingness to revolutionize the existing QNA compilation system. There are four sets of quarterly SUTs that should (or could) be compiled:

- SUTs in current prices, unadjusted;
- SUTs in previous years' prices, unadjusted;
- SUTs in current prices, seasonally adjusted; and
- SUTs in previous years' prices, seasonally adjusted.

14.31 Even if data for quarterly SUTs are not available in a comprehensive framework, a partial version in the form of product balances for particular products can provide some of the benefits of SUTs for balancing. The validation process of QNA is performed by means of a simplified quarterly supply-use model derived on the basis of assumptions from the most recent annual SUTs. Some countries use apply the SUTs framework on a quarterly basis typically at a less detailed level than annually and as a compilation/validation tool whereby the detailed results are not intended for publication.

14.32 The main advantage of using SUTs in the validation process of the quarterly GDP is that inconsistencies calculated at the aggregate level can be transformed into detailed imbalances between total supply and total use of specific products (or between total output and total input of specific economic activities, if the fixed input-output ratio assumption is relaxed). This detailed view permits to pinpoint the major sources of inconsistencies, and allows the compilers to identify the most critical areas of intervention. The editing process should be reiterated until the quarterly GDP data show a satisfactory degree of consistency in the quarterly supply-use model.

14.33 This validation tool can be helpful in assessing the consistency of both quarters that are benchmarked to closed years, and quarters that are extrapolated from the latest annual benchmark. Although the quarterly data are benchmarked to consistent annual data, they may still lack consistency at the quarterly level due to seasonal effects, outliers, and other sub-annual effects. These effects may introduce distortions in the measurement of short-term changes of GDP, with possible consequences in the determination of business cycle turning points. In extrapolation, a supply-use model for validation can be particularly useful in verifying that the quarterly aggregate GDP figures are internally consistent.

14.34 There are three main ways in which the SUTs framework can be used for the compilation of QNA and described in the next Section. They consist of:

- the use of annual SUTs with a "product flow" method for the compilation of QNA;
- the use of partial quarterly SUTs based model to validate QNA; and
- the compilation of quarterly balanced SUTs to underpin the compilation of QNA.

14.35 Country practices may use different variations of these methods but the main considerations presented here are still valid.

1. Annual SUTs and the QNA

14.36 When only annual SUTs are available, they can be used in aid to the compilation of QNA in combination of a "product flow" method. The "product flow" method essentially consists of a simple form of the SUTs but requires much less and up-to-date information. This is in contrast with the SUTs which require full information on the supply of products which come from both domestic production and imports and on the uses of products for their own production (i.e. intermediate consumption), final consumption, gross capital formation and exports. The "product flow" approach based on the SUTs requires a bridge between basic prices and purchasers' prices.

14.37 The annual SUTs are used to derive ratios that are applied to quarterly totals or to make extrapolation. In the Federal Statistical Office of Germany, the "product flow" method is used in the calculation of GFCF in machinery and equipment. The domestic supply is first determined from base statistics with a detailed breakdown of goods. By applying capital formation ratios (from the previous SUTs and/or IOTs) and adding some supplementary information and adjustments, machinery and equipment can be derived from this. The "product flow" method is mainly based on sources that are available on a quarterly basis, for example, the production statistics, or even on a monthly basis, for example, turnover surveys and the foreign trade statistics. Therefore, the up-to-date quarterly accounts follow the flow pattern from the annual accounts. The quarterly results can be aggregated to form annual results. GFCF in machinery and equipment is determined at a very fine level of product disaggregation as difference between product supply (production plus imports) and exports.

14.38 Table 14.1 demonstrates the type of information required to balance supply and use of products (goods and services) at purchasers' prices. Any differences have to be allocated to supply of goods and services or the use of goods and services or both.

Table 14.1 Balancing supply and use of products

PRODUCTS \ CATEGORIES			Output at basic prices	Imports CIF	Trade margins	Transport margins	Taxes on products	Subsidies on products	Supply at purchasers' prices	Intermediate consum[tion	Final consumption expenditure by households	Final consumption expenditure by NPISH	Final consumption expenditure by government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total use at purchsers' prices
No	Code		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	01111	Wheat, seed																
2	01112	Wheat, other																
3	01121	Maize (corn), seed																
⋮	⋮																	
3150	97990	Other miscellaneous services n.e.c.																
3151	98000	Domestic services																
3152	99000	Services provided by extra-territorial org.																
		Total																

2. A quarterly SUTs based model to aid validation of the QNA

14.39 A quarterly SUTs based model consists of a partial compilation of quarterly SUTs based on existing National Accounts data and based on modelling of the remaining data that are required in a SUTs approach. The quarterly SUTs based model uses the relationships in the annual tables to expand the level of detail available quarterly to better articulate the relationships between the different approaches to measuring GDP and thus assist in the identification of possible inconsistencies. The quarterly SUTs based model uses the economic relationships between variables in the latest available annual SUTs (referred to as the reference year tables) to generate the additional product detail required to complete the quarterly SUTs. The fundamental assumption underlying the model is that the economic relationships that apply in the reference year tables, in theory and in volume terms, remain the same during the subsequent quarterly estimation periods. As the substantial component is based on modelled data, it is not generally used to compile the QNA but is used instead as a validation tool in the compilation process. It helps to identify and resolve inconsistencies in the data and in the longer run, it may help to identify areas of improvements of the accounts and lead the way for the establishment of a regular compilation of quarterly SUTs.

14.40 In general, a quarterly SUTs based model makes use of the relationships in the latest annual SUTs and expands the data of the QNA to roughly the level of detail in the annual SUTs. The underlying assumption is to consider industry/product structure in the quarterly SUTs is relatively stable until the next set of annual SUTs become available. As industries and economies are ever-changing more rapidly, then this assumption albeit valid becomes weaker, especially in current prices. Here, coefficients of the previous quarter should be used, where data is available.

14.41 The quarterly SUTs based model is best applied to seasonally adjusted data in volume terms. As mentioned earlier, a quarterly SUTs based model should be based on ratios calculated from annual SUTs. Annual-to-quarter assumptions work better for volume estimates than for current price estimates, as the price component may be subject to sudden changes even in the short-term. For example, large swings in international oil prices can modify remarkably the I-O ratios of high energy consuming industries such as transport. Similarly, assumptions from annual SUTs are better suited for seasonally adjusted data. Seasonal effects may change the annual relationships between variables, so it would be inappropriate to apply annual ratios to distribute quarterly patterns not adjusted for seasonality.

14.42 It may be useful to note that in order to accommodate a time dimension in the quarterly SUTs based model, the basic SUTs will need to be expanded to create a suite of inter-related tables with each table having a time dimension covering the total estimation period.

14.43 The first step in the construction of a quarterly SUTs based model is to create a domestic output table at basic prices from the production based GDP estimates. The domestic output table distributes output by economic activity into primary and secondary products. Quarterly output is usually calculated in the QNA system by economic activity, very often by assuming a stable relationship with GVA in volume terms. A quarterly distribution of the output of economic activities can be made by taking the shares of primary and secondary products from the most recent annual SUTs. This assumption reflects the mix of products produced by an industry, in volume terms and seasonally adjusted, should remain fairly stable in the short-term.

14.44 The next step is to populate the remaining elements contained in the Supply Table. Quarterly data on imports of goods and services are readily accessible with sufficient detail from the merchandise trade statistics and Balance of Payments data; therefore it should not be complicated to populate the imports column with actual data. In absence of detailed data, the structure of imports of goods separate from the imports of services from the annual SUTs can be used to distribute total quarterly imports of goods and services. However, this assumption may not work well, for example, for economies with large shares of imported capital goods, which can cause swift changes in the mix of imports and their destination for use.

14.45 The Supply Table is completed with the transformation of basic prices into purchasers' prices, which is the valuation needed for supply of products to match the valuation for the use of products in the Use Table.

14.46 The first transformation required is to allocate trade and transport margins among the various products. This calculation can be done using the structure of margins by product from the annual SUTs. As the total amount of margins is known from the quarterly domestic output table, the initial allocation of margins by product (based on the annual SUTs) has to be reconciled with the total amount. A similar two-step transformation is done for taxes less subsidies on products. The initial allocation of net taxes based on the flows of output is reconciled with the total quarterly net taxes provided by government data.

14.47 The intermediate consumption part of the Use Table should also be linked to the production based GDP estimates. Intermediation consumption by industry should preserve the fixed (or stable) relationship between GVA and output. Hence, total intermediate costs by industry are to be distributed based on the intermediate input structure in the annual SUTs. The assumption of a stable intermediate input structure is reasonable for relatively short-term periods of time in volume terms. This is not true in current prices due to short-term price volatility. When compiling quarterly SUTs (in current prices and in previous years' prices, unadjusted and seasonally adjusted), the assumption of stable product structures by industry may be acceptable for seasonally adjusted data in volume terms. The seasonality of output and intermediate consumption may cause the quarterly structure of unadjusted data to differ from the annual structure, here it would be better to use the ratios from the SUTs of the same quarter of preceding year.

14.48 The last step in the calculation of quarterly SUTs based model is to break down each of the final use components by product. The Use Table should be based on the quarterly estimates of expenditure components that are as far as possible independent from the production based quarterly GDP estimates.

14.49 The quarterly total flows in the Use Table are distributed by product using the simplest assumption that the shares in the annual SUTs for each final use category remain stable in the short-term in volume terms. This assumption can be satisfactory for household consumption, which presents fairly regular patterns dominated by frequent purchases (food, housing, transportation, etc.). However, this assumption may not hold true, even in the short-term, for other final use categories. For example, purchases of certain capital goods may be very volatile, which can introduce substantial differences with respect to the product shares. The same can happen with exports, especially for small-open economies. Once again, this assumption may work well only for quarterly seasonally adjusted data and in volume terms.

14.50 For changes in inventories, it is very unlikely that the product allocation in a year remain the same for each quarter. Inventory levels can move very rapidly between quarters due to different phases in the economy, movements that can modify substantially the product shares estimated in the annual SUTs. An alternative assumption for calculating quarterly inventories in the SUTs based model is to link the opening and closing levels of inventories to the supply of products (output plus imports). The difference between the closing and opening stocks (inventory levels) would give an estimate of the changes in each quarter. In this case, however, the quarterly distribution for the type of product for the changes in inventories is based on the annual SUTs is preferred for practical reasons.

14.51 Once all the elements of the quarterly SUTs based model are generated and put into place, it is possible to compare and analyse the discrepancies between total supply and total use for each individual product. This is the main objective of using a SUTs based model for validating the components of quarterly GDP. Although the quarterly tables are constructed with several assumptions, they can provide a very useful insight into the sources of aggregate discrepancies arising from the aggregate quarterly GDP estimates as well as identifying at detailed levels, where new, and significant, product imbalances have materialised.

Reference Year

14.52 The reference year plays an important role in the structure of the quarterly SUTs based model as the ratios from the annual SUTs influence the breakdown of the quarterly totals. The obvious natural choice is to use the latest year of the annual SUTs. Re-referencing the quarterly SUTs model involves re-specifying the level and composition of outputs and intermediate inputs for each industry to reflect the relationships in the latest reference year. Updating the reference year ensures that changes in economic relationships are captured in the quarterly SUTs based model as soon as possible, although the reference year may have lags with the QNA data by between one and two years.

14.53 For some years, the structural changes in the economy may be relatively small, with change occurring incrementally in response to factors such as technological advances and changing consumer tastes. However, some events can have a significant impact on the cost structure of industries and take place rapidly. For example, a severe drought is likely to change the relationship between the supply of products and the intermediate use of products for the agriculture industry.

Seasonally adjusted data versus unadjusted data

14.54 A priority when using SUTs for validating the components of quarterly GDP is that all the assumptions made should maximise the preservation of the time series properties of the QNA and avoid any breaks between quarters. Using seasonally adjusted data facilitates the application of annual ratios to distribute quarterly data. However, ratios taken from the annual SUTs of contiguous years (when available) can be substantially different. This could create steps between the last quarter of one year (based on a set of ratios from that year) and the first quarter of the following year (based on a different set of SUTs). In such cases, instead of using fixed quarterly ratios, the annual ratios in the two different years can be interpolated to smooth out the transition between the two levels.

14.55 For the QNA data, unadjusted for seasonal effects, a quarterly SUTs based model using annual assumptions poses greater challenges. The relationship between economic variables can be highly seasonal. For example, the share of purchases of tourism services during a holiday period is certainly higher than the annual average. However, if proper assumptions about the seasonal variation can be made, a quarterly SUTs based model for unadjusted data can help reveal inconsistencies between the seasonality of production and expenditure data. For example, seasonal peaks and troughs are expected to appear in the same quarters along the supply and use of specific product rows. A quarterly SUTs based model based on unadjusted data could reveal inconsistencies when related QNA variables are based on indicators with diverging seasonal patterns.

14.56 An approach to consider in obtaining quarterly seasonally adjusted benchmarked chain-linked data may be:

- Step 1- Seasonally adjust quarterly national accounts data at the highest level of breakdown and obtain the corresponding seasonal factors;
- Step 2 - Derive seasonally adjusted data at previous years' prices;
- Step 3 - Different aggregates seasonally adjusted at previous years' prices can be obtained just by adding up the corresponding components;
- Step 4 - Balance the quarterly SUTs and chain-link the results; and
- Step 5 - Carry out a residual seasonality analysis (in some cases, this implies changing the seasonal factors using the balanced unadjusted series, and then returning to Step 1).

Data in current prices versus data in volume terms

14.57 The construction of quarterly SUTs (fully balanced or nearly balanced) in volume terms can help analyse the consistency of the QNA figures in current prices. The final quarterly SUTs in previous years' prices can be reflated with available price indices (for example, producer prices, consumer prices, imports and exports prices). Discrepancies in the resulting quarterly SUTs in current prices can identify inconsistencies in the price statistics at a detailed product and industry level. Furthermore, the results from the quarterly SUTs based model can be compared with the current price estimates derived from the QNA system. In this way, a quarterly SUTs based model can also be beneficial for improving the quality of the estimate of the GDP deflator.

Level of detail and classification

14.58 The level of detail for a quarterly SUTs based model is to be chosen with pragmatism. Theoretically, one may wish to build quarterly SUTs with hundreds of rows and columns to improve the robustness of the assumptions. However, the work for developing and maintaining large systems of quarterly SUTs may be unsustainable. Quarterly SUTs based models should be simplified versions of existing annual SUTs. The detail level of the QNA system is certainly to be considered when deciding the number and type of products and economic activities of the quarterly SUTs based model.

14.59 When quarterly GDP is calculated using only the production approach, the quarterly SUTs based model can be used to develop a rudimentary estimate of quarterly GDP using the expenditure components. Many countries do not produce quarterly GDP by expenditure because of lack of source data (i.e. lack of a continuous household consumption data source). Product-flow assumptions from available annual SUTs (i.e. fixed shares underpinning the breakdown of final use) can be used to allocate the production based estimates between the different uses. With this approach, however, the resulting GDP estimate using the expenditure approach would be constructed from the production based GDP data (no discrepancy would appear between the two estimates). Consequently, the quarterly GDP by expenditure could not be considered an independent measure of the GDP.

14.60 The classification used in the quarterly SUTs based model should reflect the classification used in the annual SUTs and the QNA and therefore the underlying data sources.

3. Quarterly SUTs for QNA

14.61 The compilation of balanced quarterly SUTs is the best option for the compilation of coherent and consistent QNA but it poses some challenges such as data availability and data coverage, timeliness of the data processing, balancing and an appropriate level of resources.

14.62 Most of the considerations covered in the previous section also hold for the compilation and publication of quarterly SUTs. However, the compilation of quarterly SUTs often relies on a wider set of source data with high frequency and a more complete balancing process. Some countries regularly compile and publish quarterly SUTs. The text below is based primarily on the experience in the compilation of quarterly SUTs in the Netherlands.

Quarterly SUTs in the Netherlands

14.63 In the Netherlands, the quarterly estimate of GDP and its components covering both the production and expenditure approaches to measuring GDP are compiled using quarterly SUTs. The quarterly SUTs are simultaneously compiled in current prices and in volume terms.

14.64 For each quarter, two estimates are made, a flash estimate which is published at T+45 days and a firmer estimate which published at T+90 days. When making the estimate for the fourth quarter, the first three quarters are updated in order to get a best possible first flash estimate of the concerning reporting year. The four quarterly SUTs also form the base for estimates for the preliminary years combined with new information for certain industries and expenditure categories, for example, government, banking and insurance, health services and foreign trade.

14.65 Like the annual SUTs, the quarterly SUTs are balanced at purchasers' prices excluding VAT (Use Table). The valuation gap between output at basic prices and the supply at purchasers' prices is covered through the additional columns on trade and transport margins and taxes and subsidies on products in the Supply Table. Also, non-deductible VAT is recorded in a separate row in the Use Table.

14.66 The quarterly SUTs cover estimates in both current prices and in volume terms. The volume based estimates are expressed in average prices of the previous year. The choice for the price base ensures additivity of the four quarters to annual figures in volume terms. In order to estimate volume changes, the corresponding quarter of T-1 has to be also expressed in average prices of T-1.

14.67 For each cell of the SUTs, the following data are available:

$CP_{i,t} = \sum_i (P_{i,t} * Q_{i,t})$, current prices of quarter i of year T

$PYP_{i,t} = \sum_i (P_{t-1} * Q_{i,t})$ 'volume terms' of quarter i of year $T-1$ expressed in average prices of the year T-1

$AYP_{i,t-1} = \sum_i \left(P_{t-1} * Q_{i,t-1}\right)$ 'volume terms' of quarter i of year $T-1$ expressed in average prices of the year $T-1$

$CP_{i,t-1} = \sum_i (P_{i,t-1} * Q_{i,t-1})$, current prices of quarter i of year $T-1$

$PI_{i,t/t-1} = CP_{i,t}/PYP_{i,t}$, price index of quarter i of T expressed in the average prices of year $T-1$

$PI_{i,t-1/t-1} = CP_{i,t-1}/AYP_{i,t-1}$, price index of quarter i of $T-1$ expressed in the average prices of year $T-1$

$VI_{i,t} = PYP_{i,t} AYP_{i,t-1}$, volume index of quarter i of T compared with quarter i of $T-1$.

Source data

14.68 Compared with the annual data, the source data for quarterly estimates are less detailed and are often less reliable. In addition to the lack of detail, the main omissions include data covering intermediate consumption and changes in inventories.

14.69 For manufacturing and commercial services, the main data sources for turnover are based on VAT or surveys. For agriculture, the data on quantities and prices are available. For the flash estimate, government budget data are used whereas for the firmer based estimate, for a large part of government, quarterly government accounts are available. Data on financial institutions are provided by the central bank. Health care is estimated using a model approach.

14.70 Estimates for exports and imports of goods and services are based on data derived from foreign trade statistics. Consumption of households is based on data from retail trade, and specific information like vehicle registration.

14.71 When GFCF is not available on a quarterly basis, estimates can be derived from the supply of capital goods following a "product flow" approach. For specific parts, additional information is available like the vehicle registration, airplanes, ships, etc.

14.72 For changes in inventories, only limited information is available and estimates are made during balancing combined with the seasonal pattern of the previous year.

14.73 No quarterly data are available for trade and transport margins. These are estimated using the ratios/percentages from the annual SUTs of the previous year. For the volume estimates, this corresponds to the rules described in Chapter 9. By applying this assumption for current prices, a possible change in the percentage of trade and transport margins will be missed until the incorporation of the next annual SUTs.

14.74 For the deflation of the quarterly SUTs, producer price indices, import and export prices and consumer price indices are available. The observed data are transformed into indices having the average prices of T-1 as the base.

14.75 As very little data for intermediate consumption are available, the initial estimates are based on the assumption of fixed I-O coefficients in volume terms. For each industry, each product forming intermediate consumption, the ratio to total output of the corresponding quarter of T-1 is applied to the estimates in volume terms of the quarter being estimated. In order to get current price estimates, the volume estimates are inflated using the above mentioned price indices. When balancing, these initial estimates of intermediate consumption are adjusted and reconciled with the estimates of supply.

Balancing

14.76 The balancing of quarterly SUTs is very similar to the balancing of annual SUTs. The balancing process starts with the detection of large inconsistencies which need additional analysis and detailed investigations, these are balanced manually. An important difference with balancing annual SUTs is the reliability of the estimates of intermediate consumption. The same identities must hold and the same plausibility checks can be applied. However in the quarterly SUTs, there are more and larger adjustments made on intermediate consumption, although they must be within the limits that the balanced results show plausible movements over time and plausible I-O ratios.

14.77 In the balancing process, other checks are also undertaken such as the links with the labour accounts. Changes in labour productivity are an important indicator for judging plausibility. For the firmer based estimates in the quarterly SUTs, a balanced link with the quarterly sector accounts is also established.

Benchmarking or reconciliation

14.78 In order to get consistency between the quarterly accounts and the annual accounts benchmarking or reconciliation may be necessary. This implies that:

i. the sum of the four quarters in current prices equals the annual estimates in current prices.

ii. the sum of the four quarters of year T in average prices of the previous year (T-1) equals annual estimates of T in prices of the previous year (T-1).

iii. the sum of the four quarters, for example, for T-1 in average prices of T-1 equals the annual estimates of T-1 in current prices (of T-1).

14.79 In the Dutch approach, the preliminary annual estimates are the sum of the four quarters combined with annual information for specific industries or expenditure categories (for example, government, banking and insurance, health services and foreign trade). After having reconciled large discrepancies between quarterly and annual information for those specific items, the balancing of the four quarters and the annual information is done simultaneously using automated procedures.

14.80 For the final estimates, for most industries the annual source data are available including intermediate consumption and changes in inventories. The final annual estimate of the SUTs is made autonomously and is not linked to the (updated) quarterly SUTs. Therefore for the final estimates, the quarterly SUTs have to be benchmarked/reconciled with the annual SUTs. After having reconciled the large discrepancies between quarterly and annual SUTs, the benchmarking of the four quarters is done simultaneously using automated procedures.

Chapter 15. Disseminating Supply, Use and Input-Output Tables

A. Introduction

15.1 Data dissemination is an important activity for any statistical production process as it provides the users with a range of statistics produced to internationally agree guidelines. Presenting SUTs and IOTs to the users in a clear, transparent and user-friendly manner is thus an important task of the statisticians. This Chapter provides an overview of the elements that should be considered when disseminating SUTs and IOTs. It starts in Section B with the identification of users' needs in order to tailor the dissemination to the main types of users of SUTs and IOTs. Section C describes the importance of having a dissemination strategy and the elements that should be covered in the strategy. Section D describes the importance of the communication strategy when disseminating statistics as statistical information is nowadays not just made available but is 'communicated' to the users in a way that it is made more accessible and understandable. Section E provides examples of dissemination formats of SUTs and IOTs and provides the list of tables that are often published. Finally, Section F elaborates on the Statistical Data and Metadata Exchange (SDMX) which was developed for the data and metadata sharing for National Accounts and which includes a module for SUTs and IOTs.

B. User identification

15.2 Economic statistics have a wide variety of users with very different uses of the statistics. The SUTs, IOTs and other related products provide important analytical tools for many types of users including all levels of government, international organizations, the private sector, research institutions, the public including the media, etc. These users can be grouped into two main categories with respect to the intensity of statistical use of the information disseminated. There are general data users (such as journalists, students, teachers, small businesses, or general citizens who have simple data requirements but from a great range of information) and analysis users (such as government departments, local authorities, researchers, and international organizations with complex data requirements on detailed variables, time series and regional breakdowns).

15.3 The need to be aware and understand who the users may be and their needs is extremely important not only to compile SUTs and IOTs (the identification of users' needs is the first phase of the statistical compilation process, see Chapter 3) but also to identify effective ways to disseminate the statistical information. Indeed, knowing who the users are helps to steer what message is being conveyed when statistics are released in a language understood by users (who may not have the technical expertise of the nuances of National Accounts or references like the SNA or BPM).

15.4 To meet the different demands, the dissemination of SUTs and IOTs can be made using different channels. For example, *press releases* are generally used by the media and the general public with the presentation of the main findings from the SUTs and IOTs. Detailed information on SUTs and IOTs is usually presented in the *Yearbooks* of the country; this information can be used by researchers, students or international organizations. *Special publications* can also be prepared with time series, with detailed data, accompanied by metadata and sometimes by a short economic analysis based on these indicators. These publications can be used for different purposes by government, researchers, academic media or international organizations. Finally, *electronic dissemination* offers the opportunity to reduce the costs of dissemination and make information more usable and accessible, for example, through the NSO Website.

C. Dissemination strategy

15.5 The compilation of SUTs and related products in general form a small subset of the data compiled by the NSO (or NCB) but a key and very rich dataset in terms of the inter-linkages between all players in an economy - all producers of goods and services and all consumers of goods and services. Thus, the dissemination of SUTs and IOTs should be part of a more comprehensive dissemination strategy of the office compiling these tabulations.

15.6 The dissemination strategy includes various elements such as what information is made available, the timeliness, coherence between disseminated data sets, statistical confidentiality, revision policy, user needs, formats and means of dissemination, and dissemination of metadata and information on data quality.

15.7 The dissemination strategy is to be developed/formulated in line with the Fundamental Principles of Official Statistics (2013), see Box 15.1. Principle 1, in particular, states that "…official statistics are to be compiled and made available on an impartial basis by official statistical agencies to honour the entitlement of citizens to public information" and sets out a clear steer for dissemination.

Box 15.1 UN Fundamental Principles of Official Statistics

Principle 1

Official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honour citizens' entitlement to public information.

Principle 2

To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.

Principle 3

To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.

Principle 4

The statistical agencies are entitled to comment on erroneous interpretation and misuse of statistics.

Principle 5

Data for statistical purposes may be drawn from all types of sources, be they statistical surveys or administrative records. Statistical agencies are to choose the source with regard to quality, timeliness, costs and the burden on respondents.

Principle 6

Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.

Principle 7

The laws, regulations and measures under which the statistical systems operate are to be made public.

Principle 8

Coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system.

Principle 9

The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels.

Principle 10

Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries.

Adopted by the UN General Assembly – 73rd plenary meeting on 29 January 2014

15.8 To help establish good dissemination practices, there is a range of information and good practice already available. For example, the General Data Dissemination Standards (GDDS) (IMF, 2013) was developed by the IMF to assist Member Countries not in a position to subscribe to the Special Data Dissemination Standards (SDDS) to develop nevertheless a sound statistical system as the basis for timely dissemination of data to the public. The purpose of the GDDS is to encourage member countries: to improve data quality, to provide a framework for evaluating needs for data improvement and setting priorities in this respect, and to guide countries in disseminating comprehensive, timely, accessible, and reliable economic, financial, and socio-demographic statistics to the public. The United Nations Economic Commission for Europe developed a set of publications providing guidance to statistical organisations covering communication and dissemination of statistics (see UNECE, 2009). These publications have been prepared within the framework of the UNECE Work Sessions on the Communication and Dissemination of Statistics.

15.9 Other examples of dissemination practices can be found in the Statistics Code of Practice, such as the EU Statistics Code of Practice (Eurostat, 2011), the UK Code of Practice for Statistics (UK Statistical Authority, 2009), etc.

1. Release calendar

15.10 The availability of a release calendar is important for the users. Knowing when the information is released/disseminated allows the user to plan their activities accordingly. The compilation and release schedule should be realistic for compilers and, at the same time, useful for users. In addition, it is often a good practice to announce in advance the precise dates at which particular data series will be released. The advance release calendar should be posted at the beginning of each year, or at least well in advance of the release date on the websites of the agencies responsible for the dissemination. By doing so, this also helps to provide evidence of no political or ministerial interference with the production and dissemination of official statistics.

15.11 Figure 15.1 shows an example of a national release calendar covering SUTs, IOTs and National Accounts as in Statistics Denmark.

Figure 15.1 Release calendar covering SUTs, IOTs and National Accounts – Statistics Denmark

Statistics Denmark National Accounts Publication Schedule for 2017 (including revision schedule)					
Month of publication	Year T Q1	Year T Q2	Year T Q3	Year T Q4	Year T
Mid May of year T	A				
End May of year T	P				
End June of year T	R				
Mid August of year T	-	A			
End August of year T	R	P			
End September of year T	R	R			
Mid November of year T	-	-	A		
End November of year T	R	R	P		
End December of year T	R	R	R		
Mid February of year T+1	-	-	-	A	
End February of year T+1	R	R	R	P	P (SQ)
End March of year T+1	R	R	R	R	R (SQ)
End June of year T+1	R	R	R	R	R (SQ)
Beginning November of year T+1	-	-	-	-	R (AP1)
End November of year T+1	R	R	R	R	-
Beginning November of year T+2	-	-	-	-	R (AP2)
End November of year T+2	R	R	R	R	-
Beginning November of year T+3	-	-	-	-	F
End November of year T+3	F	F	F	F	-

Note:

A	Advanced or flash GDP estimate (GDP 45)
P	Preliminary QNA figures (QNA60)
R	Revised (applies both to QNA90 and to successive revisions)
F	Final (applies both to annual and quarterly figures) Annual figures include final SUTs and IOTs.
SQ	Sum of quarters
AP1	First preliminary annual calculation including IOTs.
AP2	Second preliminary annual calculation including IOTs.

The revisions of the quarterly figures in November T+1, T+2 and T+3 are made in order to make the quarterly figures consistent with the annual figures.

The above detail has been compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) (as at February 2017).

2. Data revision and revision policies

15.12 Revisions are an essential part of data compilation. They occur as a consequence of the trade-off between the timeliness of published data and their reliability, accuracy and comprehensiveness. To address this trade-off, the responsible agencies often compile and disseminate the provisional data that are then revised when new and more accurate data become available. Although, in general, repeated revisions may be perceived as reflecting negatively on the reliability of official data, the attempt to avoid them by producing accurate but very untimely data will result in failing to satisfy the users' needs.

15.13 Figure 15.2 shows the UK quarterly and annual revision (including SUTs) policy to the first estimate of quarterly GDP through successive quarterly exercises through to annual benchmarking. The pending revision policy (quarterly or annual) and description of revisions is communicated well-in advance so users can prepare appropriately. This is even more important for significant revisions such as a new SNA or industrial classification or methodological changes and takes place via articles, seminars, etc. Although descriptions are provided, the exact estimates are not available until the release day.

Figure 15.2 Measuring United Kingdom GDP and SUTs - Revision policy

Month	Revision time frame – UK GDP estimate for 2013 Q1 (First UK Quarterly GDP estimate and subsequent revisions through to annual benchmarking)		
	Release	**Brief description**	**Revised periods**
Apr-13	1st estimate	Preliminary Estimate of GDP (after 25 days)	No revisions
May-13	2nd estimate	2nd Estimate of GDP (after 55 days)	2013 Q1 only
Jun-13	3rd estimate (Quarterly exercise)	Quarterly National Accounts (after 85 days) GDP, BoP, financial and non-financial accounts for all institutional sectors also released at the same time.	Up to past 13 quarters
Sep-13	Annual Exercise ONS Blue Book and Pink Book	2013 Q1 potentially revised	Annual and quarterly revisions back to 1990 Q1. SUTs revisions back to 1997.
Dec-13	Quarterly exercise	2013 Q1 potentially revised	Up to past 11 quarters
Mar-14	Quarterly exercise	2013 Q1 potentially revised	Up to past 12 quarters
Jun-14	Quarterly exercise	2013 Q1 potentially revised	Up to past 13 quarters
Sep-14	Annual Exercise ONS Blue Book and Pink Book	1st annual exercise Partial benchmarking	Annual revisions back to 1948. Quarterly revisions back to 1955. SUTs revisions back to 1997.
Dec-14	Quarterly exercise	2013 Q1 potentially revised	Up to past 11 quarters
Mar-15	Quarterly exercise	2013 Q1 potentially revised	Up to past 12 quarters
Jun-15	Quarterly exercise	2013 Q1 potentially revised	Up to past 13 quarters
Sep-15	Annual Exercise ONS Blue Book and Pink Book	2nd annual exercise Benchmarking short-term indicators 1st annual balancing exercise through SUTs	Annual revisions back to 1985. Quarterly revisions back to 1985. SUTs revisions back to 1997.
:	:	:	:
:	:	:	:

Note:
The Revision Policy can, and does, vary for quarterly exercises, for example, to allow for exceptional cases. Always determined well in advance.
For each quarterly / annual exercise, whatever the policy for periods open to revision, it applies to all variables, accounts and institutional sectors.
The periods open to revision cover both current prices and previous years' prices as well as reflect annual chain-linking of the volume data.
The above detail has been compiled by Sanjiv Mahajan (Office for National Statistics, United Kingdom) (as at February 2017).

15.14 In general, countries are encouraged to develop a well-designed revision policy that is carefully managed and coordinated with other areas of statistics as well as communicated to users well in advance. The development of such a policy should aim at providing users with the necessary information to cope with revisions in a more systematic manner. The absence of coordination and planning of revisions is considered a quality problem by users. Essential features of a well-established revision policy are a predetermined schedule, reasonable stability from year to year, openness, advance notice of reasons for the revision and its effects, easy access of users to sufficiently long time series of revised data, as well as adequate documentation of revisions included in the statistical publications and databases.

15.15 In general, errors (statistical or data processing errors) should be corrected as soon as they are detected. In some cases, the compiling agency may decide to carry out a special revision for reasons of reassessing the data coverage and/or data compilation methods, which could lead to significant changes in the historical time series. It is recommended that such revisions be announced in advance and the reasons for such revisions, as well as assessment of their possible impact on the available data, should be given. (see also the United Nations forthcoming Handbook on Backcasting)

3. Confidentiality

15.16 One of the most important policy concerns relevant to data dissemination is the preservation of statistical confidentiality. Statistical confidentiality is necessary in order to gain and keep the trust of both respondents to statistical surveys and users of the statistical information. The Sixth United Nations

Fundamental Principles of Official Statistics (see Box 15.1) stipulates that individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons or not, are to be strictly confidential and used exclusively for statistical purposes.

15.17 It is therefore important that appropriate disclosure checking procedures are in place as part of the dissemination process. In some cases, permissions may be sought from a business to publish information which helps to reduce the number of disclosive cells.

15.18 Where data validation by an external organization or a specific expert is necessary or significant benefits as part of data quality assurance are expected or have been previously demonstrated, unreleased non-confidential information may be provided in such cases under strict and agreed conditions for the purposes of validation/quality assurance before its official release.

4. Metadata

15.19 Metadata are "data about data" which enable and facilitate sharing, querying, understanding and using statistical data over the different stages of collection, compilation and dissemination, and at their various levels of aggregation (i.e. from micro-data to macro-data). They encompass administrative facts about the data (who has created them and when) and definition of concepts applied as well as description of how data were collected and processed before they were disseminated or stored in a database. Metadata are important for users and also play a crucial role in the statistical production process, as common standards and definitions should be followed to the extent possible throughout all statistical domains in order to facilitate the linking and integration of statistical information.

15.20 As metadata are generated and processed during every step of the compilation process, there is a strong need for a metadata management system to ensure that the appropriate metadata retain their links with data. Metadata dissemination should be an integral part of the dissemination strategy. A good practice in this regard is to actively link metadata to the statistical data they describe, and vice versa by implementing metadata-driven systems and management systems for metadata throughout the various stages of the statistical production process. There are several information model specifications that can contribute to achieving this goal, most notably SDMX (see Section F). While such specifications are designed to enable performance of different functions, they can be used together in the same system, or complement each other, in the compilation and exchange of data and metadata. Box 15.2 provides examples of reference Metadata in the SDMX Metadata Structure for SUTs and IOTs.

Box 15.2 Reference Metadata in the SDMX Metadata Structure for SUTs and IOTs

1. Contact	11. Quality management
2. Metadata update	12. Relevance
3. Statistical presentation	13. Accuracy
4. Unit of measure	14. Timeliness and punctuality
5. Reference period	15. Coherence and comparability
6. Institutional mandate	16. Cost and burden
7. Confidentiality	17. Data revision
8. Release policy	18. Statistical processing

9. Frequency of dissemination 10. Accessibility and clarity	19. Comment

Source: http://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/data/database

D. Communications of SUTs and IOTs with users

15.21 The production, analysis and dissemination of official statistics must be done in a transparent and accessible way. To aid all users, information is provided through different channels, for example website, regular press releases, news releases, statistical reports and emails.

15.22 All communications should be supported via a solid relationship with the media, who tend to be the main distributors of public statistics to the general public. In this way, the information is available to all users at the same time without privileged access, although there may be limited number of people with time limited pre-release access for specific reasons.

15.23 The communications department in the NSO (or NCB) is responsible for the relationship between NSO (or NCB) and the media organising and coordinating press briefings, press conferences, interviews with experts, requests from journalists and other requirements such as handling media crisis or correction responses to media comments. In addition, lock-in type briefings for journalists and media reporters may be undertaken just ahead of a release to allow for quick, timely and efficient dissemination of material by the media moments after the official releases.

15.24 This type of approach should be applied to most official press releases, more so those which may contain market sensitive material. With such lock-in type procedures, attendees would not be allowed use of mobiles phones or access to the Internet or other electronic devices. They would operate within the NSO (or NCB) controlled-environment whereby all connections go through a central switch which the NSO (or NCB) can manually turn on and off thereby preventing any leaks before release. These approaches also contribute to strengthening the image in the public eye of statistical independence, trust, confidence and there is no government/ministerial interference with official statistics.

15.25 The link between the media officers and the statistician is important. Media training should be provided for all statisticians who come into contact with the media as this is outside the scope of the work of the professional statistician.

15.26 To communicate National Accounts data effectively, a press release, report or article should:

- interpret the tables of numbers and graphs clearly;
- tell a story about the data;
- catch the reader’s attention quickly with a headline or a graph;
- be written in a clear and accessible way without (excessive) use of economic and statistical jargon;
- be easily understood, interesting and entertaining; and
- encourage others, including the media, to use the national accounts data appropriately to add impact to what they are communicating.

15.27 Before preparing such materials, the target audience should be identified as a first step. It is also important to be aware of the available communication media, including the press, television, radio, Internet and (rapidly evolving) social media options.

E. Dissemination format for SUTs and IOTs

15.28 More often than not, SUTs and IOTs data tends to be annual data and less timely compared to the latest quarterly estimate of GDP. Nonetheless, this does not imply a newsworthy story cannot be extracted from the SUTs and IOTs data to form the basis of a news release. On the contrary, often newspaper headlines can be generated from the releases of SUTs and IOTs.

15.29 SUTs and IOTs data are disseminated mostly via the NSO (or NCB) websites with dedicated topic web-pages and through various file formats. Press releases, articles and analyses may be disseminated in PDF form as these are easier to print for users whereas the data are also provided in Excel or alternative spreadsheet formats on-line to allow users to easily manipulate the data to suit their needs – this aspect is very important in meeting user needs. Other lesser used formats include SAS, GAUSS and GAM. However the NSOs (or NCBs) need to ensure any format used is user-friendly.

15.30 The release of SUTs and/or IOTs and related articles and analyses can be produced and published as separate printed publications as well as produced as web-based analyses. Given the increasing popularity of data visualisation, data visualisation graphics could, or should, be utilised in releasing SUTs/IOTs based material making the products more understandable, and accessible, to users who are unfamiliar with them.

15.31 Other analyses such as satellite accounts for energy and air emissions are often linked to web-pages for SUTs and IOTs. These data are presented using exactly the same principles, definitions and classifications in National Accounts and SUTs and IOTs, and it is therefore possible to combine data for use in a wider range of analyses of economic trends and structures – this approach adds considerable value to the user, especially in terms of consistent and coherent related products available in close proximity.

15.32 The SUTs data can be disseminated in various forms and formats, for example, using open data formats, tabular data structures, etc. SUTs can be disseminated in a structured template format, for example, in Excel, with several worksheets covering different parts of the framework for a “specific year”. This structured template format has to adhere to good practice, discipline and stability as well as metadata standards in order to be effective. Below are examples of tables, after disclosure testing, that could be considered as part of the dissemination of SUTs, with the main tables shown in italics:

- *Supply Table at basic prices, including transformation into purchasers’ prices.*
- *Use Table at purchasers’ prices.*
- Valuation matrices.
- *Use Table at basic price with the split of Domestic Use Table and Imports Use Table.*
- *GVA by industry (split by the factor incomes and by institutional sector).*
- GGFCe table (separating Central Government and Local Government both split by ISIC by CPC).
- Household final consumption expenditure table (COICOP by CPC and analyses by type of durables and services).

- NPISHs table (ISIC by CPC and/or COPNI by CPC).
- GFCF table (ISIC by CPC).
- *Production account by industry and by institutional sector.*
- *Generation of income account by industry and by institutional sector.*
- PSUTs / EE-IOTs.

15.33 Similarly, an Excel workbook approach could be used for IOTs and related analyses for a "specific year". Examples of what is included when disseminating IOTs are provided below:

- Industry by Industry IOTs and/or Product by Product IOTs.
- Leontief Inverse.
- Multipliers (for example, output, employment, employment costs, etc.).
- Range of environmental accounts such as, for example. EE-IOTs, air emissions accounts, energy accounts, etc.

15.34 The above approach provides data for a "specific year". Assuming the structure of the templates are the same for each year, derived analyses or analytical tools or a menu driven analyses or pivot tables could be provided to allow for time series analyses or revision analyses of any cell in the framework or ratio-type analyses. Further examples of such derived analyses may include:

- Export shares of goods and services by product.
- Import penetration of goods and services by product.
- Net trade in goods and services by product.
- Labour and capital productivity by industry.

15.35 Furthermore, the NSO (or NCB) could provide functional analyses meeting a range of user needs. More examples are provided in the Additional Reading section at the end of this Handbook, for example:

- Specific cross-cutting sectors such as the "digital sector", "sharing economy", "creative sector", "food sector", "oil and gas sector" and "sports sector".
- Concentration ratios for businesses by industry.
- Satellite accounts, for example, agriculture, tourism, health and education.

F. The Statistical Data and Metadata Exchange initiative

15.36 Seven institutions, namely the BIS, European Central Bank, Eurostat, IMF, OECD, United Nations and the World Bank sponsor the Statistical Data and Metadata Exchange (SDMX) initiative to foster standards for the exchange of statistical information. The standard is an ISO standard (ISO/Technical Specification ISO 17369:2013, which revises ISO/Technical Specification 17369:2005). It offers an information model for representing statistical data and metadata, as well as several formats to represent this model (SDMX-EDI and several SDMX-ML formats). It also proposes a standard way of implementing web services, including the use of registers.

15.37 The SDMX information model covers various elements. They are listed and described as follows:

- Descriptor concepts. In order to make sense of statistical data, it is necessary to know the concepts associated with them. For example, on its own, the figure 1.2953 is pretty meaningless but if we know that this is an exchange rate for the United States dollar against the euro on 23 November 2006, it starts to make more sense.
- Packaging structure. Statistical data can be grouped together at the following levels: the observation level (the measurement of a phenomenon); the series level (the measurement of a phenomenon over time, usually at regular intervals); the group level (a group of series, a well-known example being the sibling group, a set of series which are identical except for the fact that they are measured with different frequencies); and the data set level (comprising several groups covering, for example, a specific statistical domain). The descriptor concepts mentioned above can be attached at various levels in this hierarchy.
- Dimensions and attributes. There are two types of descriptor concepts: dimensions, which both identify and describe the data, and attributes, which are purely descriptive.
- Keys. Dimensions are grouped into keys, which allow a particular set of data (a series, for example) to be identified. The key values are attached at the series level and given in a fixed sequence. By convention, frequency is the first descriptor concept and the other concepts are assigned an order for that particular data set. Partial keys can be attached to groups.
- Code lists. Every possible value for a dimension is defined in a code list. Each value on that list is given a language-independent abbreviation (code) and a language-specific description. Attributes are represented either by codes or free-text values. Since the sole purpose of an attribute is to describe and not to identify the data, this is not a problem.
- Data structure definitions. A data structure definition (data classification scheme) specifies a set of concepts which describe and identify a set of data. It indicates which concepts are dimensions (identification and description) and which are attributes (just description), and it gives the attachment level for each of these concepts on the basis of the packaging structure (data set, group, series or observation), as well as their status (mandatory or conditional). It also specifies which code lists provide possible values for the dimensions and gives possible values for the attributes, either as code lists or free-text fields.

15.38 The SDMX Data Structure Definitions for National Accounts data exchange covers a module for the SUTs and IOTs. It is envisaged that the implementation of SDMX compliant databases will facilitate the data and metadata exchange.

Part C

Chapter 16. Regional Supply and Use Tables

A. Introduction

16.1 The SUTs compiled at the national level, similarly to the National Accounts, can often hide differences in the economic and social development between various regions within the country. In the recent years, there has been an increasing interest in compiling regional National Accounts as well as regional SUTs, consistent with their national counterpart providing more detailed and disaggregated information for regional economic analysis, fiscal and monetary policy and monitoring. The term "regional" refers in this Chapter to sub-national areas that make up the country under consideration.

16.2 Many of the issues in compiling regional SUTs and IOTs are similar to those encountered in the compilation of regional National Accounts, such as, for example, assigning transactions to *multi-regional units* which have the centre of predominant economic interest in more than one region. Assigning transactions to *national units* for which the centre of predominant economic interest cannot be geographically located as in the case of multi-regional units (this is the case, for example, of government, national railway, electricity corporations, etc.) (see 2008 SNA paragraphs 18.47-18.51).

16.3 Other issues involve the compilation of the inter-regional trade flow matrices. Since in the regional accounts each region is treated as a different economic territory thus the transaction with other regions are treated as external transaction. However, the distinction of external transactions between those with the rest of the world and those with other regions within the country is important in order to explicitly maintain the link with the National Accounts.

16.4 This Chapter provides in Section B a general description of the two main methods to compile regional SUTs and IOTs using the top-down and bottom-up methods. The issues in the compilation of regional SUTs are presented in Section C as part of a practical country example of Canada. The country example is representative of the conceptual and practical issues commonly encountered in the compilation of regional SUTs and IOTs.

B. Issues and methods for compiling regional SUTs and IOTs

16.5 There are a number of statistical issues related to the compilation of regional accounts. They include the selection of the relevant statistical unit, the treatment of productive activities crossing regional boundaries, data availability, confidentiality and the consistency of matching micro estimates and macro estimates.

16.6 In general, the statistical units that are particularly relevant for compiling regional aggregates are local kind-of-activity units (establishments) and kind-of-activity units (enterprises). Enterprises often cover activities in more than one region and therefore not totally suitable for regional accounts. Establishments are often preferred as they are strictly defined to be in geographically identified places. However, there are also some issues with their choice. Full information at establishment level may not be available. In addition, mobile equipment such as ships, trains, planes cannot be local units. They have to be attached to local units in an appropriate and consistent way. Also, sites with no labour activity (such as railway crossing or automated signal boxes) cannot be local units.

16.7 The case when a producer unit has only one site does not generally pose conceptual issues. However, in practice, many producer units have sites in more than one region and are active in more than one industry (multi-regional and heterogeneous units). Depending on the information available for the different type of statistical units, whether local units, establishments or enterprises, the classification at local and aggregated level should be consistent as much as possible in order to obtain reliable regional aggregates, for each region and by industry, and consistent with the national aggregates.

16.8 Some productive activities cross regional boundaries. These include, for example, transport services and energy supply. Producer units may also operate in more than one region either at permanent sites or on a temporary basis, for example, builders may undertake work in different regions. This inter-regional activity has to be allocated consistently between regions. Two general approaches could be used: the *residence approach* and the *territorial approach*.

16.9 The residence approach consists of allocating GVA to the region where the unit is resident and the GFCF to the same region where the producer unit owning the goods use them. The residence principle is particularly difficult to apply in the energy and transport industries. In brief, the residence principle means that GVA from transporting goods across several regions is not split between the regions but allocated to one region, the region in which the producer unit is resident. Also GFCF in national infrastructure networks is allocated to the region where the unit in charge of the infrastructure is resident rather than where the asset is located.

16.10 In the territorial approach, activities resulting from factors of production would be allocated to the region in which the economic activities are actually carried out, irrespective of the resident regions of either the factor of production or the production units. The activities of the builder, for example, would be allocated to the region where the building site is located. The inter-regional transport activity would be split between the regions and GFCF on energy and transport networks would be allocated to the region where the asset is located. In more general terms, the activity resulting from factors of production would be allocated to the region in which the economic activities are actually carried out, irrespective of the resident regions of either the factor of production or the production units.

16.11 Data availability represents a major constraint when compiling regional accounts, SUTs and IOTs. The availability of regional statistics greatly impacts the method chosen for the compilation of regional accounts particularly for the compilation of trade flows across regions within a nation.

16.12 With a smaller territory of reference, represented by the regions of a country, more issues on confidentiality may arise as greater granularity is likely to create more data disclosure issues.

16.13 Another important issue with the compilation of regional accounts, SUTs and IOTs is the coherence and consistency of the accounts at regional and national level and also matching micro estimates and macro estimates.

16.14 The two main methods for compiling regional National Accounts, and thus regional SUTs and IOTs, are the *top-down* and *bottom-up methods*. The bottom-up (or ascending) method of estimating a regional aggregate involves collecting (or using) data at establishment level, and ascending by addition until the regional value of the aggregate is established. The method is named bottom-up because the elements for calculating the aggregate are directly collected at this local level.

16.15 The top-down method consists in the disaggregation at regional level of the National Accounts aggregates without attempting to single out the establishment or local unit. The national figure is distributed using an indicator which is as close as possible to the variable to be estimated. For example, wages and salaries might be allocated to regions using total employment multiplied by average earnings from a different statistical source. However, variables like GFCF are much more difficult to allocate across several regions meaningfully in economic terms as there are no linked proxies. The method is named top-down because the aggregate is allocated to a region and not to a local unit. The notion of a local unit does not always underpin the estimates. Sometimes an indicator is used to allocate an aggregate to regions.

16.16 In general, the **bottom-up method is the preferred method** but it relies on the availability of detailed data collected at regional level. In practice, the choice of the method is usually determined by the availability of data and the legislative and administrative arrangements in the country and the methods often used consist of a combination of the two methods above. For more information on the comparison between the top-down and bottom-up methods and methods for the compilation of regional accounts, please see Eurostat (2013) and (1995), and Eding, Oosterhaven, de Vet, and Nijmeijer (1999).

C. Example of bottom-up methods for regional SUTs - the Canadian experience

16.17 This section presents practical issues in the compilation of regional SUTs using a bottom-bottom-up approach through the description of the experience of Statistics Canada. The issues encountered by Statistics Canada reflect, to a great extent, general issues and therefore their description is done through a country example.

16.18 This section provides first an overview of the development and evolution of the annual Canadian Regional I-O programme since its inception in the late 1990s. It then describes the inter-regional accounting framework and the methods used to address specific issues such as the regional trade flows, the valuation, and other conceptual issues in the regional accounts. The last section describes the lessons learnt by Statistics Canada and future directions for the Canadian programme which provides useful insight to other countries at various stages of their statistical development.

1. Development and evolution of regional economic accounts

16.19 The Canadian Macroeconomic Accounts programme produces comprehensive annual provincial and territorial I-O Accounts. These consist of detailed rectangular SUTs built for the most part from the bottom-up approach, with the national SUTs being the sum of the provinces and territories. They are released around two and a half years after the reference period in question and are fully integrated with the other regional dimensions of the Canadian System of Macroeconomic Accounts (CSMA) programme. This includes more timely annual estimates of GDP income based and expenditure based, and real GDP by industry for Canada's provinces and territories. They draw on a well-developed statistical feeder system including economic surveys, tax data and other administrative and regulatory sources. They are entrenched in regional fiscal policy implementation and enable a range of important inter-regional analyses and applications.

(a) The evolution of the inter-regional accounts

16.20 The need for regional accounts to provide a rigorous framework for economic analysis has long been recognised in Canada. The Canadian economy is characterised by a high degree of regional diversity and specialization, as well as a high volume of trade among provinces and territories.

16.21 Regional I-O Accounts evolved out of national programmes with a long history in Canada. They started with developing the components of the income approach to measuring GDP and final domestic demand by province in 1981. The accounts replicated the concepts and framework at the national level but were constructed with more limited information. Rather than bottom-up estimation by region, they were generally based on approximate allocations of more robust statistics built at the national level. The early accounts were experimental in nature and lacked the critically important regional trade flows, which were subsequently developed when the enabling regional SUTs framework was in place.

16.22 Experimental IOTs for Canadian provinces and territories were developed on an ad hoc basis as resources permitted and included the reference years 1974, 1979, 1984 and 1990. These tables were primarily intended for modelling purposes and exploited data from existing statistical programmes designed to compile estimates at the national level. Unlike their national counterparts, they were not fully integrated with the standard national accounts programme and did not serve as benchmarks for National Accounts compilation.

16.23 Official, annual regional SUTs were introduced to the CSMA programme with the reference year 1997, when a significant investment was made in provincial economic statistics to improve the quality for use in specific regional fiscal policy applications. In particular, the regional tables would provide quality and detail sufficient for use in allocating revenue from the newly introduced Harmonised Sales Tax, a VAT type tax among the federal government and participating provinces.

16.24 Starting in 1997, a comprehensive programme was implemented to compile fully integrated national and provincial/territorial statistics for three components of the CSMA on an annual basis:

- income and expenditure dimension;
- provincial and territorial GDP by industry; and
- Input-Output accounts.

16.25 The use of the regional accounts was thereafter integrated in fiscal formulae spelled out in federal regulations.

(b) The development of statistical feeder systems

16.26 The new role played by regional accounts called for a significant improvement in the quality and detail of economic source data at sub-national level. To fulfil this role, an agency-wide project known as the Project to Improve Provincial Economic Statistics (PIPES) was launched in 1996. A principal mandate of PIPES was to ensure that provincial statistics used to build the new accounts were adequately reliable for inter-governmental revenue sharing and for critical scrutiny by participating governments. Since fiscal formulae relied on provincial shares to determine revenue entitlements, it was also necessary that estimates were uniformly reliable across all provincial jurisdictions. The existing survey framework and infrastructure was overhauled and revamped, and a range of new annual business surveys introduced.

16.27 A critical strategy of PIPES was to integrate the content of the economic survey programme via the introduction of the Unified Enterprise Survey (UES). The features of the UES included a centralised survey frame via an enhanced business register with regular profiling of the organizational structure of large complex enterprises to ensure their accurate representation of establishments by region. The strategy focused on the collection of production, employment, sales and other required information at the establishment level to accurately reflect the region where operations took place, while maintaining coherence at the enterprise level.

16.28 A second element of PIPES was to enhance Statistics Canada's access to, and its capacity to make use of, administrative records such as corporate tax files. Increased reliance on administrative records allowed data collection at substantially lower cost and with minimal response burden. The principal administrative data base is the General Index of Financial Information (GIFI), consisting of the financial statements of all Canadian businesses based on corporate income tax records. Other tax data on income statistics such as personal tax and personal income are also used extensively.

16.29 More recently, the objectives of the UES programme are being advanced through an expanded harmonization initiative at Statistics Canada known as the Integrated Business Statistics Program (IBSP). This new framework further integrates survey operations including content, collection and processing to realise important efficiency objectives. It also benefits from a more mature system of administrative data sources. Unlike the UES, which was limited to annual economic surveys covering specific industries (manufacturing, services and distributive trades) the IBSP will eventually cover all industries and activities surveyed, both annual and sub-annual.

2. The regional accounting framework

16.30 The Canadian SUTs are rectangular in format, permitting the articulation of many products per industry covering both outputs and inputs. A product may thus be produced by many industries and purchased by many users. The national and the inter-regional tables record 230 industries based on the North American Industry Classification (NAICS) and 490 products, as well as 278 categories of final uses, comprising:

- 100 household final consumption expenditures groups;
- 54 industry groups for gross fixed capital formation in machinery and equipment;
- 54 industry groups for gross fixed capital formation in construction;
- 54 industry groups for gross fixed capital formation in intellectual property;
- two inventory groups;
- nine categories of government and NPISH expenditure; and
- five categories for imports and exports.

16.31 The regional accounts in Canada are compiled for 14 regions which consist of 10 provinces, three territories and one territorial enclave.

16.32 In order to effectively integrate national and regional concepts and conventions, Statistics Canada focused on two principal areas: the development of inter-regional trade flows and the regionalization of production. These are described next.

(a) Inter-regional trade flows

16.33 The accounting framework of the inter-regional (or inter-provincial, as they are known in Canada) SUTs is an extension of the framework of the National SUTs. It consists of two sets of tables:

- SUTs for each region; and
- an inter-regional trade flows table.

16.34 The format of a regional SUTs differs from that of a national table in one essential aspect. The final expenditure categories include regional import and regional export columns, in addition to foreign export and foreign import columns of the national tables. This is represented in Table 16.1.

Table 16.1 SUTs framework for inter-regional SUTs

National

		Products				Industries				Final uses				Total
		Agriculture, forestry, etc.	Ores and minerals; etc.	...	Services	Agriculture, forestry, etc.	Mining and quarrying	...	Services	Final Consumption	Gross capital formation	Exports to ROW	Imports from ROW	
Products	Agriculture, forestry, etc.													
	Ores and minerals; etc.													
	...													
	Services													
Industries	Agriculture, forestry, etc													
	Mining and quarrying													
	...													
	Services													
Gross value added														GDP
Total														

Zero by definition

....

Region 2

Region 1

		Products				Industries				Final uses						Total
		Agriculture, forestry, etc.	Ores and minerals; etc.	...	Services	Agriculture, forestry, etc.	Mining and quarrying	...	Services	Final Consumption	Gross capital formation	Exports to ROW	Imports from ROW	Exports to other Regions	Imports from other Regions	
Products	Agriculture, forestry, etc.															
	Ores and minerals; etc.															
	...															
	Services															
Industries	Agriculture, forestry, etc															
	Mining and quarrying															
	...															
	Services															
Gross value added																
Total																

Zero by definition

16.35 The inter-regional trade flow tables provide a further regional breakdown for each column of regional export and import. This is a matrix which identifies the exporting and importing regions for each product. The data sources used in developing the flows are:

- Annual Survey of Manufacturers (destination of shipments);
- Annual Wholesale Survey (origin and destination);
- Surveys on transportation origin and destination;
- Surveys on destination of services data from business services; and
- Travel Survey of the Residents of Canada.

16.36 Trade flows are conceptually reflected by the sale of products from one region (or abroad) to another. Exports originate from a region if the goods or services are produced or withdrawn from inventories of an establishment in the region. The region of export or import refers to the ultimate region of origin and destination rather than the port of landing or the regions where goods are shipped. A regional export also occurs when goods and services are purchased within a region by non-residents, for example, hotel accommodation, meals or entertainment. Similarly, imports are defined if the goods or services are destined for the region's current expenditure or capital expenditure, used as intermediate inputs by establishments in the region or make up additions to inventories. Goods shipped into a region but destined for another region do not constitute imports.

(b) Valuation

16.37 Trade flows of goods are valued at basic prices. By this definition, the valuation of a good excludes all costs associated with transportation, distributive trade (wholesale and retail) mark-ups as well as taxes on products. This method of valuation is preferable to purchasers' prices, since it more accurately measures the value of trade flows of goods and services by permitting the decomposition of purchasers' price into its separate costs.

16.38 To illustrate this point, take a good produced in Quebec purchased by a wholesaler in Ontario and subsequently sold to a customer in Alberta via a retailer. A Manitoba trucker transports the good from Quebec to Alberta. As a final consumer, Alberta is importing from three provinces: Quebec, Ontario and Manitoba. The basic price value of the good is an import from Quebec, the wholesale mark-up is an import from Ontario, while the transportation service is an import from Manitoba. The retail margin is Alberta's own production and hence, there is no inter-provincial trade flow generated. If the trade flows were valued at purchasers' prices for the above example, this could only be represented as a single trade flow from Quebec to Alberta, and the activity occurring in Ontario and Manitoba would not be shown.

(c) Accounting Identities

16.39 The principal accounting identities used in the derivation of inter-regional and international trade flows of goods and services are described below.

16.40 In each province and for each product, the total domestic supply must equal the sum of sales to the rest of the world (international exports), sales to other provinces (inter-regional exports), and sales to its own region. Total domestic supply is defined as the value of production plus shipments out of the inventories of producers, wholesalers and retailers. Estimates of the total domestic supply originate with the regional SUTs. Each side of the identity (whether trade flows or components of total domestic supply) is often measured from different data sources.

16.41 In each province and for each product, the total domestic use must equal the sum of purchases from the rest of the world (international imports), purchases from other provinces (inter-provincial imports), and purchases from its own province. Total domestic use is equal to final domestic use plus intermediate domestic use (inputs into the production process) plus additions to inventories of producers, wholesalers and retailers. Again, estimates of the total domestic use originate with the regional SUTs. Each side of the identity (whether trade flows or components of total domestic use) is often measured from different data sources.

16.42 In each region and for each product, the total domestic supply minus total domestic use equals total exports minus total imports. This yields a measure of net trade by province and by product.

16.43 For each product, the sum of international exports and imports by region are identical to their national counterparts.

16.44 For each product, inter-regional exports and imports are the same when summed over all provinces since one region's exports must be another region's imports.

16.45 For each product, the sum for all regions' total domestic supply and use, combined with foreign supply and use equal the national values of total supply and total use.

16.46 Goods purchased outside Canada and re-exported to the rest of the world are not part of the regional identities. They are recorded as a separate element, as a trade flow from rest of world to outside Canada.

16.47 The above identities collectively form an accounting framework for adjusting source data, filling data gaps and analysing the quality and consistency of trade flow estimates. They are particularly important because although several sources exist that indicate trade flows, they are often not adequate for developing a complete matrix of inter-regional trade flows.

16.48 It is worth noting, that surveys on destinations are very unusual and difficult to undertake. However, it is essential to include wholesale trade to be able to follow deliveries. Chile is another country that undertakes similar surveys for their five-yearly benchmark SUTs.

16.49 The rectangular framework allows the trade flow pattern obtained from the sources mentioned to be prorated iteratively, for example, using the RAS technique to the domestic supply and domestic use control totals originating from the provincial SUTs. This is done with respect to the above identities for each product at the highest level of detail possible, the 490 products.

16.50 Table 16.2 presents the accounting framework and identities reviewed and also a summary of the total of all inter-regional and international trade flows for the year 2010. There is a similar table for each of the 490 products where all of the above mentioned accounting identities are in place.

Table 16.2 Inter-regional and international trade flows by province and territory, 2010 ($ millions)

$ millions

Origin	Destination															Supply	Exports to ROW	Exports to other regions
	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	Govt. Abr.	World			
N.L.	31,678	78	946	1,949	2,103	1,351	328	56	314	108	3	16	7		10,959	49,897	10,959	7,259
P.E.I.	90	7,241	273	275	183	369	21	19	54	30	0	0	0		927	9,483	927	1,315
N.S.	870	377	55,273	1,325	1,587	2,170	220	159	592	461	9	37	28	0	6,354	69,461	6,354	7,834
N.B.	959	586	1,663	44,450	3,852	1,853	265	106	874	347	11	43	17		12,377	67,404	12,377	10,577
Que.	1,597	339	2,453	3,116	498,869	38,721	2,317	1,792	7,696	6,001	78	316	246	19	78,083	641,643	78,083	64,692
Ont.	3,280	829	5,394	4,722	40,717	958,738	8,083	6,267	24,535	18,364	305	609	408	224	186,975	1,259,450	186,975	113,737
Man.	112	35	211	182	2,152	6,235	76,824	1,880	2,811	1,686	25	72	29	0	12,909	105,162	12,909	15,430
Sask.	38	27	102	128	1,016	5,736	2,254	82,644	5,142	1,621	15	42	27	0	26,130	124,922	26,130	16,148
Alta.	683	92	750	743	5,543	19,861	5,409	11,658	373,317	15,459	313	811	332	0	79,807	514,779	79,807	61,655
B.C.	287	87	671	577	5,014	10,451	1,603	1,966	13,089	301,484	402	282	168	0	41,527	377,609	41,527	34,598
Y.T.	2	0	4	4	22	133	7	9	38	92	3,511	23	6	0	313	4,164	313	341
N.W.T.	9	1	10	4	111	659	23	28	133	87	17	5,999	85		2,122	9,286	2,122	1,166
Nvt.	5	0	9	2	50	387	11	7	33	12	1	31	3,376		21	3,945	21	548
Abroad	0	0	0	0	0	9	0	0	0	0	0	0		1,374	1	1,384	1	9
World	7,997	973	10,369	14,605	100,959	214,299	13,746	14,420	60,944	49,740	396	846	287	528	24,708	514,817	24,708	
Demand	47,607	10,665	78,128	72,083	662,178	1,260,971	111,109	121,010	489,573	395,493	5,086	9,127	5,018	2,146	483,213	3,753,407	458,505	335,308

	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	Govt. Abr.	World	Supply
Imports from ROW	7,997	973	10,369	14,605	100,959	214,299	13,746	14,420	60,944	49,740	396	846	287	528	24,708	514,817
Imports from other regions	7,932	2,451	12,486	13,027	62,350	87,934	20,539	23,946	55,312	44,269	1,179	2,283	1,355	244		335,308

Canada 2010

16.51 The numbers along each row, except those on the diagonal, represent the exports of the province or territory identified at the head of the row toward the other provinces or territories and the rest of the world. The last number along a row represents the total domestic supply of the exporting region. Total domestic supply estimates are derived from the regional SUTs.

16.52 The numbers down each column, except those on the diagonal, represent the imports of the region identified at the top of the column from other regions and the rest of the world. The last number at the bottom of a column represents the total domestic use of the importing region. Total domestic use estimates are derived from the regional SUTs.

16.53 The estimates along the diagonal represent the value of the goods produced and consumed within the same region. The estimate on the diagonal at the "world" intersection represents goods imported from outside Canada and re-exported to the rest of the world. These re-exported international imports have been excluded from both international imports and exports of all regions.

16.54 Note that since one region's exports forms another region's imports, the Canada total of inter-regional exports is equal to total inter-regional imports. Finally, the number on the diagonal at the intersection of the total supply column and total use row represents Canada's total supply or use from both domestic and foreign sources.

16.55 As the trade flows are derived in a fully balanced set of provincial SUTs, whereby the supply/use constraints are derived from these tables, changes in trade flows are often traced to changes in these supply and use constraints. Furthermore, these constraints yield net trade estimates which provide reliable constraints for the derivation of provincial trade flows.

(d) Conceptual issues involved in regionalization of economic accounts

16.56 2008 SNA paragraph 18.47 identifies three types of institutional units that require different treatments in regionalization of accounts:

- regional units;
- multi-regional units; and
- national units.

16.57 Multi-regional units have their centre of predominant economic interest in more than one region. National units such as national governments have a centre of predominant economic interest that is not located geographically, not even in the sense of a multi-regional location. When regional source data is available, a bottom-up-approach is applied where the sum of (actual) provincial data becomes the national total. This is done for all goods-producing industries, distributive trade and several service industries. In cases where there is no detailed regional data, the approach used is generally top-down where national estimates are allocated to regions based on industry-specific methodologies. Starting with the 1997 reference year, when regional surveys and other sources came on stream, the top-down approach is used in only a few areas in the Canadian I-O Accounts.

16.58 The accounting framework was developed to effectively integrate national and regional concepts and conventions. The accounting framework incorporated the following conventions which are further described in the next sections:

- an extra-region that contains foreign production such as embassies and armed forces abroad.
- consistent and economically meaningful treatment for the head offices for multi-regional corporations.
- regionalization of central government expenditures, construction projects, and the output of the air transportation industry.
- treatments for regionalization of (multi-regional) financial services such as banking and insurance.

(e) Spatial boundary: extra-regional foreign production

16.59 Developing regional accounts in an existing national framework encounters certain economic activities that properly belong in the national jurisdiction but not in any specific region. Examples include embassies, armed forces stationed abroad and activities relating to off-shore oil and gas extraction. With off-shore activities in relation to Canada, these do not pose a regionalization problem as, under the constitution, each province and territory has their respective jurisdiction over off-shore resources. The activities of embassies and armed forces stationed abroad, however do not take place within the spatial boundary of a province or territory, and, although part of national GDP, they have no economic impact on the region where the main responsibility centre is located. Rather than allocating activity across regions and thereby distorting GDP, a fourteenth region was created to accommodate such activities.

(f) Head offices

16.60 Head offices and other ancillary units, like warehouses, serve all establishments that make up an enterprise. They often undertake significant expenditure on behalf of their establishments by, for example, purchasing data processing services delivered to constituent establishments or incurring costs that benefit them indirectly such as wages of managers, advertising services, etc. Head offices typically do not receive corresponding revenue from their establishments for these services.

16.61 The problem of multi-establishment head offices and ancillary units has two key dimensions: **classification** and **allocation**.

16.62 "If an establishment undertaking purely ancillary activities is statistically observable, in that separate accounts for the production it undertakes are readily available, or if it is in a geographically different location from the establishments it serves, it may be desirable and useful to consider it as a separate unit and allocate it to the industrial classification corresponding to its principal activity." (2008 SNA, paragraph 5.41)

16.63 This treatment ensures that GVA generated by head offices is recognised in the region of the head office. If the head office expenses were allocated to all constituent establishments in different regions, the head office would be effectively "moved" to other regions. Consequently, the actual host region's GVA, and in turn GDP, would be reduced or understated while those of other regions would be overstated.

16.64 In order to preserve the GVA and GDP associated with the head office in the region of its actual residence, the treatment adopted in the Canadian accounts is to impute an output for the services provided by head office equal to the sum of their own intermediate expenses plus compensation of employees that staff the head office. In addition to these costs, a consumption of fixed capital component may be added to the imputation of output when adequate data is available. However, this is not done in the Canadian accounts. The output of the head office is then shown as a purchased input of all establishments in all industries and regions served by the head office.

16.65 Up to the 2014 reference year, the Canadian accounts do not include a separate head office industry. Outputs, inputs and GVA relating to head offices and ancillary units are classified to the industry of their primary establishment.

(g) Output of central government

16.66 The output of central government and local government services is defined as the sum of the costs incurred in producing the services. The costs consist of intermediate inputs, compensation of employees, consumption of fixed capital, and other taxes less subsidies on production (see 2008 SNA paragraph 6.94). Canada's system of government consists of three main levels: federal, provincial or territorial, and municipal. The last two levels of government do not present regionalization problems because their services are limited to the geographic boundaries of a single region.

16.67 Activities of the central or federal government are undertaken on behalf of all residents of Canada in all regions. As such, the federal government is a resident of all regions. In the allocation of federal government expenditures, the central conceptual question is where the goods and services are used in order to produce the government output. The convention adopted for this purpose is that production occurs in the region where transactions occur such as where wages and salaries are paid, intermediate inputs are used and physical capital is consumed. This criterion is more relevant for National Accounts because it is the impact of federal government activity on the regional economy that is most relevant for measuring production and in presenting regional policy choices. When the region where services are consumed is not identifiable, a treatment is used to approximate the actual flow of goods and services. For example, the expenditure related to a coast guard vessel which patrols several provinces are assigned to the province of the home port of the vessel.

16.68 Another criterion considered but not implemented in the Canadian accounts calls for the allocation of federal government revenues and expenditures on the basis of benefits received by each region. Based on this "service benefit criterion" federal expenditures would be allocated on a per capita basis regardless of the regions in which expenditures are incurred. This criterion assumes federal expenditures generate services benefitting every Canadian.

(h) Taxes

16.69 In Canada, taxes on production are predominantly collected by local and provincial governments. Activities of these governments fall completely within boundaries of regions and present no regionalization problems.

16.70 Taxes on products are levied by all three levels of government: federal, provincial and municipal. Only federal taxes applicable to, and collected in, all provinces and territories present a regionalization issue. The federal government exacts a number of consumption taxes on goods and services, the largest of which are the Goods and Services Tax (GST), fuel tax, and federal excise taxes such as the sales tax on tobacco. These taxes on products are allocated to regions where taxable products are consumed as an intermediate use or purchased by final use categories. Similarly, other federal product taxes such as excise duties, excise taxes and import duties are distributed based on the regional consumption of the relevant products.

(i) Construction

16.71 In the Canadian I-O Accounts, construction is defined as the activity of putting in place buildings and structures by specialised trades managed by general contractors. Activity by construction contractors and by industries and governments on their own-account are combined into a single industry group. This treatment was adopted due to data limitations, since values of materials and services are not available separately for construction contractors and own-account producers. It is preferable to assign an input product such as ready-mix concrete, for example, to a total construction activity than to distribute it among contract and own-account producers. This implies a shift of materials and labour compensation from industries undertaking own-account construction to the construction industry.

16.72 Construction is broken down into eight structural types, residential construction, non-residential building construction, transportation engineering construction, oil and gas engineering construction, electric power engineering construction, communication engineering construction, other engineering construction and repair construction. Each structural type is treated as an industry with outputs, intermediate inputs and GVA components. Hence, the sub-contractor's sales of special trades to general contractors are netted-out of production and intermediate inputs, materials, services and primary factors are routed directly to the construction industry.

16.73 Following this concept of construction, the GVA generated belongs in the region where the structure is put into place, regardless of the residency of the contractor or its labour force. When regional boundaries are crossed by contractors, a notional establishment is created that employs the labour and capital dedicated to the project in the region where the work is put in place.

(j) Air transportation

16.74 In Canada, there are very few dominant players in the air transportation industry, so at the provincial level, data sources show an over-representation of revenue in provinces where the national air carriers have their corporate head offices located. Therefore, the revenue from these sources is not very amenable for use in regionalization of the output. Other data is available on revenue by province but this data is based on the point of sale, which does not represent production as much as it does consumption. Although data is also available on origin and destination of passengers, these do not include the intermediate steps of the journeys. Given the limitations of the available datasets, it was decided to distribute the national output of this industry over provinces using GVA by province. The provincial distribution of compensation of employees is obtained from personal income tax data. Gross operating surplus is allocated provincially based on consumption of fixed capital data by province.

(k) Financial institutions

16.75 The regional distribution of financial institutions presents unique problems that involve both conceptual issues on the nature of production and measurement challenges that are the subject of current debate in many countries. The CSMA has determined approaches to regionalise statistics on financial services taking into account currently employed national concepts and conventions.

Banks and other deposit accepting credit intermediaries

16.76 These institutions are legally chartered to accept deposits, and produce two distinct products: FISIM and other (explicit, fee-for-service) financial services. With regards to the regional allocation of FISIM, output is produced whether a lender loans funds to a bank or a borrower receives funds from a bank. Each type of transaction comprises a component of FISIM. Using this concept of output, production in the regions will vary depending on how much borrowing and lending activity takes place in each region, with some regions potentially showing flows of net lending and others showing net borrowing from other regions. This is consistent with the notion of intermediation service underlying the SNA concept, where production is deemed to occur when funds are either borrowed or lent out. The CSMA uses a provincial distribution of assets and liabilities that has some detail to allocate the FISIM by sector across the provinces. Output of FISIM by province is then calculated as the sum of the allocated national sectoral FISIM using the closest available proxy of loan or deposit. The second product of deposit accepting institutions is financial services for which explicit fees are charged. Regional estimates for the output of these products present no conceptual problems, although a number of practical difficulties and data gaps remain. For instance, as fee incomes are not reported by region, total fees at the national level must be allocated to regions. Average levels of assets and liabilities by region are used as a guide to allocate fees that relate to each type of asset or liability, for example, the amounts held in cheque accounts is used to allocate fees earned from managing cheque accounts. Wages by province are used for fee types that do not have a logical asset or liability associated with them.

Life and non-life insurance

16.77 Like other financial services, underwriters of life insurance and non-life insurance tend to be located in one region, whereas their clients and regional networks are dispersed across all regions. Since the most crucial part of insurance provision is risk management through risk pooling and re-insurance, there is a compelling argument that the security offered by an insurance policy is a product of risk pooling. Accordingly, the regional location of insurance production is taken to be that of the head office province. However, the network that distributes and delivers these services is located across all regions. In relation to these regional operations, the insurer incurs wages and salaries, commissions paid to sales staff, other intermediate expenses, and depreciation of physical capital located at their regional offices. A part of total output of insurance is therefore produced by its regional operations and must be allocated accordingly. Wages by province are used to do this allocation, as this is the most reliable data by province available. A direct consequence of this concept of production is that production and consumption of services are geographically separated and generate inter-regional flows of payment between the producing and consuming regions.

Investment brokers

16.78 There are two distinct services offered by investment brokers. Firstly, brokerage services, consisting of purchase and sale of publicly traded financial assets such as bonds, equities, etc. are provided to clients. While they may interact with their clients through their network of local offices located in the regions, brokers provide these services by executing trades at their head office locations. Trades are executed at exchanges or through the electronic trading networks and electronic settlement infrastructure owned and operated by brokerage houses. Clearly, there is some production taking place in the head office province where either the virtual or the physical exchanges follow client instructions and transact their trade. Secondly, these services are sometimes combined with provision of financial advice to clients in their region of residence. There are wages, salaries and commissions corresponding to the services provided in regions. These services are produced and consumed in the same region, while that part of the service that relates to trade execution is produced in the head office province and consumed in the province of residence of the client. Since no adequate data exists on transactions by province of residence of clients, the cost of these services are presently allocated to provinces using proxies relating to investment income.

Open-end investment (mutual) funds

16.79 In Canada, members of the public can purchase units of mutual funds, which in turn invest their funds in a wide-range of financial assets. The funds contract out the portfolio management to asset management companies, and purchase professional services to manage affairs and conform to regulatory requirements. These fees are known collectively as management and administrative expenses and are usually expressed as a ratio to the net asset value of the fund (management expense ratio or MER) and represent the output of the mutual fund. The money managers and other professional services firms are located in all regions of the country, so output does not coincide with the location of the mutual fund. However, since the money management company is most often the fund sponsor, the regional location of the investment manager and fund tend to coincide. A practical way to regionally allocate output is therefore to use the fund location. A secondary expense (and output) associated with purchase of mutual fund units is incurred because companies sponsoring a fund, that is, marketing and distributing units of the fund, often charge a fee or "load" against the fund to compensate their licensed sales forces and financial advisors who recommend the fund. Such sales charges related to mutual funds are allocated to regions using data on labour compensation by region. The geographic location of the consumption of MER is straightforward because it depends on the region where the beneficiaries or investors are located. Since no data is available on the regional residence of funds' beneficiaries, household expenditure on mutual funds services is allocated to regions using proxies related to investment income. Consequently, there will be inter-provincial exports of these services from those regions where money management is concentrated and imports of services into other regions.

3. Lessons learned and future directions

(a) Role in Canadian SNA

16.80 The Canadian regional SUTs are at the core of the CSMA, serving as a statistical audit for consistency, integrity and comprehensiveness. The SUTs framework enforces coherence across programmes, with the SUTs functioning as a benchmark for integrated CSMA programmes, including the income approach and expenditure approach to measuring GDP, GDP by industry and provincial labour productivity. The detailed SUTs also enable estimation of regional trade flows up to the latest reference year, which in turn allows for the estimation of inter-regional trade flows in the current period using a projected SUTs approach.

16.81 In order to assure quality across the integrated CSMA programmes, annual reconciliation processes are held between the various internal stakeholders in Statistics Canada. This enables important feedback on national estimates including feedback to survey partners producing source data. Work-in-progress quality reviews with provincial government statistical counterparts are also integrated into the annual cycle and provide additional quality checks.

16.82 In addition to the benchmarking and quality assurance role, the availability of regional SUTs has enabled Statistics Canada to maintain provincial I-O models and analytical products. Statistics Canada therefore offers custom, client-specified economic impact simulations to clients on a cost-recovery basis. There is an increasing appetite to undertake this work to understand regional impacts of infrastructure projects, for example, in the oil and gas industry. Specialised analyses are also undertaken for key clients such as the simulation of the impact of tax policy alternatives. The tables are also used in experimental work to develop, for example, estimates of sub-regional GDP for municipalities and provincial multi-factor productivity. Statistics Canada also offers regular regional workshops to educate potential users about these models and analytical products.

(b) Challenges

16.83 The production of detailed annual regional SUTs adds significantly to the cost and operational complexity of the statistical programme and comes with a range of other important challenges in the Canadian context, summarised below.

Heightened scrutiny of data

16.84 Since the data are used to allocate tax revenue across provincial governments (similar theme in the EU, where National Accounts data are used to determine Member States' monetary contributions to the EU) and equalise fiscal capacity across provinces via fiscal arrangements, they are subject to a great deal of scrutiny at the detailed product level. Tax outputs are key deliverables and quality must be maintained at a very detailed level. This accountability limits the flexibility to use approximate modelling top-down techniques in estimation and favours direct compilation from source data so that estimates are transparent and justifiable.

Confidentiality

16.85 The broad use of detailed data presents challenges in terms of confidentiality suppressions. Efforts need to be made to develop a confidentiality mask to minimise residual suppressions and to avoid releasing only very aggregate estimates by province. Work is also required to adapt aggregations to ensure maximum information can be released. However, although publicly released data used to include aggregations and confidentiality suppressions, access to the full detail has been made available to all users as of 2016.

(c) Costs

16.86 While deemed to be worth the investment, Canadian regional SUTs are costly to maintain. There are approximately 50 staff involved in the I-O programme within the CSMA (this is unusually high but indicates the high priority attached to this work and its impact). There is additionally a very important investment to collect the source data required to build the estimates. In a recent "modernization", the industry and product classifications were streamlined. Detail that was considered no longer relevant was eliminated and new detail added in areas of growing economic importance, for example, services industries and oil and gas.

(d) Operational complexity

16.87 Maintaining a complex and detailed integrated programme involves coordinating a series of reconciliation and feedback processes on an annual cycle. It also implies constant active interaction with partners across a broad spectrum of sources to ensure data requirements are met. It is particularly challenging in periods of downsizing and constrained resources to maintain quality of outputs.

(e) Historical continuity

16.88 This is particularly an issue when historical revisions are undertaken. In the CSMA, the last "big-bang" historical revision was undertaken in 2012 with the introduction of 2008 SNA. This involved a lengthy and complex decision-making process and for cost-benefit reasons it was not possible to recompile the tables back in time. It was therefore decided to undertake a back-casting exercise using a modelled approach for analytical purposes, implemented over time as capacity constraints allowed. The CSMA is moving to a new approach of more frequent, smaller scale revisions across all programmes. A new mechanism is therefore needed to assure coherence in the historical period that is feasible to maintain on an on-going basis.

Chapter 17. Multi-country Supply and Use Tables and Input-Output Tables

A. Introduction

17.1 Although the focus of this Handbook is generally on national SUTs and national IOTs, there is an increasing demand for the instruments to capture the structure and mechanism of cross-border fragmentation of production activities. The development of multi-country SUTs and IOTs in recent years has been primarily driven by the academic and policy decision-making interests in three key areas of global governance.

17.2 The first area is the link between the environment and the economy. There is a growing need to respond to the range of data demands for environmental analyses that cover policy, regulation, taxation, and, more generally, better understanding of the cross-border impacts of economic activity on the environment. The study of "carbon footprint" offers a complementary view to production-based emission estimates as it gives a consumption-based perspective which identifies the emission drivers from the demand side (for example, final products associated with highest CO2 emissions). The multi-country SUTs and IOTs with environmental extensions (for example, carbon intensities, etc.) provides a powerful analytical tool for tracking the footprint of production activities all over the world, see Wiedmann (2009) and Carbon Trust (2011).

17.3 The second area of interest relates to the rapidly changing features of international trade and governance. The "trade in value-added" analysis attempts to trace international flows of GVA embodied in traded products across economic activities and countries. The traditional approaches in the study rely heavily on the information sourced from individual firms. The multi-country SUTs and IOTs based analysis complements these traditional approaches, yet provides a wider perspective for analysing the nexus of inter-industrial linkages at the global scale, see OECD-WTO (2013) and Inomata (2014) for non-technical introduction to the concept of trade in value-added. Also, Inomata (2017) provides an extensive overview on the analytical frameworks of SUTs and IOTs for the study of global value chains (GVCs).

17.4 Multi-partner country SUTs are central in the satellite accounting framework for measuring GVCs. An Expert Group on International Trade and Economic Globalization Statistics was created by the United Nations Statistical Commission in 2015 with the task of preparing a Handbook on a system of extended National Accounts and integrated business statistics. In the Handbook, the measurement of inter-connectedness of economies is dealt with by properly accounting for GVCs while maintaining a national perspective.

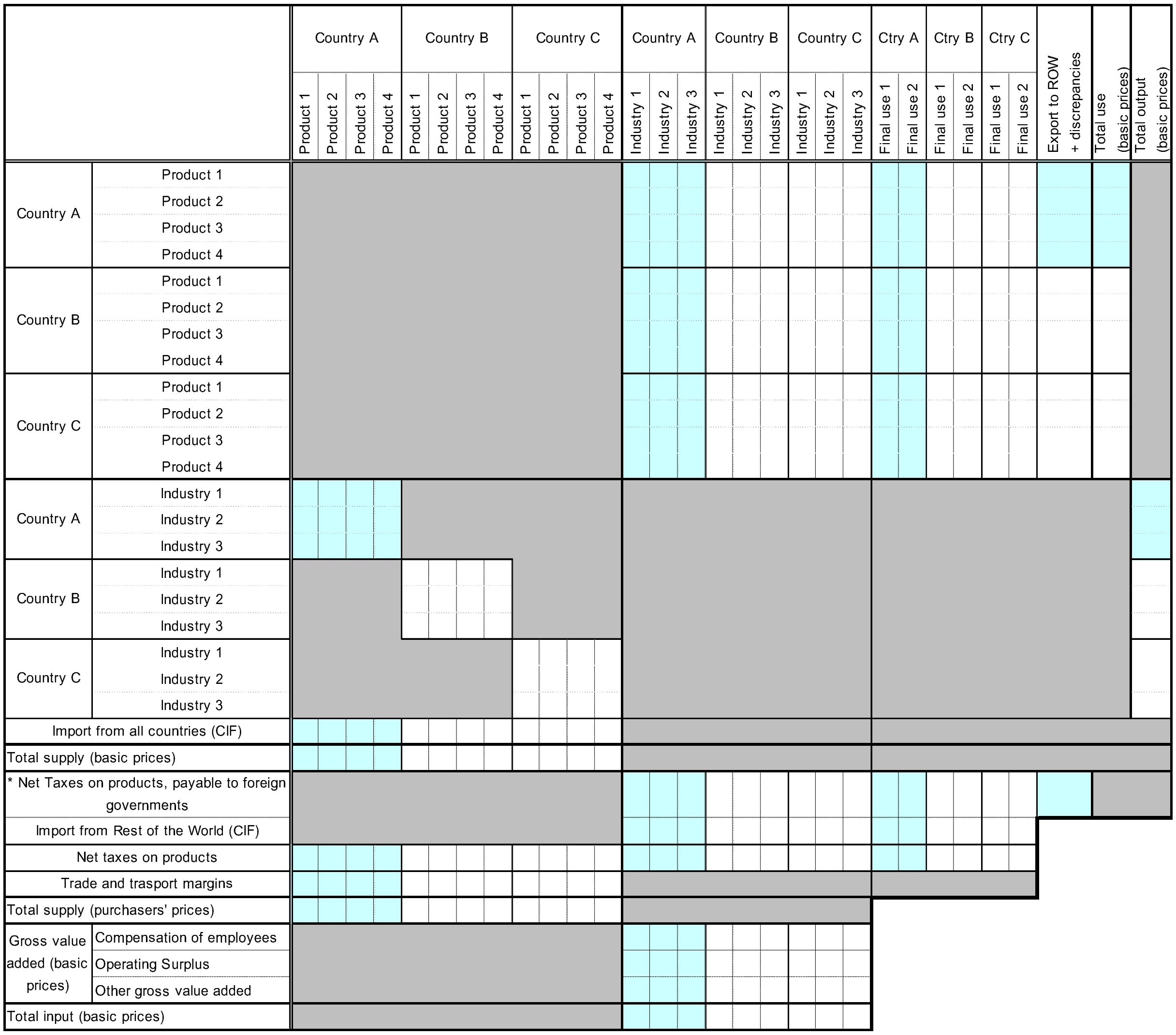
17.5 The third area of significant policy and business relevance concerns the impact of globalization on labour markets. Globalization has promoted international trade and production, yet at the same time, we observe an increasing wealth disparity between those who are connected to the global growth and those who are not. Linking multi-country SUTs and IOTs to the drivers of global growth, especially in the light of labour productivity and employment, will provide insights on the relationship between globalization and income distribution within a country. To this end, employment, wages and other labour-related dimensions are regularly added to multi-country SUTs and IOTs (for example, the European FIGARO project and OECD-WTO TiVA database), and NSOs are encouraged to consider adding these dimensions to their own SUTs.

17.6 The main objective of this Chapter is to provide a schematic description of the compilation procedure of multi-country SUTs and IOTs. Section B starts with an overview of the tables and then addresses some methodological and practical issues that arise during their compilation. Section C provides a simplified compilation procedure. Section D introduces the efforts that have been undertaken so far at the international level to build the databases and Section E describes areas of further work.

B. Overview of multi-country SUTs and IOTs and main compilation issues

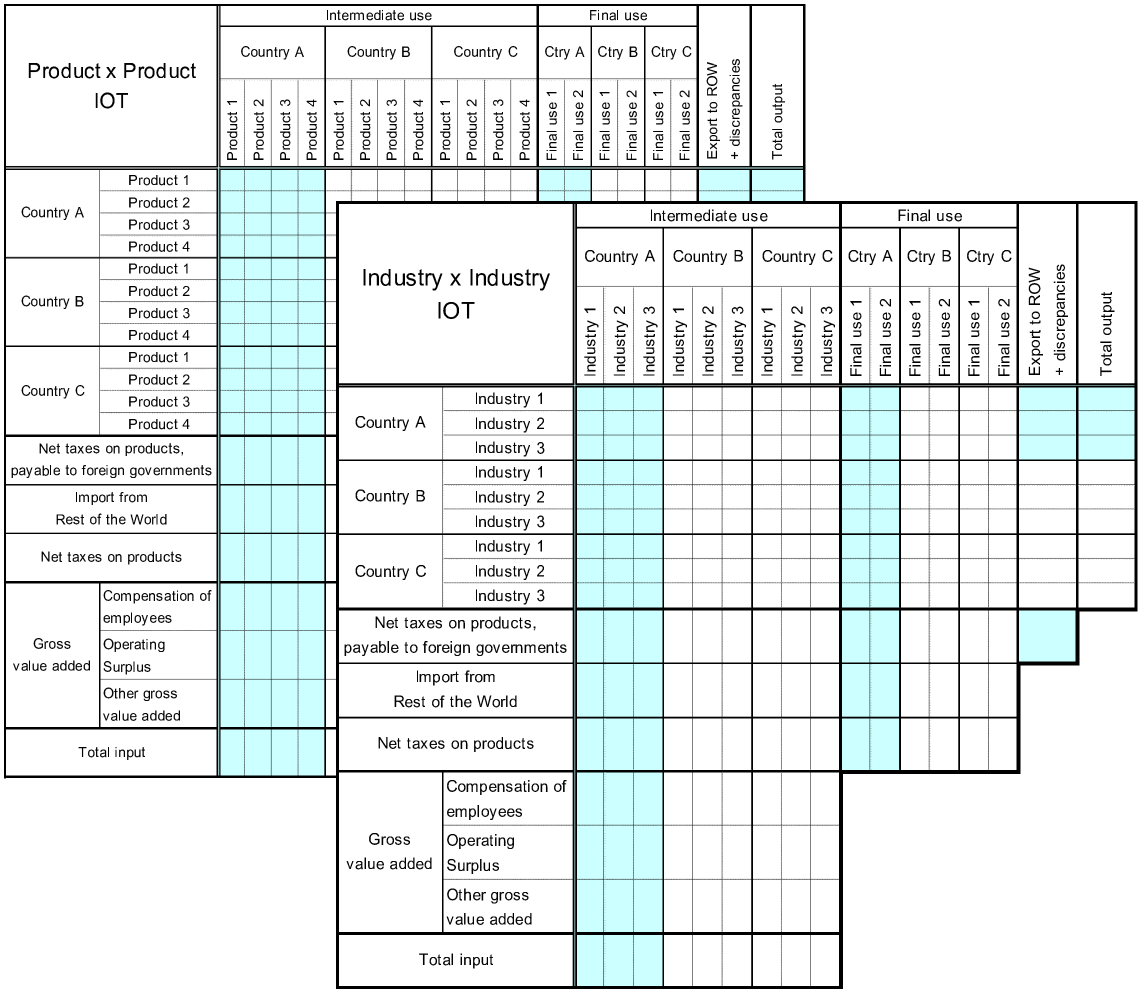
17.7 Multi-country SUTs and IOTs bring together the national tables of different countries into a single format, and thus have the same basic structure of the national SUTs and IOTs. The distinctive feature of multi-country tables, however, is that these tables explicitly present international transactions in the form of import matrices and export matrices by trading partners, which allows for a comprehensive mapping of global production networks. Figure 17.1 and Figure 17.2 shows a simplified format of multi-country SUTs and IOTs respectively, for the case of three countries with four products and three industries. The cells in blue colour refer to the entries based on the source data of Country A, while segments without cells (shown in grey colour) in the multi-country-SUTs correspond to non-existent data by construction.

Figure 17.1 Schematic representation of multi-country SUTs (three country case)



* Except to those of the countries in Rest of the World

Figure 17.2 Schematic representation of multi-country IOTs (three country case)



17.8 As described in Chapter 12, the SUTs system offers a flexible solution for choosing an appropriate type of model for the IOTs. The choice of model depends upon the nature of the research question that the model is seeking to satisfy.

17.9 The Product by Product IOTs are, in theory, generally recognised as having a better matching for the technical coefficients, yet the Industry by Industry IOTs may work better for policy analyses upon a practical consideration. This is because most of the analytical extensions in this research area are often derived from ancillary data such as carbon emission accounts, employment tables or capital stock matrices and these data are typically constructed on the industry basis rather than the product basis. In particular, the information on GVA is collected and shown at the industry level in the Use Table, which endorses the choice of Industry by Industry multi-country IOTs for the analyses of trade in value-added. In addition, it is generally recognised that construction of the Product by Product IOTs is more demanding than the Industry by Industry IOTs from the viewpoint of data requirements and assumptions.

1. Valuation

17.10 There are different valuation schemes for SUTs and IOTs and each scheme has its own advantages and disadvantages as covered in Chapter 7. This Handbook, in line with the 2008 SNA, recommends basic prices for SUTs and IOTs, and in turn, this applies for the multi-country SUTs and IOTs.

17.11 If a country only compiles tables based on either producers' price or purchasers' price, they should be converted to the basic price valuation (for variables like GVA and output), including the export column which is valued at FOB in the purchasers' price table, by the use of appropriate information on trade and transport margins and taxes less subsidies on products.

2. Classifications of constituent national SUTs and IOTs

17.12 Each national SUTs and IOTs may have its own product and industry groupings aligned to international classifications as appropriate. Table 4.1 in Chapter 4 provides a flavour of the differences in terms of the number of products and industries used in various countries. The weights of different products/industries can also vary significantly. Countries with large agricultural based economies have relatively detailed classifications covering the agricultural industry, whereas industrialised economies attribute more comprehensive coverage to the manufacturing industries. Therefore, the product and industry classifications (and their breakdown) used in national SUTs and IOTs reflect the characteristics of the economy concerned, and a precise concordance system that bridges national classifications to the classification used for multi-country SUTs and IOTs (referred to as "uniform classification") is absolutely essential for compiling consistent tables.

17.13 In general, a product/industry concordance system has a tree-like structure where one product/industry of the uniform classification corresponds to one or several items in national classifications. If the concordance system has a clear-cut structure (i.e. "one to one" or "one to many") then the aggregation of national tables into the uniform classification of multi-country tables is much easier.

17.14 The problem arises when a single item in national tables is associated with several categories of the uniform classification. In such a case, preliminary disaggregation of the corresponding rows and/or columns of the national tables are required for appropriate reallocation of values under the uniform classification. This can be done by using the split ratios derived from other sources such as industrial statistics or business surveys.

17.15 The use of international classifications such as ISIC Rev. 4 for industries and CPC Ver. 2.1 for products in national tables facilitates enormously the compilation of multi-country SUTs and IOTs.

3. Supplementary national data

17.16 For the compilation of multi-country SUTs and IOTs, supplementary data are needed which may not be part of the regular set of tables compiled at the national level. As a starting point, it is important to have national SUTs at basic prices which are not always available on an annual basis. In the European Union, for example, Member States are required to transmit yearly national Supply Table at basic prices and Use Table at purchasers' prices, and, every five years, the valuation tables, the Use Table at basic prices including the split between domestic and imports and the IOTs including the split between domestic and imports. In addition, data needs for multi-country SUTs and IOTs go beyond these requirements and they have to be prepared for all respective countries participating in the scheme. The necessary additional data include:

- Import data (CIF) and export data (FOB), by product and by country of origin/destination. The values of re-exports must be clearly distinguished in the data since they are recorded separately in the export vector of the Imports Use Table (not in the Domestic Use Table) in the national SUTs. The 2008 SNA mentions the overall CIF/FOB adjustment (see, for example, 2008 SNA paragraph 28.11 and Chapter 5 of this Handbook) but here the total amount would need to be detailed by products and countries.
- Rates of international freight and insurance costs (with respect to CIF import values), by product and by country of origin. Only few countries have the data available from their data sources; others typically estimate them based on some assumptions and raw data. However this data item can be shared if a country is also able to collect import data on FOB basis.
- Rates of domestic trade margins, preferably those on domestic export, by product and by industry. Some countries have separate information for wholesale and retail margins respectively.
- Rates of domestic freight transport costs, preferably those on domestic export, by product and by industry.
- Rates of net taxes on domestically produced products (i.e. "not" including those levied on imported products such as duties and import product taxes), by product and by industry.

17.17 The imports and exports of goods data can be directly constructed from foreign trade statistics, notably the UN International Merchandise Trade Statistics. However, this database does not distinguish between domestic exports and re-exports. This aspect is generally addressed through the use of other related sources such as the data on the country of consignment for imports, for example, in EU COMEXT for the European Union. It is advisable to separately present the data for intermediate uses and for final uses by drawing an appropriate reference such as the UN BEC or the OECD Bilateral Trade Database by Industry and End-Use (BTDIxE). The imports and exports of services data by product, and by country of origin/destination should be supplemented wherever available, for example, from the Balance of Payments and business surveys, etc.

17.18 The data covering international freight and insurance costs is limited, and therefore, some estimation work is required on the data available to make up for the missing information. Most empirical literatures on international trade employ gravity equations, using the geographical distance between trading partners as a main explanatory variable for these costs, see for example, Gaulier and Zignago (2010). In this respect, the OECD has produced detailed estimates of CIF/FOB margins for those countries where data are not available, and includes these data together with official published data in its database, see Miao and Fortanier (2017).

17.19 In contrast, the data on domestic trade margins, transport costs and taxes less subsidies on products are usually presented in national SUTs.

4. Bilateral trade data

17.20 In compiling the multi-country SUTs and IOTs, bilateral trade data should be as coherent as possible with equivalent data reported by partner countries, yet in reality there are substantial discrepancies between mirror statistics declared by two partners.

17.21 One of the sources of discrepancies is inherent in trade statistics itself. This is often referred to as the problem of trade asymmetries. Theoretically, Country A's export of a particular product to Country B should be equal to Country B's import of that product from Country A. In practice, however, this is often not the case for many circumstances. The main causes of the asymmetries phenomenon include:

- difference in valuation schemes of import (= CIF) and export (= FOB);
- recorded difference between the country of origin (for import) and the country of destination (for export). While the former is identified on the basis of several criteria (product's custom code, GVA, etc.), the latter is typically assigned to the most immediate shipping destination;
- improper declaration of product classification at the customs border, either entry or exit;
- misspecification of re-exports and re-imports;
- shipping time-lag across different accounting periods (quarters or years);
- differences in coverage of "merchanting" trade;
- goods entering or leaving the territory illegally such as smuggling; and
- other unspecified transactions (for example, the issue of confidentiality, etc.).

Guo, Webb and Yamano (2009) provides a further description of the problem.

17.22 The discrepancies in the table can also be attributed to mismatches between the record of international transactions in SUTs/National Accounts and those of the custom statistics, which aggravate the statistical discrepancies in the multi-country SUTs and IOTs.

5. Goods sent abroad for processing and merchanting trade

17.23 With the growing impact of globalization, the production process is becoming increasingly fragmented and dispersed to various locations of different countries. Goods sent abroad for processing is a production arrangement where a manufacturer sends out materials or semi-finished products to foreign contractors for further processing, without a change in legal ownership of the products throughout the arrangement.

17.24 The issues associated with the choice of recording principles of goods sent abroad for processing is discussed in Chapter 8. Thus, only the points relevant for the compilation of multi-country SUTs and IOTs are covered in this Chapter.

17.25 The 2008 SNA and BPM 6 generally recommend the "net" principle for recording the transaction of goods sent for processing, both domestically and across countries. Foreign trade statistics (notably customs statistics) on the other hand record physical flows of goods based on a border crossing principle rather than a change of economic ownership principle. In constructing multi-country tables by integrating the information of foreign trade statistics, therefore, the values of goods sent abroad for processing have to be removed from trade statistics in order to achieve consistency under the "net" principle.

17.26 Likewise, merchanting is a trading activity where a merchant generates profits by purchasing goods, typically primary products such as metals, oil, coal, gas, cereals, coffee, etc., from a resident of a foreign country and then reselling them with a higher value to a resident of another foreign country (1) without changing the condition of goods, and (2) without having the goods crossing the border of the merchant's home country.

17.27 Merchanting trade is not considered in the international mechandise trade statistics since it does not involve any physical inflow or outflow of goods across the national border of merchant's home country. Only export and import of goods between the third countries as a result of merchanting are recorded.

17.28 The 2008 SNA and BPM 6 treat merchanting trade as net exports of goods by the merchant's home country (defined as the sum of negative export for the acquisition of the goods and positive exports for their resale). Hence, some adjustment is required to harmonise between the records in the BoP and those in foreign trade statistics.

17.29 In BPM 6 the activity is considered under the goods account in line with the change of ownership principle in the 2008 SNA. Accordingly, there will be trade asymmetries if trading parties follow different versions of the BPM.

17.30 The need for these adjustments has already been pointed out in Chapter 8 for the construction of the Imports Use Table, yet the problem spills over to the compilation of multi-country tables. The failure to apply a necessary adjustment will result in aggravation of statistical discrepancies in the multi-country SUTs and IOTs.

6. Diversity of presentation formats

17.31 Despite the fact that SUTs and IOTs form a central part of the SNA, comparisons of each national table of an individual country exhibit different features and characteristics, reflecting the country's institutional idiosyncrasies such as different legal and taxation schemes as well as the issues like the availability of data. In addition, there may be a legacy of country practice, for example, only either SUTs or IOTs are compiled, or even where both SUTs and IOTs are compiled, the former is produced from the latter and not vice versa as recommended by the SNA. In line with the 2008 SNA, countries are encouraged to compile national SUTs first, and then the IOTs using the SNA based methodologies, concepts and the various international classifications such as ISIC and CPC. This also helps to improve the quality, comparability and the compilation processes of the multi-country tables.

17.32 Consequently, the compilers of multi-country SUTs and IOTs have to conduct thorough examination of conceptual as well as methodological differences among countries in the estimation of basic statistics for the national SUTs and IOTs, and if necessary, to carry out pre-adjustment of these tables onto a common format prior to the compilation of multi-country SUTs and IOTs. In general, it is often the case that the statistics of detailed and information-rich tables have to be adjusted to conform to those that are less detailed in order to achieve commonality unless there is a good prospect of obtaining additional information for upgrading the less detailed tables. Therefore, there is always a trade-off between the level of uniformity and the level of information embedded in generating consistent multi-country SUTs and IOTs, and hence careful and thorough consideration is required in making adjustment rules.

17.33 Table 17.1 lists some examples of adjustment targets for national IOTs that constitute the Asian International Input-Output Tables (AIIOT). The list reveals the diversity of presentation formats across the tables as well as the difficulty of harmonization, see Inomata (2016) for a detailed description of the methods applied.

Table 17.1 Adjustment targets for national tables of selected countries in the Asian International Input-Output Table for the year 2000

	China	Indonesia	Japan	Rep. of Korea	Malaysia	Philippines	Singapore	Thailand	United States
1. Conversion of valuation									
of Private Consumption Expenditure					x		x		x
of Export vectors					x		x		
of Import matrix/vector			x	x		x		x	x
2. Negative entries				x					
3. Dummy sectors	x		x	x	x		x		x
4. Machine-repair sector	x		x			x			x
5. Financial intermediaries (FISIM) sector			x		x		x	x	
6. Special treatment of import/export									
for water transport									x
for "Pure import" of gold									x
for re-export					x				
for telecommunication				x					
7. Producers of government services								x	x

Source: Inomata (2016)

C. Compilation procedure

17.34 Multi-country IOTs can be compiled either from national SUTs or national IOTs. In general, however, the preferred method for compiling multi-country IOTs is to use national SUTs as basic constituent tables. Using this approach, an Imports Use Table of each country is split by country of origin and linked internationally together with the Domestic Use Table to form the multi-country Use Table. The entire table is then transformed to square multi-country IOTs by an appropriate technology/fixed sales structure assumptions as covered in Chapter 12.

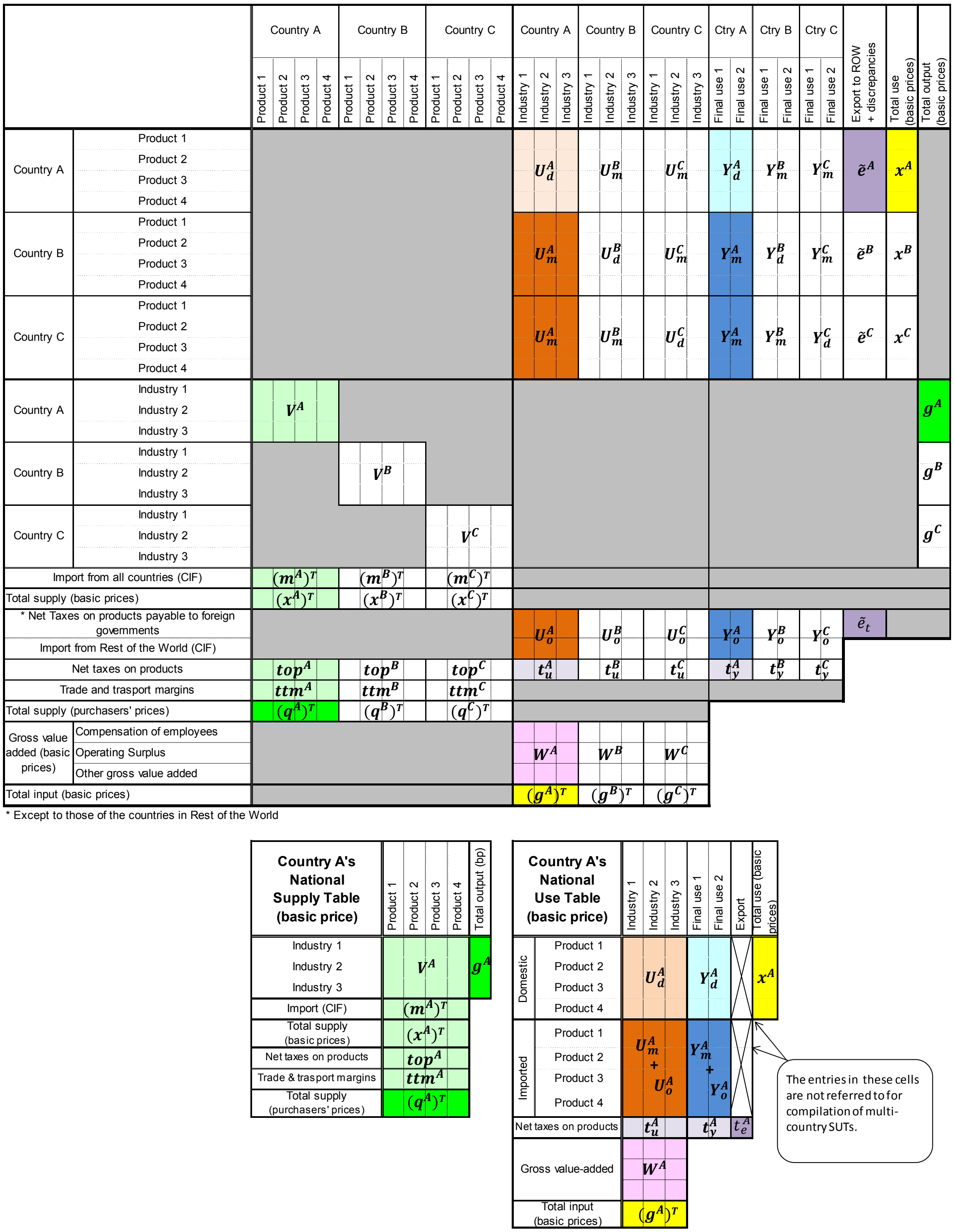
17.35 The benefit of using SUTs rather than IOTs as inputs to the multi-country IOTs is concerned with three main issues:

- Using SUTs implies that one is able to retain the information from source data on the input structures of industries in the form of multi-country Use Tables.
- When the Imports Use Table is split row-wise by the country of origin, the country shares from the trade statistics are used. Since the rows of the Use Table are shown as product categories, it is possible to split the import matrices at the product level which is usually more detailed than the industry level. This improves the quality of the final product (i.e. multi-country IOTs) when only non-survey methods are applied in the process.
- Both Industry by Industry and Product by Product types of multi-country IOTs can be derived from the system of multi-country SUTs depending on the analytical objective of users.

17.36 For these reasons, and with an expectation that an increasing number of national SUTs will become available in the foreseeable future, these guidelines propose the SUTs approach for compilation of the multi-country IOTs, building on the method developed in the World Input-Output Databases, see Timmer (2012). Alternative methodologies used by different institutions are shown in Section D.

17.37 Figure 17.3 presents the entire image of the system of multi-country SUTs for the three-country case with four products and three industries. The segments without cells (shown in grey colour) correspond to non-existent data by construction. The other coloured cells refer to the entries based on the source data of Country A with each colour showing the link to the relevant segment in the national SUTs.

Figure 17.3 The system of multi-country SUTs and its conceptual correspondence to a national SUTs framework



17.38 Following the notations given in Box 12.2 in Chapter 12, we have:

$\boldsymbol{V^r}$ Domestic output matrix (= transpose of supply matrix)

$\boldsymbol{U_d^r}$ Intermediate use matrix for domestic products

$\boldsymbol{U_m^r}$ Intermediate use matrix for imported products from partner countries

$\boldsymbol{U_o^r}$ Other entries for intermediate uses, including imports from Rest of the World

$\boldsymbol{Y_d^r}$ Final use matrix for domestic products

$\boldsymbol{Y_m^r}$ Final use matrix for imported products from partner countries

$\boldsymbol{Y_o^r}$ Other entries for final uses, including imports from Rest of the World

$\boldsymbol{\tilde{e}^r}$ Export to Rest of the World and statistical discrepancies

$\boldsymbol{top^r}$ Net taxes on products, by product

$\boldsymbol{ttm^r}$ Trade and transport margins, by product

$\boldsymbol{m^r}$ Total import, by product

$\tilde{e}_t$ Net taxes on products paid out by the countries in ROW

$\boldsymbol{t_u^r}$ Net taxes on products for intermediate use, by industry, derived through the conversion process of matrices into basic price by using top^r in Supply Table

$\boldsymbol{t_y^r}$ Net taxes on products for final use, by final demand sector, derived through the conversion process of matrices into basic price by using top^r in Supply Table

t_e^r Net taxes on products for export, derived through the conversion process of the export vector into basic price by using top^r in Supply Table

$\boldsymbol{W^r}$ Gross value added

$\boldsymbol{q^r}$ Total supply, purchasers' price

$\boldsymbol{x^r}$ Total supply/use, basic price (= total output by product)

$\boldsymbol{g^r}$ Total input/output, basic price, by industry

bp Basic price

pp Purchasers' price

CIF Cost, freight and insurance

where, superscript r is country code (r=A, B, and C), and superscript T indicates a transpose of a vector/matrix. Upper-case bold italic refers to a matrix, lower-case bold italic to a vector, and lower-case italic to a scalar.

17.39 As shown in Figure 17.3, the domestic transaction parts (in pale colours) of the multi-country SUTs can be directly transplanted from the original tables after the relevant aggregations into the uniform product/industrial classification. In contrast, international transaction parts (in dark colours) require some processing before linking, as illustrated in Figure 17.3.

17.40 In order to integrate the national SUTs into multi-country SUTs, various common criteria need to be met for these constituent tables, most of which are already assumed in the recommendations provided throughout this Handbook. In the main, the tables should be:

- Consistent with key National Accounts aggregates.

- Valued at basic prices, and expressed in common currency (for example, US dollar), using the year-average of IMF official exchange rates (the linking via external trade data at world market prices makes official exchange rates acceptable).
- Aggregated into the uniform product and industry classifications.
- Harmonised across the different sources in terms of presentation format (see Section B.6 above).
- Split between the Domestic Use Table and Imports Use Table of the same dimension. The export vector in the Domestic Use Table should contain only domestically produced products, and it should not include re-exports, which should be separately presented in the export vector of the Imports Use Table.

17.41 Once the classifications of the constituent national SUTs have been harmonized and supplementary data have been gathered, the compilation of multi-country SUTs can then be organized in the following four steps:

Step 1: Splitting the Imports Use Table by country of origin

Step 2: Converting valuation of the Imports Use Table from CIF to basic price

Step 3: Creating the export vector to Rest of the World

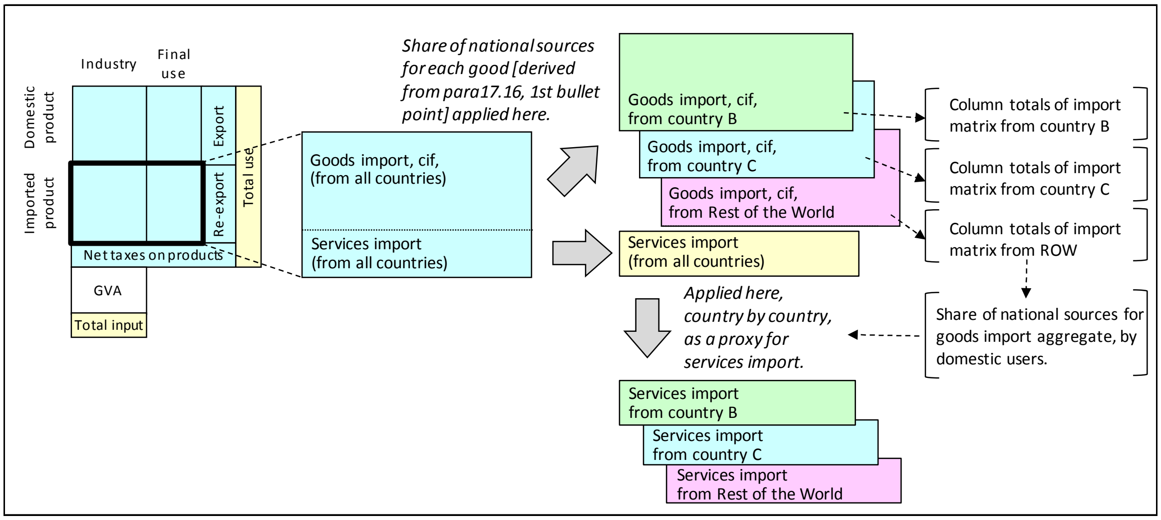
Step 4: Linking and reconciliation of the table

Step 1 Splitting the Imports Use Table by country of origin

17.42 The first step of this stylized example is to split the Imports Use Table using the share of national origins for each imported product as shown in Figure 17.4. The goods transaction part is split by the shares derived from foreign trade statistics (see the first bullet point in the description of data in paragraph 17.16). Here, it assumes an identical distribution structure of an imported product among domestic users, irrespective of the countries from which the product is sourced (the "proportionality assumption"). Bilateral trade asymmetries should be reconciled as far as possible prior to using these data in order to minimize statistical discrepancies in the linked table as mentioned in Section 4 of this Chapter.

17.43 If the information on partner countries for imports of services is available, the same treatment as for imports of goods can be applied to splitting the import matrix of services. Otherwise, the service transaction part can be split by referring to the aggregate shares of goods transaction as a proxy, as indicated on the right-hand side of Figure 17.4.

Figure 17.4 Splitting the import matrix by country of origin

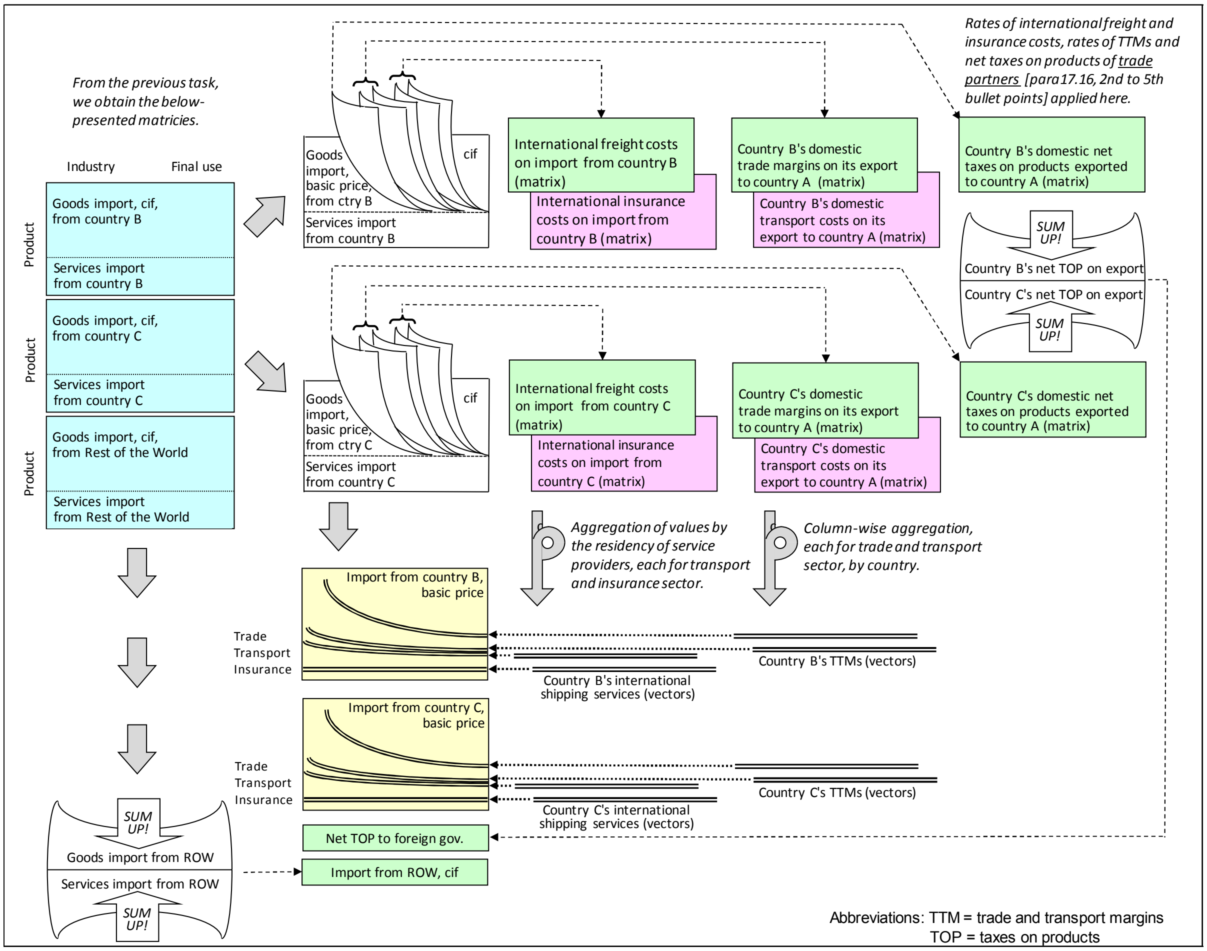


Step 2 Converting valuation of the Imports Use Table from CIF to basic price

17.44 Since the import transaction is valued in CIF, it must be converted to basic prices from the partner country's perspective. This process is important in order to achieve valuation that is consistent between domestic products and imported products, and to approximate a mirror relation between its own import and the partner's export (noting that the export vectors in the benchmarked National Use Tables are now valued at basic price, not at FOB). The margins are individually removed by using the respective margin rates in the correct order (see the description of all the bullet points except the first bullet point in paragraph 17.16). Figure 17.5 shows the steps for handling the valuation conversion.

17.45 As shown in the right-hand side of the figure, "taxes less subsidies on products payable to foreign governments" are aggregated column-wise across all countries of origin into a single row vector, which is separately presented in the multi-country SUTs and IOTs.

Figure 17.5 Converting valuation scheme



17.46 In contrast, the domestic trade and transport margins, for the delivery of goods from factories to ports in the exporting countries, are individually aggregated column-wise, country by country, and the former is merged into "trade" sector, and the latter into "transport" sector of the corresponding import matrices. This is based on the recognition that trade and transport margins embodied in imported products are considered as import of trade and transport services. It should be noted therefore, that for the separation of trade and transport margins, and likewise taxes less subsidies on products, the rates of partner countries, and not those of its own, must be applied.

17.47 For international freight and insurance costs, the residency of service providers should be identified using information from the third sources, in addition to the origins and destinations of international shipping. In the current OECD Inter-Country Input-Output Tables, for example, international transport margins are redistributed to countries of origin according to the export share of transport services of each country concerned using the service trade data derived from various sources. The values are then added to the corresponding sector (transport or insurance) of countries from which these services are sourced. In the case that the residency of the service providers cannot be identified, the international freight and insurance matrices are aggregated column-wise across all countries of origin into a single row vector, which is separately presented in the table.

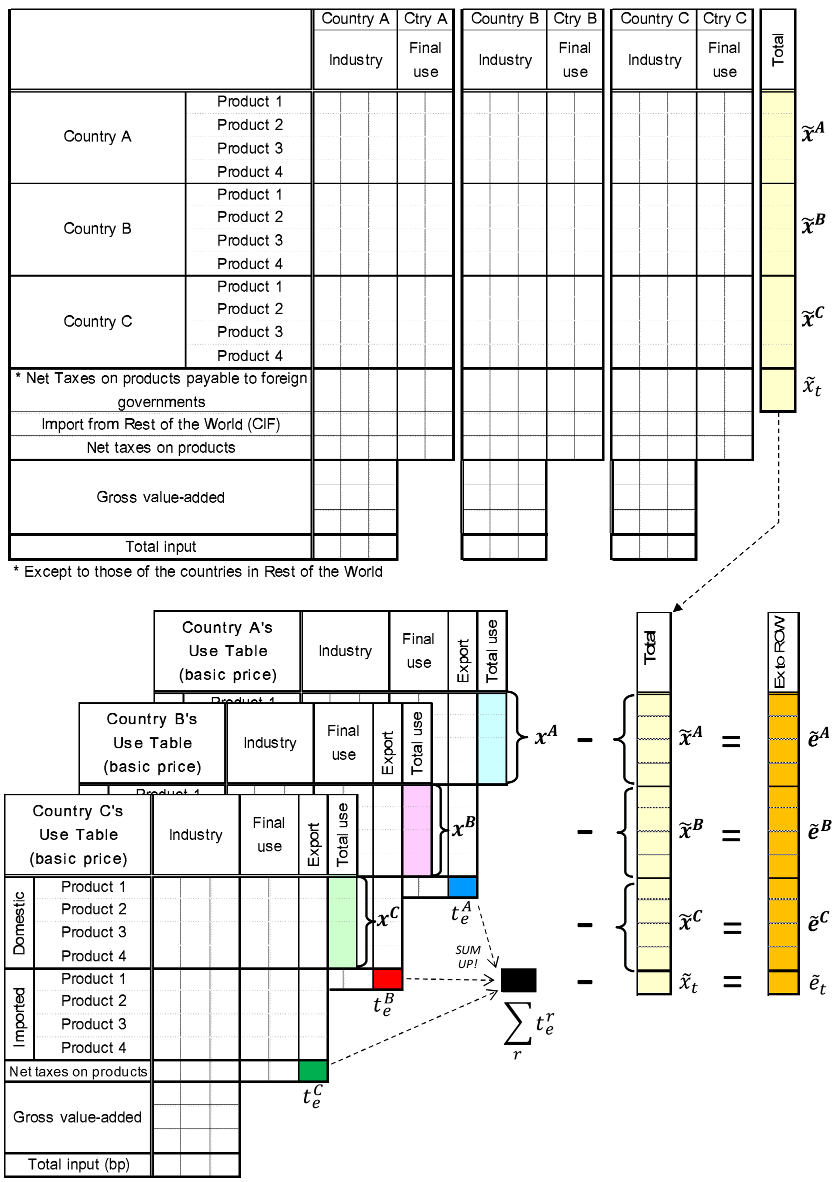
17.48 The imports from Rest of the World are aggregated column-wise to form a vector, valued at CIF.

17.49 The result of these steps generates the multi-country Use Tables, which provides the core information for compiling the multi-country IOTs.

Step 3 Creating the export vector to Rest of the World

17.50 Assuming mirror trade relations, the import uses (both intermediate and final) by country of origin in the multi-country Use Table are considered to represent exports of the corresponding trade partners to the respective importers in the Table. The exports to any remaining countries other than these importers are lumped up in the vector of Export to Rest of the World. A simple three-country case is presented in Figure 17.6.

Figure 17.6 Making export vector to Rest of the World



17.51 As shown in Figure 17.6, for the three-country case (Country A, B and C), the vector can be simply derived as a difference between the row totals of juxtaposed multi-country Use Tables ($\tilde{x}^A, \tilde{x}^B, \tilde{x}^C$) on the one hand, and the total uses in the original national Use Tables (x^A, x^B, x^C) on the other, element by element.

17.52 Net taxes on products (TOP) for Rest of the World is derived as a difference between the corresponding row total in the multi-country Use Tables ($\tilde{x}_t$) and the sum of net TOP entries in the export columns of all countries' Use Tables $\left(\sum_r \mathrm{t}_e^r = \mathrm{t}_e^A + \mathrm{t}_e^B + \mathrm{t}_e^C\right)$. This relation stands as follows.

17.53 Entries in the row, "Net TOP payable to foreign government", shows the amount of cross-national transfer of net tax revenues, as embodied in traded products, among the three Countries A, B and C. On the other hand, the sum of net TOP on export of all three countries' Use Tables represents the entire flows of cross-national tax revenues to these countries from all over the world. The difference is therefore the net taxes paid out by the countries in Rest of the World, embodied in imported products from the three countries. (This is a balancing item rather than a statistics of any analytical significance.)

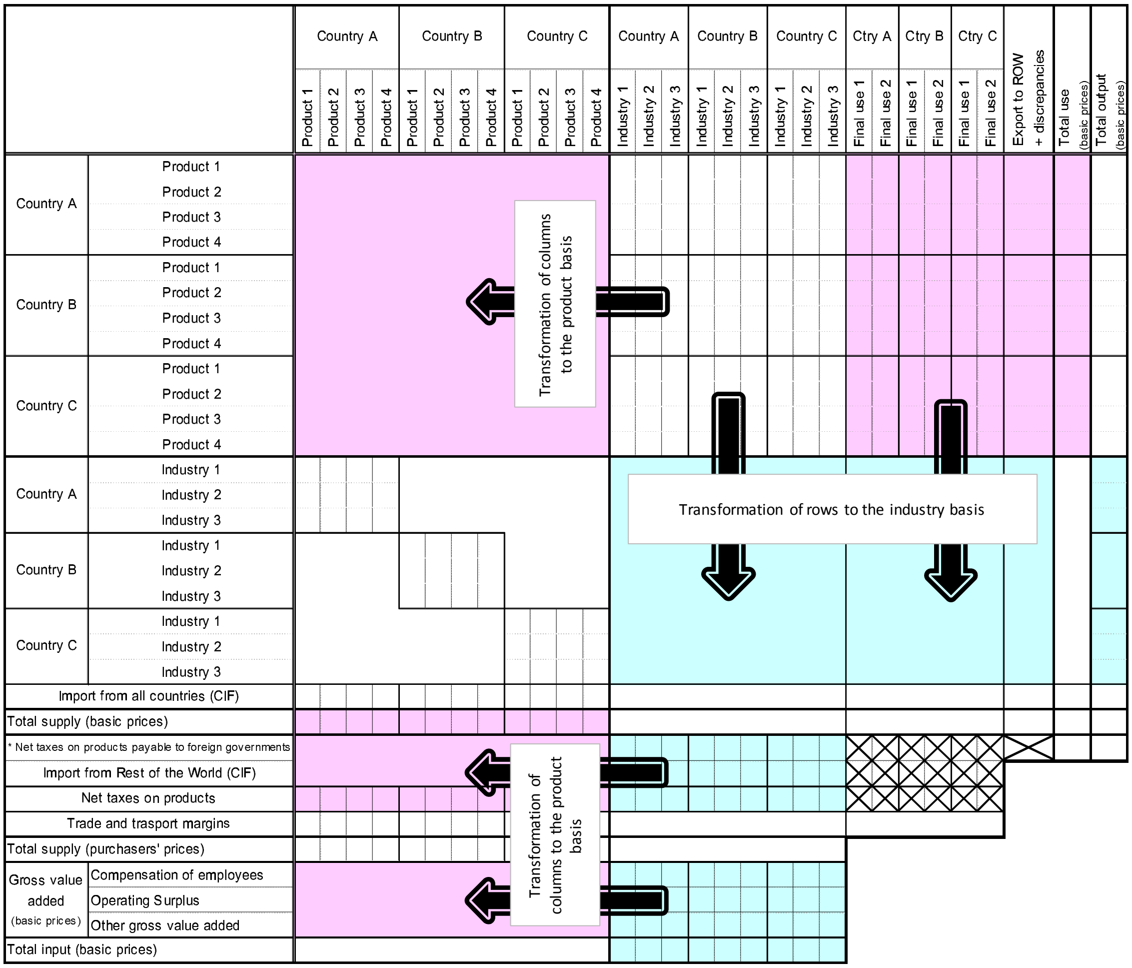
17.54 Such a treatment for Rest of the World inevitably leads to the characterization of the vector as a "residual" of the entire multi-country IOTs matrix, containing various statistical discrepancies. These discrepancies arise out of the linking process as a reflection of data confrontations among different sources, when the export data in each national Use Table is replaced by the import transaction matrices of trading partners assuming a mirror relation between the two partners.

17.55 This could be explicitly presented in the final multi-country SUTs and IOTs by naming the vector as "Export to Rest of the World and statistical discrepancies".

Step 4 Linking and reconciliation of the table

17.56 As a result of Steps 1, 2 and 3, all the pieces of the jigsaw puzzle are now ready for linking, which produces the system illustrated in Figure 17.3. The system can now be transformed to the Product by Product or Industry by Industry multi-country IOTs as presented in Figure 17.2. Figure 17.7 shows an image of the transformation. The areas in pink colour form the Product by Product multi-country IOTs and the areas in blue colour form the Industry by Industry multi-country IOTs. The entries in the cells with a cross are shared between the two types of tables. The transformation to multi-country IOTs is based on the information given by the domestic output matrices ($\boldsymbol{V^A}, \boldsymbol{V^B}, \boldsymbol{V^C}$ in Figure 17.3) in line with the conversion formulae shown in Chapter 12 on the transformation of SUTs into IOTs.

Figure 17.7 Transformation to multi-country IOTs



* Except to those of the countries in Rest of the World

17.57 The final stage covers the reconciliation of the table, which has three tasks to complete:

- cross-checks between key aggregate figures of the linked table and corresponding macro-statistics from national sources, for example, National Accounts and foreign trade statistics.
- the investigation of the causes and the correction of errors if there is any outstanding mismatch.
- application of an automated balancing method for rounding up the table such as the RAS algorithm, where necessary. It is however advised that the use of such an automated method should be restricted to the final round-up of the table, only after thorough cognitive adjustment of the matrix. Also various constraints have to be set for the maximum utilization of the available information, see Ahmad, Wang and Yamano (2013).

D. Multi-country Input-Output databases initiatives

17.58 Since the early 2000s, several multi-country SUTs and IOTs databases have been developed by the scientific community and international organizations. The reference to the background papers of each initiative is shown in Box 17.1.

Box 17.1 Background papers of each database initiative

AIIOT	Meng, Zhang and Inomata (2013).
EORA-MRIO	Lenzen, Moran, Kanemoto and Geschke (2013).
EXIOPOL/EXIOBASE	Tukker, de Koning, Wood, Hawkins, Lutter, Acosta, Rueda Cantuche, Bouwmeester, Oosterhaven, Drosdowski, and Kuenen (2013).
FIGARO	Rueda-Cantuche, Remond-Tiedrez, Martins-Ferreira, Rocchi, Valderas-Jaramillo, Velázquez, Amores, Román and Cai (2017)
Global MRIO Lab	Lenzen, Geschke, Abd Rahman, Xiao, Fry, Reyes, Dietzenbacher, Inomata, Kanemoto, Los, Moran, Schulte in den Bäumen, Tukker, Walmsley, Wiedmann, Wood andYamano (2016).
GTAP-MRIO	Peters, Andrew, and Lennox (2011).
OECD-ICIO	http://www.oecd.org/sti/ind/tiva/tivasourcesandmethods.htm
WIOD	Dietzenbacher, Los, Stehrer, Timmer, and de Vries (2013) and Timmer (2012).

17.59 The database initiatives in Box 17.1 were originally developed to answer different policy needs and scientific aims, for example:

- EXIOBASE and EORA tackle environmental issues.
- GTAP-MRIO considers trade policy measures and impacts.
- OECD-ICIO, FIGARO and WIOD illustrate global production and value-added trade. OECD-ICIO and WIOD also provide data on socio-economic and environmental indicators at the industry level that can be used for a wide scope of applications.
- AIIOT focuses on the production networks in East Asia.

17.60 These international initiatives also differ in the data sources that underlie the models, by the country coverage, by the time span of data available, by the level of detail for industries and products, by the accessibility to the database and by the methodological choices in the compilation process.

17.61 Methodological choices are necessary when building up multi-country SUTs and IOTs. GTAP-MRIO uses trade data as benchmark to adjust the SUTs and IOTs whereas the other models start from the SUTs or IOTs and benchmark them to National Accounts statistics using trade data. In the case of EXIOBASE, FIGARO and WIOD, the SUTs are the first dominant input, whereas for AIIOT, the IOTs form the base. For OECD-ICIO, EORA and the Global MRIO Lab, there is a mix of SUTs and IOTs, although the OECD's data is moving to a fully SUTs-based approach for future editions. Specific challenges such as the treatment of re-exports, the CIF/FOB adjustment, the method for reconciling trade data will vary from one to another. In general, UN COMTRADE is used for trade statistics albeit some models complement it with specific datasets of national sources, for example, EU COMEXT for the European Union.

17.62 As previously mentioned, it is important to have the data at basic prices for both Supply Tables and Use Tables, in order to build multi-country SUTs and IOTs. Many national Use Tables are compiled and disseminated at purchasers' prices. Therefore, estimation is needed to compile the Use Table at basic prices when they are unavailable from the country in question. EXIOBASE, FIGARO and OECD-ICIO are based on the available data (therefore reflect the Use Table at basic prices when disseminated) or estimated from existing information. WIOD estimates the Use Table at basic prices using the SUT-RAS procedure. GTAP-MRIO constructs the data by exploiting information on multi-country margins and taxes. In EORA and the Global MRIO Lab, the Use Table at basic prices are constructed during a large-scale optimization procedure. Similar approaches occur to estimate the imports matrices with an extensive use of the proportionality assumption.

17.63 The earlier sections in this Chapter presented a standard practice of making the Imports Use Table by country of origin, which is to split the import matrix using the shares of national origins for each imported product. Alternatively, the OECD Regional-Global TiVA Expert Group takes a dual approach to this method. The export values in partner countries' Use Tables are allocated, country by country, using the row-wise distribution ratios of the import matrix (converted to FOB) in order to form its mirror statistics. Since the values in the derived import matrices are benchmarked to partner countries' export data in FOB valuation, it gives a more solid link to the SUTs of the exporting countries.

17.64 In 2018, the OECD-ICIO tables underlying the TiVA database will be updated to the 2008 SNA methodology. In the same year, the Eurostat FIGARO project will provide European reference data based on the latest international classifications and the ESA 2010 (adaptation of the 2008 SNA for the European Union). The new data will also include specific adjustments for merchanting trade and goods sent abroad for processing, see Section B.5 in this Chapter, as the FIGARO Project has a particular focus on the trade asymmetries within the European Union.

Box 17.2 Overview of the main features of the various databases

Database Name	Number of countries	Number of industries and products	Years	Availability of data
AIIOT	10 (8 for 1975 table)	76 products (56 for 1975 table, 77 for 1985 table)	1975, 1985, 1990, 1995, 2000, 2005	Yes
EORA	187	Varying across countries; simplified version with 26 industries	1990-2013	Yes
EXIOBASE Versions 2 and 3 are more enhanced	43 countries; 5 world regions	220 products; 163 industries	2000, 2007	Yes
FIGARO	28 EU countries; USA; Rest of the World	64 industries; 64 products	2010; 2010-2017 (in progress)	Yes
Global MRIO Lab	220 countries	Flexible choice: 6357 product, industry root classification	1990-2015 (preliminary data)	Yes
GTAP-MRIO	140 GTAP regions	57 GTAP commodities	2004, 2007, 2011	Only to GTAP members
OECD-ICIO	64 (including Rest of the World)	34 industries; 34 products	1995, 2000, 2005, 2008-2011; now-casted for 2012-2014	Yes (TiVA indicators only)

WIOD (2013 release)	41 (including Rest of the World)	35 industries; 35 products	1995-2011	Yes
WIOD (2016 release)	44 (including Rest of the World)	56 industries; 56 products	2000-2014	Yes

E. Way ahead

17.65 The multi-country SUTs and IOTs can be continually improved and extended in various directions. Presently, the areas listed below are amongst those requiring the greatest attention of the statistical communities:

- Bilateral trade symmetries;
- Rest of the World;
- Proportionality assumption;
- International freight and insurance costs;
- Direct purchases by travellers;
- Firm heterogeneity;
- Factor income transfers; and
- Sub-regionalization of multi-country SUTs and IOTs.

(a) Making trade data symmetric

17.66 The problem of bilateral trade asymmetries has been extensively discussed in the earlier section, and it is one of the key obstacles to constructing consistent and harmonized multi-country SUTs and IOTs.

17.67 The on-going joint effort by the OECD, WTO, Eurostat and other international organizations, in collaboration with various NSOs, aims to develop benchmark trade dataset of both goods and services in which the asymmetry problem is resolved in alignment with National Accounts constraints. Using this benchmark data in the compilation of multi-country SUTs is expected to significantly reduce the aforementioned discrepancies, see Fortanier and Sarrazin (2016) and Fortanier, Liberatore, Maurer and Thomson (2016).

(b) More countries to cover, less to be included in Rest of the World

17.68 The format of the multi-country SUTs and IOTs introduced in this Chapter treats any country whose SUTs are not integrated into the table as outside the system and puts it under the label of "Rest of the World". In line with the globalization of economic activities, however, the cross-border production networks continue to expand further to involve more countries which have not been given much attention to date. Also, the new entrants of the international networks may grow faster as a result of participation in more sophisticated production sharing among countries. As a result, they may have a significant impact on the global production system and a failure to include them in the model becomes increasingly inappropriate, see Stadler, Steen-Olsen, and Wood (2014).

17.69 Some existing multi-country IOTs, notably the OECD's Inter-Country Input-Output Tables (ICIO) and the European Commission funded World Input-Output Tables (WIOD) have featured Rest of the World as a single endogenous region in the transaction matrices. This allows the multi-country Leontief inverse to be derived with respect to the corresponding segments, see Dietzenbacher, Los, Stehrer, Timmer, and de Vries (2013).

17.70 In contrast, the EORA database developed by the University of Sydney and the Global MRIO Lab developed by Project Réunion utilise all relevant information to estimate unavailable transaction matrices with the aid of a powerful estimation algorithm, and thereby maximizes the number of endogenous countries to the extent that Rest of the World as a residual of the system becomes almost negligible in terms of transaction volumes, see Lenzen, Moran, Kanemoto, and Geschke (2013).

(c) Departure from the "proportionality assumption"

17.71 The countries with less developed statistical bases often resort to the proportionality assumption in making the Imports Use Table as described in Chapter 8. This approach assumes an identical distribution structure of a product among different domestic users, no matter whether it is imported or domestically produced. While the assumption could be acceptable for a highly disaggregated Use Table, it may cause some inappropriate allocation of imported goods when the products with different degrees of foreign sourcing are mixed under the same product category.

17.72 The problem spills over to the construction of the Imports Use Table by country of origins for the multi-country SUTs and IOTs. For example, the production chain of a cellular phone, from designing, research, and manufacturing to distribution may spread over different countries, where the parts and components are produced in some countries and then assembled into a finished product in a yet different country. If the phones' finished product and parts are bundled together in the Use Table under the label of, for example, "Telephone sets, including telephones for cellular networks or for other wireless networks; other apparatus for communication in a wired or wireless network" (CPC Ver. 2.1 4722), the sourcing country mix of this product category will be different between the household final consumption (buying finished products, and hence more import from the country of final assembly) and industries (buying part and components, and hence more import from other countries). Here, the "proportionality" is disturbed among different users of the product.

17.73 With these types of cases, it is recommended that a special survey is conducted on key imported products, or wherever available, the information from business registers is integrated, in order to identify their distribution structures among domestic users with a sufficient level of detail. Any additional information of this kind will significantly improve the quality of multi-country SUTs and IOTs. Constructing import data by end-use categories (BEC or BTDIxE) is an improvement on the proportionality assumption.

17.74 Apparently, it is not only about trade in goods but also trade in services that the data should be developed in this direction, alongside the search for more information on detailed service categories and partner countries than currently available in the Balance of Payment statistics and others.

(d) Direct purchases by travellers

17.75 In the current SUTs framework, the household final consumption expenditures in the Use Table is recorded on the domestic territorial basis with macro-adjustment rows of "Direct purchases abroad by residents" and "Purchases on the domestic territory by non-residents". The counterbalancing entries for imports and exports are presented along these rows vis-à-vis respective columns in the Supply Table and the Use Table as shown in Chapter 5 and Chapter 6.

17.76 With an increasing flow of people crossing borders, however, it is advisable to record household final consumption expenditures on the national basis by product, accompanied by a corresponding adjustment for the elements in the import and export vectors. For this end, the entries in the adjustment rows should be expanded and redistributed by product, by making an appropriate reference to external sources such as international passenger surveys (for example, expenditure on food, alcohol, hotels, travel, leisure and shopping). It is noted that the spending by business travellers must be separated out in these data, as this expenditure should be recorded as intermediate consumption by an industry.

(e) Disaggregation of industries by firm characteristics

17.77 The rapid increase of foreign direct investment over the past few decades has added a new feature of production technology in developing economies. Technological heterogeneity within a single industry, say, among domestic oriented producers, processing exporters and non-processing exporters or between large scale enterprises and small/medium scale firms, implies that the current treatment of SUTs and IOTs is less effective in analysing the structure of global production sharing.

17.78 In this respect, the multi-country SUTs and IOTs can be extended by further disaggregating its industrial sectors by firm characteristics. Ideally, this breakdown should be provided within the context of constructing national SUTs, possibly through the development and application of structured firm-level micro data. In many cases, however, the relevant data build on existing national sources, for example, by linking firm-level trade data and business registers, and thereby aim to identify the characteristics of traders such as sizes (number of employees), types (exporter/importer) or ownership (foreign controlled/domestically controlled). These efforts include Trade by Enterprise Characteristics (TEC), Services Trade by Enterprise Characteristics (STEC) and Foreign Affiliate Statistics (FATS). The interest and analytical demands in this area is rapidly growing, see Piacentini and Fortanier (2015), and OECD (2015).

(f) Incorporation of factor income transfers

17.79 With ever-increasing mobility of people and capital being transferred across borders, the multi-country SUTs and IOTs can better capture the nature of economic inter-dependency, if these tables can be extended to embrace the cross-border transfer of factor incomes (repatriation). This is particularly relevant when considering the growing impact of multinational corporations on the international distribution of income and wealth. Identifying these flows requires not only a breakdown of SUTs by firm ownership but also a more detailed disaggregation of GVA using information from business surveys as well as FDI statistics.

(g) Sub-regionalization of multi-country IOTs

17.80 The current multi-country SUTs and IOTs framework regards a referred country as if it is a 'point' of transaction in the international production networks. A national economy, however, has a spatial dimension. It is rather unjustifiable to treat countries like Brazil or Russia in the same manner as Singapore or Costa Rica. In particular, as a result of increasing relocation of production capacities across borders, it is possible to envisage that a region in one country has stronger economic ties with regions in foreign countries rather than with its own domestic neighbours.

17.81 The multi-country SUTs and IOTs can be extended to capture cross-border economic linkages on the region-to-region basis, for example, from Guangdong province in China to Tohoku region in Japan by embedding Inter-Regional IOTs of referred countries in a single multi-country IOT matrix, as covered by Inomata and Meng (2013).

Chapter 18. Projecting Supply, Use and Input-Output Tables

A. Introduction

18.1 For a number of analytical purposes users often require comparable SUTs and IOTs. This implies, for example, that they need SUTs and IOTs available on a regular frequency and with certain timeliness. In practice, however, SUTs may be compiled on an annual basis or every five years or even at irregular time intervals. The situation for IOTs is similar.

18.2 In general, a projection problem consists of knowing one single base table (SUTs or IOTs) and estimating a target table possibly with additional information such as known row and/or column totals or even certain table elements. There are a variety of methods, techniques and approaches in projecting SUTs and IOTs and dealing with the missing data gaps. Projections are generally done by analysts and researchers but depending on the situation some projection model could be used in support of regular compilation in specific circumstances. Therefore, these techniques are not only for analytical purposes but they can also help producers, for example, dealing with periods between benchmarked years.

18.3 This Chapter provides a review of various projection methods and techniques as well as references to work in literature to help overcome the problem of incomplete data thus allowing the estimation and projection of SUTs and IOTs. The Chapter starts, in Section B, with a description of the needs for projection methods. It then provides in Section C, a review of the general approaches and categorization of the projection methods including a historical perspective on some of the work in literature that is most relevant to the scope and content of this Handbook. Section D presents a numerical example of three projection methods: the generalised RAS (GRAS) method, the SUT-RAS method, and the Euro method. Finally, Section E provides a description of the criteria to consider when choosing a projection method.

B. Why is there a need for projection methods?

18.4 Projection methods may be useful in a variety of circumstances such as dealing with the lack of timeliness of the required SUTs and/or IOTs, to reconcile inconsistent information with different reliability, to carry out the historical revisions to ensure a consistent time series of the tabulations, to compile multi-regional SUTs and IOTs; and finally to overcome the issue of incomplete data due to confidentiality. These are described next.

18.5 *Timeliness*. The frequency and timeliness of SUTs and IOTs compiled at national level varies enormously among countries and this is often a major constraint in policy research undertaken at global level.

Thus there is the need for using non-survey based methods to estimate SUTs and IOTs for missing years or updating previous SUTs and IOTs to revised totals.

18.6 *Balancing*. During the balancing process in the compilation of SUTs and IOTs, there are many cases where data for specific cells, or groups of cells, in the tables are well known (through specific data sources, for example, business surveys, government based data, etc.) or there is reliable information on certain column and/or row totals but there could also be cases where data from the different data sources are conflicting whereby the NSOs allocate different levels of reliability to the different sources. Guidance on how to resolve this is very limited, examples include: Dalgaard and Gysting (2004); Tarancón and del Río (2005); and Lenzen, Gallego and Wood (2009).

18.7 *Revisions*. Often revisions are needed to existing benchmark SUTs and IOTs to reflect, for example, a new version of the SNA or a new classification. Projection approaches may be required due to the fact that official SUTs and IOTs, going back a number of years, are not usually revised when more recent data have been estimated or when there is a change in the statistical concepts or methodological issues, such as the advent of 2008 SNA or revised classifications like ISIC Rev. 4. It is not expected that NSOs will provide SUTs and IOTs based on the 2008 SNA for "all" the back years and benchmarks. Therefore, there is a need to blend survey based data with sound mathematical techniques to avoid discontinuities in the SUTs and IOTs, for example, Rueda-Cantuche, Amores and Remond-Tiedrez (2013).

18.8 *Multi-regional or multi-country analysis*. The role and significance of multi-regional and multi-country analysis has seen a renaissance over the past two decades using multi-regional SUTs and IOTs databases to inform worldwide policy research issues such as climate change, international trade, competitiveness and sustainable production and consumption policies (see Chapter 17). Several international projects have used some of these projection methods for the estimation/projection of missing national SUTs and IOTs and for the eventual balancing of the multi-regional databases. Major examples of these databases include:

- World Input-Output Database, Dietzenbacher *et al.* (2013);
- EXIOBASE Database, Tukker *et al.* (2013);
- GTAP-MRIO Database, Andrew and Peters (2013);
- Eora Database, Lenzen *et al.* (2013);
- Asian International Input-Output Tables, Meng *et al.* (2013);
- OECD Inter-country Input-Output Database; and
- Eurostat's single SUTs and IOTs for the European Union and the Euro Area, Eurostat (2011b).

18.9 *Confidentiality*. The issue of confidentiality may render some national datasets incomplete due to the suppression of data due to confidentiality which can be overcome by projection methods in research analysis. The gaps will also vary across countries, for example, the different legislations and treatment of data collected from businesses.

C. General approaches for the projection methods with a historical view

18.10 As mentioned, the general balancing/projection approach basically relies on having available **one base table** (SUTs, IOTs or SAMs) and at least the **row and column totals for the incomplete table**. Alternatively, Mínguez *et al.* (2009) and Oosterhaven *et al.* (2011) considered several complete tables as base tables, whether they were a time series of IOTs or a group of different IOTs from different regions. Furthermore, row and/or column totals may be missing in some situations as well, as dealt with Eurostat (2008) and Temurshoev and Timmer (2011).

18.11 There are three different ways (including a modified version of the distinction made by Lenzen *et al.* (2009)) to address the projections, where data gaps for the interior elements of the tables outnumber the external constraints in the form, for example, of row and column totals. These are:

- Constrained optimization methods based on probability and information theory or based on distance measures.
- Proportional scaling methods which can be one-sided or bi-proportional.
- Modelling based methods.

18.12 Some of the projection methods can in principle be used in the reconciliation of information from different data sources and in the balancing process of SUTs and IOTs, a section is introduced to briefly describe this application of projection methods.

1. Historical overview of projection methods

18.13 This historical overview pivots around the general problem of balancing/projecting SUTs and IOTs and any other related matrices (for example, valuation matrices) concerning the different price valuations covered in the 2008 SNA, mainly basic prices and purchasers' prices and the distinction between domestic uses and import uses, wherever appropriate.

18.14 It is important to note that although the projection problem has given rise to a number of attractive mathematical features, they are often not combined with survey data, other data sources or expert opinions on certain key elements like rows, columns or individual cells. Only very recently, there have been attempts to follow the so-called hybrid strategy (Miller and Blair 1985, page 336), as a way to capture the best of both, selective survey and expert information and mathematical projection techniques. This would be highly recommendable whenever possible.

18.15 Huang *et al.* (2008) describe the projection problem as a linear or non-linear programming problem, which can be expressed as:

$$Minimize\ f(\boldsymbol{X})$$

Subject to:

$$\sum_{j=1}^{n} x_{ij} = u_j \quad \forall i = 1, \dots, m$$

$$\sum_{i=1}^{m} x_{ij} = v_j \quad \forall i = 1, \dots, n$$

$$z_{ij} \geq 0 \qquad \forall i, j$$

where: z_{ij} is the ratio derived from $x_{ij} = z_{ij}\ a_{ij}$, being $a_{\ ij}$the original entry and x_{ij}, the target entry in matrix $\boldsymbol{X}$. Row and column totals are represented by u_i and v_j, respectively. The matrix/table has m rows and n columns and can be either rectangular $(m \neq n)$ or square $(m = n)$.

18.16 The solutions of this problem can take the form of a simple iterative proportional scaling process or can lead to substantial programming requirements with sometimes long run times, for example, non-linear objective functions.

18.17 This group of methods has been categorised with the general term **constrained optimization methods** and can be split up into two groups depending on the type of objective function $f(\,)$:

- The first group, in general, has in common the fact that the methods minimise some measure of distance between all elements of the two matrices, the prior and the estimated projection. There are many types of distance measures such as absolute differences, square differences as shown in Box 18.1.
- The second group comprises objective functions that are based on the statistical concept of Kullback-Leibler (K-L) divergence, also denoted as information loss, taken from the probability and information theory laid out by Kullback and Leibler (1951). In short, the K-L divergence of two probability distributions Q and P is a measure of the information lost when Q is used to approximate P. The measure Q typically represents an approximation of P and evidently, the solution to the problem provides a minimum information loss. This concept was first associated to the RAS solution by Uribe et al (1965).

18.18 Within this framework, Bacharach (1970) used technical coefficients which to some extent could be considered as a measure of probabilities, bounded between 0 and 1 and non-negatives, to prove that the solution to this problem could also be expressed in terms of a simple bi-proportional iterative scaling method, which was the so-called RAS method used by Stone (1961). McGill (1977), Bachem and Korte (1979) and Batten (1983) also contributed to this idea.

18.19 The extension of this statistical concept to a transactions matrix prompted a lot of discussion provided that the elements of the matrices are not coefficients any more but (positive and negative) absolute values, key examples include: Günlük-Senesen and Bates (1988); Junius and Oosterhaven (2003); Huang *et al.* (2008); Lenzen *et al.* (2007); and Lemelin (2009). However, the solutions do not always turn out to be simple scaling methods, for example as covered by Stone *et al.* (1942); Robinson *et al.* (2001); Golan *et al.* (1994); Rodrigues (2014); Lugovoy *et al.* (2015); and Fernández *et al.* (2015) also proved the Bayesian approach with success.

18.20 Alternatively, there are other methods that do not necessarily have to be written in the form of a programming problem such as Tilanus (1968) and Timmer *et al.* (2005), and have been categorised as **proportional scaling methods**. This category may also include other one-sided or bi-proportional methods.

18.21 Finally, there are other methods that use I-O **modelling based methods** to project SUTs and IOTs, for example, Leontief price and quantity models used by Snower (1990); Beutel (2002) and (2008); Valderas (2015); time series analysis covered by Wang *et al.* (2015); and econometric methods used by Kratena and Zakarias (2004).

18.22 Box 18.1 shows a summary of the literature using methods for balancing/projecting SUTs and IOTs and provides a broad overview of the different available methods. The detailed aspects of all of them can be found in their respective references. This review also acknowledges the earliest, to our knowledge, related contributions even though they were not initially conceived to be used in the I-O accounts. However, these are not included in Box 18.1 but reflected within the text of this Chapter.

Box 18.1 Methods for projection of SUTs and IOTs

Year	Author(s)	Summary of methodology
	Proportional scaling methods	
1960	Osborne	Diagonal similarity scaling (DSS)
1964	(*) Matuszewski, Pitts and Sawyer	Proportional correction method (PCM)
1968	(*) Tilanus	Statistical correction method (SCM)
1970	Ehret	Procedure of selected coefficients (PSC)
1974	Evers	Procedure of selected coefficients (PSC)
2005	(*) Timmer, Aulin-Ahmavaara and Ho	EUKLEMS
2008	Eurostat	Procedure of selected coefficients (PSC)
2011	(*) Temurshoev, Webb and Yamano	EUKLEMS
2013	Pereira, Carrascal and Fernandez	PATH-RAS (or GLOBAL MODEL)
2013	Rueda-Cantuche, Beutel, Remond-Tiedrez and Amores	Good practices guidelines (GPG)
2013	Rueda-Cantuche, Amores and Remond-Tiedrez	RACE
	Constrained optimisation methods (based on probability and information theory)	
1961	Stone	RAS
1963	Paelinck and Waelbroeck	MRAS
1970	Bacharach	RAS
1972	Stäglin	Method of double proportion patterns (MDPP)
1986	Israilevich	ERAS
1988	Günlük-Senesen and Bates	GRAS
1994	Golan, Judge and Robinson	Minimisation sum of cross-entropies (MSCE)
1999	Gilchrist and St. Louis	TRAS
2003	Junius and Oosterhaven	GRAS
2004	Dalgaard and Gysting	Commodity-flow balancing algorithm (CFB)
2008	Eurostat	Method of double proportion patterns (MDPP)
2009	Lenzen, Gallego and Wood	KRAS
2011	Temurshoev and Timmer	SUT-RAS
2014	Rodrigues	Bayesian approach for SUTs (BY-SUT)
2015	Fernández, Hewings and Ramos	Cross-entropy based Bayesian approach (BY-CE)
2015	Lugovoy, Polbin and Potashnikov	Bayesian approach for IOTs (BY-IOT)
	Constrained optimisation methods (based on distance measures)	
1961	Friedlander	Normalised square differences (NSD)
1964	Matuszewski, Pitts and Sawyer	Normalised absolute differences (NAD)
1968	Almon	Square differences (SD)
1971	Jaksch and Conrad	Least squares method (LS)
1987	Hartoorn and van Dalen	Generalisation of least squares differences (HvD)
1988	Kuroda	Square (weighted) relative differences (KUR)
2001	Lahr	Weighted absolute differences (WAD)
2004	Lahr and Mesnard	Absolute differences (AD)
2004	Jackson and Murray	Global change constant (GCC)
2004	Jackson and Murray	Sign-preserving absolute differences (SPAD)
2004	Jackson and Murray	Weighted square differences (WSD)
2004	Jackson and Murray	Sign-preserving square differences (SPSD)
2005	Tarancón and del Río	ANAIS
2008	Huang, Kobayashi and Tanji	Improved square differences (ISD)
2008	Huang, Kobayashi and Tanji	Improved normalised square differences (INSD)
2008	Huang, Kobayashi and Tanji	Improved weighted square differences (IWSD)
2008	Eurostat	Least squares method (LS)
2008	Rampa	Weighted least squares (WLS)
2009	Mínguez, Oosterhaven and Escobedo	Cell-corrected RAS (CRAS)
	Modelling based methods	
1990	Snower	TAU-UAT
2002	Beutel	EURO
2004	Kratena and Zakarias	Econometrics based method (ECO)
2008	Eurostat	EURO
2008	Beutel	SUT-EURO
2015	Valderas	SUT-EURO
2015	Wang, Wang, Zheng, Feng, Guan and Long	Matrix Transformation Technique (MTT)

Notes: (*) One-sided proportional methods.

For some methods (for example RAS) there are earlier works that refer to applications not related to SUIOTs and I-O analysis. They are cited instead in the text for the sake of comprehensiveness.

2. The RAS method

18.23 There are some common features to the proportional scaling methods and the constrained optimization methods that are based on the minimum information loss principle (information theory). They usually provide a solution that is simple to implement, relatively quick, sign-preservation, and with minimum data requirements. The most prevailing method is the so-called RAS method.

18.24 The basic idea of RAS was firstly developed to be used with IOTs, and particularly, applied to the intermediate inputs part of the Use Table. It consists in changing the structure of the known base table as little as possible. Suppose that there are two square matrices of technical coefficients, $\boldsymbol{A}$ and $\boldsymbol{B}$. All the elements in $\boldsymbol{A}$ are known but only some of the elements of $\boldsymbol{B}$ are known, such as:

- the total industry output, which means that we are implicitly considering Industry by Industry IOTs;
- GVA by industry, therefore, by difference, intermediate consumption by industry, u_j; and
- total final uses by products; and therefore, by difference, the sum of outputs of products to industries for intermediate consumption, v_j).

18.25 The problem is to project the elements of $\boldsymbol{B}$ in such a way that they are as close as possible to the corresponding elements of $\boldsymbol{A}$, subject to the known marginal column and row totals, as described by Toh (1998). The closeness in the RAS method is achieved by minimizing the following K-L based objective function described by Bacharach (1970):

$$Minimize \sum_i \sum_j b_{ij} \ln\left(\frac{b_{ij}}{a_{ij}}\right)$$

Subject to:

$$\sum_j b_{ij}x_j = u_i$$

$$\sum_i b_{ij}x_j = v_j$$

18.26 The solution is the set of r and s scaling factors, which satisfy:

$$b_{ij} = r_i a_{ij} s_j$$

$$\sum_j r_i a_{ij} s_j x_j = u_i \quad (1)$$

$$\sum_i r_i a_{ij} s_j x_j = v_j \quad (2)$$

18.27 For bi-proportional methods, this problem could be written either in terms of technical coefficients or transaction values, as covered by de Mesnard (1994) and Dietzenbacher and Miller (2009) illustrating that the results were indeed equivalent.

18.28 In matrix terms, $\boldsymbol{B} = \boldsymbol{RAS}$, being $\boldsymbol{R}$ and $\boldsymbol{S}$ diagonal matrices with the corresponding r and s scaling factors in the main diagonal. However, there is no direct solution to the scaling factors, r and s. Instead, the following simple and iterative procedure converging to the desired totals is applied. It starts by choosing a first set of r scaling factors, say all equal to 1, and the elements of s are computed using equation (2). These s scaling factors are then used in equation (1) for the calculation of the scaling factors r, which can be fed back into equation (2) to derive new estimated s scaling factors. The process is repeated until the values of the scaling factors are not changed between iterations within a certain threshold or a sufficient number of times. de Mesnard (1994) proved that the solution to the RAS problem is independent of the initial values of r and s and therefore, it remains unchanged.

18.29 The origins of the RAS method go back several decades - Bregman (1967) attributed this method to 1930s Leningrad architect Sheleikhovskii, who used this approach to estimate transportation traffic flows. Kruithof (1937) also used the RAS approach to estimate telephone communication traffic flows. Nonetheless, it was not until Deming and Stephan (1940) when this approach became accessible to social scientists and the English language, Lahr and de Mesnard (2004). Since then, there have been many applications to many fields different from SUTs and IOTs, for example, migration and transportation flows, international and inter-regional trade, voting patterns, etc.

18.30 According to Lahr and de Mesnard (2004), it was Leontief (1941) who first used bi-proportional techniques within the context of I-O analysis with the purpose to identify the sources of inter-temporal change in the elements of IOTs. Nevertheless, it was Sir Richard Stone, Stone *et al.* (1942), Stone (1961), Stone (1962), Stone and Brown (1962) who waved the banner on behalf of the RAS method within the field of I-O analysis. For further details of the historical background of the RAS method, refer to Bacharach (1970), Lecomber (1975), Polenske (1997) and Miller and Blair (2009).

18.31 The RAS method was used extensively by Bacharach (1970) to update old IOTs to a more recent or even future period for which only the row and column totals were available. Similarly, Hewings (1969) and (1977) also used bi-proportional techniques to the problem of regionalising the national IOTs given some row and column totals at the regional level. Later, Oosterhaven *et al.* (1986) combined both ideas to solve the problem of updating inter-regional IOTs. Miller and Blair (2009) provide an overview of this issue.

18.32 There is no doubt that RAS has been one of the most successful methods in terms of the number of applications where it has been used. Following Jackson and Murray (2004) and Lahr and de Mesnard (2004), the main features that have contributed to RAS being used so often can be summarised as follows:

- In terms of information theory, the RAS solution provides the **minimum information loss**, when we use the input structure of an original IOT as an approximation to the input structure of the target IOT. In other words, the target table is as close as possible to the prior.
- RAS is **sign preserving** and does not allow converting zero elements from the original matrix into non-zero elements in the target table, and does not yield negative values, which is helpful for input structures.
- The iterative solution to the RAS method is **simple to understand** and **straightforward to program and apply**.
- RAS has the **minimum data requirements**, only row and column totals.
- Scaling factors *r* and *s* can be interpreted as **substitution and fabrication factors**, respectively. The former (row-wise) are meant to be a measure of the degree to which an input has replaced or has been replaced over time by other inputs while the latter refers to the extent to which the initial industry mix of the economy varies (column-wise). Van der Linden and Dietzenbacher (1995), de Mesnard (2002) and de Mesnard (2004) remarked, that a meaningful interpretation of the RAS-type scaling factors is only possible if transformed into relative values, for example, normalization, but never with the absolute

values of *r* and *s*. Interestingly, Toh (1998) also proved that *r* and *s* can also be interpreted as statistical estimates obtained from the method of Instrumental Variables (IV) allowing for asymptotic standard errors and confidence intervals.

18.33 The RAS method, however, has also several drawbacks. They include the following:

- Projection of the intermediate matrix only may not be sufficient to build up the target IOTs. There are other missing components such as GVA and final uses, which may also contain legitimate negative values such as changes in valuables and inventories, and other net taxes on production.
- The RAS method requires row and column totals to be known, and sometimes, they are missing and have to be estimated. It may also be that less information is available on these totals, for example, only industry output or column totals may be available.
- The RAS method can deal with one single price valuation at a time while the SNA defines several price valuations, for example, basic prices and purchasers' prices as well as current prices and in volume terms. They can actually be even more disaggregated, for example, trade margins are shown separate from transport margins or consumption is split between domestic output and imports.
- Sign-preservation is a feature of RAS can also be seen as a drawback - where the cell value can switch sign between periods, for example, taxes less subsidies on products or changes in inventories. However, Lenzen *et al.* (2014) successfully addressed this issue and proposed a mathematical solution.
- If RAS is carried out successively over a number of years, hysteresis problems will arise leading to discontinuities and potential errors as covered by Lenzen *et al.* (2012).
- The RAS method cannot handle conflicting external data and cannot incorporate constraints on the row and/or column totals and/or any set of interior elements unless it is properly extended as in Gilchrist and St. Louis (1999) and Oosterhaven *et al.* (1986) or unless the KRAS method covered by Lenzen *et al.* (2009) is used with non-unitary coefficients. For example, the total of trade margins must be equal to the total output of trade industries at basic prices which may not occur automatically. The supply and use of products and industries must be balanced in advance.
- The RAS method does not allow the use of relative reliabilities on the initial tables and on external constraints which would be advisable to compute interval estimates rather than point estimates. Indeed, the RAS method may generate implausible results and requiring further adjustments. However, for research purposes, Miller and Blair (2009) claimed that as long as the resulting multipliers perform well, they should be still used.
- The dimension of the initial and target tables must be the same, which makes impossible to address the problem of a change in the classification and/or methodological systems. In this sense, the number of industries and products may change from one system to another.

(a) Further extensions of RAS - with less information

18.34 Different variants of the RAS method have been utilised with the aim to circumvent the limitations presented above. One of them is a further extension of the RAS method to deal with less information.

18.35 Günlük-Senesen and Bates (1988) defined Generalised RAS (GRAS) method which was further formalised mathematically by Junius and Oosterhaven (2003). The GRAS method allows for positive and negative values in the initial tables and it is sign preserving, like the RAS method. The RAS method can be considered as a special case of the GRAS method. However, unlike RAS, the objective function of the GRAS method has been somewhat controversial in the sense that it eventually does not really represent the K-L divergence or minimum information loss principle as covered by Lemelin (2009).

18.36 The latest versions of the GRAS method are used in Lenzen *et al.* (2007), Huang *et al.* (2008) and Temurshoev *et al.* (2013). In particular, the latter authors present a GRAS analytical solution that does not need of high performance, non-linear solvers, as in Lenzen *et al.* (2007). They also deal with full non-positive rows and/or columns, for example, the row elements of trade industries in a trade margins matrix are always negative, and infeasible RAS cases as covered by Miller and Blair (2009, page 336). In practice, this is very helpful since small positive numbers are often added to the initial table in order to guarantee convergence.

18.37 Another advantage of the GRAS analytical solution proposed by Temurshoev *et al.* (2013) covers control of the convergence process by setting the desired threshold level, which is not straightforward when using solvers. Furthermore, the scaling factors derived from the analytical solution have, as mentioned earlier, economic interpretations covered by Stone (1961), Toh (1998), van der Linden and Dietzenbacher (2000) that cannot be found if solvers are used.

18.38 However, similar to the RAS method, the GRAS method needs to have known row and column totals, which is sometimes unrealistic if we extend the projections to SUTs instead of just IOTs. Indeed, the total product outputs are not usually known and therefore, row totals are not known. To solve this issue, Temurshoev and Timmer (2011) proposed the SUT-RAS method, which has an additional number of advantages compared with the GRAS method. The SUT-RAS method was extensively used in the construction of the World Input-Output Database, Dietzenbacher *et al.* (2013). Most prominently, the SUT-RAS method can be applied in a variety of settings: basic prices, purchasers' prices and with a distinction between domestic and import uses, while the GRAS method is envisaged to be applied only to a single price valuation at a time, for example, basic prices and to total uses. Moreover, the SUT-RAS method is conceived as a joint estimation of rectangular SUTs such that total supply and total use match both for products and industries. Similarly, Temurshoev *et al.* (2011) and Timmer *et al.* (2005) proposed the so called EUKLEMS method, which is based on one constraint only, columns sums condition – industry output, resulting in a one-sided RAS-type technique.

18.39 Concerning the lack of information, the situation might be worse in some cases. Information may even not be available on industry outputs (the column totals). Within this context, there are two outstanding methods that were designed with the philosophy of projecting SUTs and IOTs using a minimum set of data requirements:

- EURO method for IOTs covered by Beutel (2002); Eurostat (2008); and SUT-EURO method (for SUTs) covered by Beutel (2008) and Valderas (2015); and
- Path-RAS method covered by Pereira *et al*. (2013), also denoted as the Global Method.

18.40 Instead, they require GVA by industries, total final uses of the different categories, total taxes less subsidies on products, and total imports.

18.41 The SUT-EURO method cannot handle rectangular SUTs and should be used with IOTs or square SUTs only. In particular, the SUT-EURO method has been used extensively by Eurostat in the estimation of European SUTs and IOTs provided that the number of industries and products was the same within the context of the CPA and NACE classifications used in the EU. The Path-RAS method as stated in Pereira *et al*. (2013)

is only conceived for IOTs but recent work in progress made by Pereira and Rueda-Cantuche (2013) has proven that it can also be extended to either square or rectangular SUTs. It estimates SUTs jointly (as in SUT-RAS) distinguishing between domestic and import uses and it consists of an iterative process that allocates the deviations obtained in each iteration to final uses and GVA using a weighted average of the conflicting estimates of the corresponding intermediate uses.

18.42 The SUT-EURO and the Path-RAS methods can be very helpful when regionalising national or regional SUTs and IOTs into smaller geographical areas where GVA by industries are usually better known than industry outputs.

(b) Further extensions of RAS - with more information

18.43 All of the above methods do not use any other extra information other than row and/or column totals of the target tables or none of them. However, there may be the situation that additional external information is available on the interior elements of the target SUTs and IOTs and/or on the constraints that can be useful for the projections. Indeed, Szyrmer (1989), Gilchrist and St Louis (1999), Lenzen *et al.* (2006) and de Mesnard and Miller (2006) came to the same conclusion that the introduction of partial information improves the outcomes of the RAS-type projections. The RAS methods can thus be extended to cover the case that additional information is available.

18.44 The earlier work in the 1960s took the form of a Modified RAS (MRAS) covered by Paelinck and Waelbroeck (1963). The particular known cell values were set to zero and subtracted from the row and column totals. The RAS method would then be applied to the remaining cells, and eventually, the known cells would be placed back to the projected table. However, this solution may create too many zeros in the modified initial table which could lead to unsolvable RAS situations. More refined methods and applications were developed later by Barker (1975), ERAS covered by Israilevich (1986); Oosterhaven *et al.* (1986); Batten and Martellato (1985); Snower (1990); Cole (1992); Jackson and Comer (1993); TRAS covered by Gilchrist and St Luois (1999) and (2004); Planting and Guo (2004); SUT-RAS covered by Temurshoev and Timmer (2011).

18.45 By adding external known information and/or external additional constraints to the target tables which are different from those of the column and row totals, it is possible to go one step further from a full automated mathematical process to a more elaborated, and expert guided, methods for the estimation of SUTs and IOTs.

18.46 A distinction is generally made between “projection”, either in time, updating, or by regions, regionalization, and “estimation”. The availability of extra information on subsets of elements as well as on additional external constraints converts a projection problem into an estimation problem.

18.47 Furthermore, the estimation problem can also be transformed into a “compilation” problem. Suppose the IOTs (Industry by Industry), where the final uses of one product is known as well as the total output of the industry producing it. Subsequently, the total intermediate use of the same product is given by difference but nothing guarantees that it will have to be feasible, for example, positive. This is an example of conflicting external data covered by Lenzen *et al.* (2009) and RAS-type methods cannot handle them. Incidentally, this is maybe the most usual situation that NSOs face in their tasks of compiling SUTs and IOTs. For this reason, we have identified these types of methods as closer to compilation tasks rather than to estimation or projection methods. Moreover, initial SUTs produced in NSOs will never be balanced as they are based on data from several different data sources. Actually, this is similar to the scenario of balancing supply and uses of products and industries’ inputs and outputs.

18.48 With this in mind, Table 18.1 shows a categorization of the methods presented in Box 18.1 as well as providing information about whether the focus of the methods are on SUTs or IOTs (either with a transaction matrix or with a technical coefficient matrix, A).

18.49 Lenzen *et al.* (2009) proposed a balancing method that incorporated the following properties:

- Handling non-unity coefficients, for example, constraints on any subset of matrix elements instead of fixing row and column sums only.
- Handling conflicting external data and inconsistent constraints.
- Allows for relative reliabilities of initial estimates and of external constraints.
- Deal with negative values and, if required, can be sign preserving.

Table 18.1 Categorization of methods

	Projection	Estimation	Compilation
SUTs	EUKLEMS* Path-RAS** SUT-EURO* SUT-RAS**	GPG* RACE*	CFB** BY-SUT*
IOTs/A	AD, DSS, EURO*, GCC, GRAS, HvD, (I)SD, (I)NSD, (I)WSD, KUR, LS, MDPP, MSCE, NAD, PCM, PCS, RAS, SPAD, SPSD, SCM, TAU-UAT, WAD	BY-CE, CRAS, ECO ERAS, MRAS, MTT* TRAS	ANAIS** BY-IOT* KRAS** WLS*

(*) Refers to methods for which neither column nor row totals are available.

(**) Refers to methods for which only column totals are available.

The remaining methods comprise a base table and known column and row totals of the target table.

18.50 Lenzen *et al.* (2009) named their method KRAS (from "Konfliktfreies" RAS). It is a kind of RAS-type iterative procedure that can deal with all four desirable properties from above. In the first step, it minimises a GRAS-type objective function as stated in Lenzen *et al.* (2007) subject to constraints. The second step adjusts conflicting constraints simultaneously with the transaction matrix, whenever the first step fails to match them. The adjustments to the constraint constants are regulated according to its degree of uncertainty as described by Lemelin (2009). It should be noted that the main advantage of KRAS over the general constrained optimization methods in dealing with conflicting data and inconsistent constraints is that it needs less programming requirements and long run times. As stated by Lenzen *et al.* (2009), the KRAS method aims to deal with the manual removal of inconsistencies in the constrained system in a systematic and automated way.

18.51 A comparable method is the SUT-RAS, which is a particular case of the KRAS method as a solution to the general balancing problem. The SUT-RAS provides an easier and simple algorithm for the computation of the scaling factors and allows for basic prices and purchasers' prices; domestic and import uses; and external additional information. In this sense, it avoids the construction steps to build up the constraint matrix in case of a general formulation of the optimization problem.

18.52 There are two other contributions that are closely linked to compilation tasks. Dalgaard and Gysting (2004) presented an algorithm (CFB) that can handle product flow systems for Denmark within the context of the 1993 SNA and allowing for six different price concepts. Supply and use of products and industries' inputs and outputs are not required to be balanced in the initial SUTs and, in the same approach used by Lahr (2001), they use information on the relative reliability of the unbalanced column sums and other information incorporated into the balancing procedure. Their work was based on the automated balancing approach described in Stone *et al.* (1942), Byron (1978) and Stone (1984) for the situations where rows and column totals were endogenous variables.

18.53 Opposite to RAS-type methods, Dalgaard and Gysting (2004) did not allow for constant relative reliabilities for the column totals in the initial Use Table at purchasers' prices. Instead, they suggested a choice based on how likely they consider the values to be sure. For example, intermediate consumption of public administration and exports were 100 per cent reliable provided that such information usually comes from the government budget and foreign trade statistics, respectively. Other data based on annual high quality accounting statistics, for example, business surveys, were given 90 per cent reliability while other less certain areas such as GFCF and household final consumption expenditure were given 70 per cent confidence. Interestingly, the results were compared against the official manually compiled SUTs and the deviations were only around 0.13 per cent of the GDP, producing economically meaningful, and apparently, quite robust results. This was the first work reporting a real large scale (500 products and 100 uses of products) SUTs balancing process within the context of the 1993 SNA, and blending manual and semi-automated methods. Pedullà (1995) made an earlier attempt for Italy but with smaller tables.

18.54 On the other hand, Tarancón and del Río (2005) developed the ANAIS method and tested it for Spain (1994). This basically comprised an individual and global minimization of relative discrepancies between the elements of the initial and target IOTs, including not only intermediate uses but also final uses and primary inputs. The ANAIS method uses all kind of information to avoid variations in the coefficients that could be mathematically feasible but difficult to accept from the compiler's perspective. This is completed through the specification of a set of constraints that would benchmark coefficients with economic aggregates derived from National Accounts and/or macroeconomic models. One of its main advantages is an interactive process which ensures the results are consistent with the external information and expert guidance, and it provides a solution with interval estimates rather than point estimates.

18.55 The use of other elements of the SUTs and IOTs different from intermediate uses alone is not common to many methods presented in this chapter, for example:

- TAU-UAT covered by Snower (1990);
- EURO covered by Beutel (2002) and SUT-EURO covered by Beutel (2008);
- CFB covered by Dalgaard and Gysting (2004);
- ANAIS covered by Tarancón and del Río (2005); and
- SUT-RAS covered by Temurshoev and Timmer (2011).

Some of the above approaches make a distinction between uses of domestic output and imports.

18.56 The issue of reliability of the initial tables and of the external constraints have also been addressed although quite far away from the RAS-type developments by Lahr and de Mesnard (2004). The earlier works did not actually document the relative reliability used in their analyses as covered by Allen and Lecomber

(1975), Stephan (1942) and Stone *et al.* (1942). It was not until Jensen and McGaurr (1976) when they were explicitly justified. Lahr (2001) and Dalgaard and Gysting (2004) used relative reliability rates in RAS-type constrained optimization methods to deal with the uncertainty of the external constraints specified to the optimization problem. However, their approaches were somewhat limited since they could not deal with inconsistent totals or conflicting data. Apart from the KRAS method covered by Lenzen *et al.* (2009), general constrained optimization methods are typically the methods that can handle different data reliabilities and conflicting external information more easily as covered by Golan *et al.* (1994) and Robinson *et al.* (2001) than RAS-type methods.

18.57 Within a slightly different context, Rodrigues (2014) studied the projection and/or balancing of statistical economic data with a best guess, initial values, and uncertainty measures of the outcomes. This Bayesian approach considers the projected and/or balanced outcomes as random variables rather than point estimates. Rodrigues (2014) shows that methods such as generalised least squares, weighted least squares (Rampa, 2008) and bi-proportional methods like RAS are particular cases of a more general framework. For example, the relative uncertainties of the values both interior parts and of row and column sums obtained through the RAS method are implicitly assumed to be identical, which does not need to be always true.

3. Constrained optimization methods based on distance measures

18.58 There are other types of linear or non-linear constrained optimization methods characterised by minimizing some measure of distance between all the elements of the prior and the estimated tables. None of them can preserve the sign of the original table although with some non-negativity constraints they can do so. However, there might be a collateral effect in terms of a larger number of zeros in the estimated tables as covered by Lahr and de Mesnard (2004). Some of them can handle non-negative matrices only.

18.59 In order to circumvent these two drawbacks, distance measures have been modified, for example by Huang *et al.* (2008) and Temurshoev *et al*. (2013), in order to be able to handle negative values and preserve signs.

18.60 Box 18.1 provides a list of the different distance based optimization methods available in the literature. Broadly speaking, they can be grouped into:

- **Absolute differences** - Lahr and de Mesnard (2004); Matuszewski *et al.* (1964); Lahr, (2001); Jackson and Murray (2004); and Tarancón and del Río (2005).
- **Square differences** - Almon (1968); Friedlander (1961); Jackson and Murray (2004); Huang *et al.* (2008); Kuroda (1988); Jacksch and Conrad (1971); Harthoorn and van Dalen (1987); and Mínguez *et al.* (2009).

18.61 The solutions to these optimization methods can sometimes be very complicated if external information and/or potentially conflicting data are added. The works of Harrigan (1983), Harrigan and Buchanan (1984), Zenios *et al.* (1989) and Nagurney and Robinson (1992) are good examples. The combination of equality and inequality conditions, for example, non-negativity, require quadratic programming methods and solving bounded constrained optimization problems that notably complicate the scheme. Within this context, the KRAS method provides a RAS variant able to deal with conflicting external data and inconsistent constraints with less programming requirements and long run times than in general constrained optimization methods.

4. Proportional scaling methods

18.62 The basic idea of proportional scaling methods is to correct a given matrix row-wise (and column wise for bi-proportional methods) with a diagonal matrix of correction factors. There are proportional scaling methods that are not based on the minimum information loss principle. A few of them are one-sided proportional methods in the sense that the scaling is only made either on rows or on columns, for example, Matuszewski *et al.* (1964), Tilanus (1968) and Timmer *et al.* (2005), and the others are bi-proportional techniques. The former methods provide inefficient estimations since they make adjustments just column-wise or row-wise. Moreover, the EUKLEMS method covered by Timmer *et al.* (2005) requires somewhat arbitrary adjustments to make SUTs consistent with respect to the derived product total outputs covered by Temurshoev *et al.* (2011).

18.63 Eurostat has developed a set of guidelines for the estimation of missing SUTs and IOTs of countries in order to estimate single European and/or Euro Area SUTs and IOTs using a proportional scaling methods based on current and/or previous year SUTs and IOTs and/or available valuation matrices. The set of guidelines are covered in Rueda-Cantuche *et al.* (2013b).

18.64 Another bi-proportional scaling method is the Path-RAS method covered earlier. This method is meant to be used whenever rows and column totals are missing and can be applied both to SUTs and IOTs. This is covered in Pereira *et al.* (2013) and Pereira and Rueda-Cantuche (2013).

18.65 Finally, the new changes in the accounting systems like in the 2008 SNA and BPM 6 bring new challenges in the field of projections of SUTs and IOTs. One of the most important challenges for research policy analysis is to avoid a break in series of SUTs and IOTs because of changes in the classifications of products (CPC) and industries (ISIC) and/or a change in the methodologies, such as those introduced with the 2008 SNA.

18.66 All the methods mentioned so far assume the same classification and methodology both for the initial and the target SUTs and IOTs. Eurostat and the European Commission's Joint Research Centre developed an algorithm, RACE, (Rueda-Cantuche, Amores, and Remond-Tiedrez, 2013) to convert SUTs and IOTs from old classifications of products (CPC) and industries (ISIC) into new ones. As expected the results depend on the specific bridge tables of each country, whenever available.

5. Modelling-based methods

18.67 The modelling-based methods are not based on minimization of some distance function or some information loss principle, but rely on modelling assumptions that try to capture the changes from the initial to the target tables. By construction, the projected/estimated SUTs and IOTs are those that minimize some distance function or some information loss principle subject to some constraints. However, it is not guaranteed that the projected/estimated tables are going to be close to reality. de Mesnard (1997 and 2004b) interprets this gap between projection and target tables as a measure of structural change.

18.68 It is interesting to note, Minguez *et al.* (2009) showed with CRAS that using multiple region-specific tables may improve the updated results except for the case when the structural change, for example, oil price hikes, have to be projected. Then, the best outcome is likely to be obtained using only the most recent tables.

18.69 In this sense, some authors have proposed modelling approaches to the general balancing/projection problem instead of the broadly used conservative approach of minimizing information losses. The extent to which those modelling hypotheses hold in detriment of the minimum information loss principle depends very much on the way NSOs actually compile SUTs and IOTs. If they are compiled by looking at the structures of previous years, it may be logical to think that modelling based methods will not likely perform better than their counterparts. The Leontief price and quantity models are used in the TAU-UAT method as covered by Snower (1990), while the Leontief quantity model alone is used in the EURO method covered by Beutel (2002) and Eurostat (2008), and the SUT-EURO method covered by Beutel (2008) and Valderas (2015), whereas Kratena and Zakarias (2004) used econometric methods instead.

6. Manual balancing versus automated balancing

18.70 The projection models described above could provide some useful elements to consider for the regular compilation of SUTs and IOTs, in particular during the balancing process. There are differing viewpoints with respect to the use, and the benefits, of manual balancing versus automated balancing. There is an argument that automated balancing will yield superior results compared with any manual balancing that does not explicitly optimize a distance function covered by Stone *et al.* (1942). This view, however, is not shared for example, by the majority of NSOs who compile National Accounts and SUTs and IOTs. As Dalgaard and Gysting (2004) pointed out, "... based on the experience that many errors in primary statistics are spotted in the course of a balancing process that is predominantly manual, compilers are typically convinced that a (mainly) manual balancing process yields results of higher quality…".

18.71 Irrespective of the different viewpoints, there is no doubt that some sort of automated balancing is unavoidable when many periods have to be rebalanced following a comprehensive revision. The same is generally true if SUTs and IOTs are compiled in connection to provisional figures of the National Accounts system.

18.72 Hence, following the lines of Lahr and de Mesnard (2004) and Miller and Blair (2009), it would be advisable that producers and users share more knowledge and experiences with each other, especially covering data reliabilities and complexities of subjective reliability assessments into the existing mathematical projection techniques. Incidentally, this chapter provides a good step in this direction, where the aim is to get mathematical techniques more often combined with survey data, other data sources and/or expert opinions on certain key elements like rows, columns or individual cells.

D. Numerical examples

18.73 This section presents numerical examples for three of the methods described in the previous text: the GRAS, SUT-RAS and SUT-EURO methods. These methods have been selected on the basis of their easy and simple implementation; different types of external data needed to operate, row and column totals, column totals only and none of them, and because of their better performance when compared against other similar methods.

18.74 There have been many articles testing the RAS method against various RAS variants and other constrained optimization methods. As mentioned earlier, Szyrmer (1989), Gilchrist and St. Louis (1999), Lenzen *et al.* (2006), de Mesnard and Miller (2006) and Mínguez *et al.* (2009) showed that the introduction of known partial information improves the results of the RAS-type projections, for example TRAS and CRAS. Moreover, the RAS method has been assessed against entropy theoretic methods as covered in McDougall (1999), various constrained optimization methods based on distance measures such as in Pavía *et al.* (2009) and Tarancón and del Río (2005), and econometric methods covered in Kratena and Zakarias (2004). The results generally favoured the RAS method against the other alternatives.

18.75 The GRAS method also outperformed certain constrained optimization methods based on distance measures (see Murray 2004, Oosterhaven 2005, Strømman 2009 and Temurshoev *et al.* 2011), proportional scaling methods (see Temurshoev *et al.* 2011), and other modelling based methods (see Temurshoev *et al.* 2011).

18.76 Concerning those methods dealing with SUTs instead of IOTs and/or technical coefficients, Temurshoev and Timmer (2011) and Valderas (2015) demonstrated that the SUT-RAS method outperformed the SUT-EURO and EUKLEMS methods whenever industry output (column totals) is available. Nevertheless, the SUT-EURO method can still be helpful over the SUT-RAS method to project SUTs and IOTs whenever row and column totals are missing provided that the SUT-RAS method cannot handle such case.

18.77 Based on the considerations above, the GRAS, SUT-RAS and SUT-EURO methods were selected to show numerical examples of projection. The GRAS method is applied to the situation when row and column totals are known. The SUT-RAS method assumes unknown product outputs (row) but known industry outputs (columns). The SUT-EURO method is applied to the case where both row and column totals are missing.

18.78 The numerical examples are based on the set of data presented in Box 18.2. The Box shows the SUTs and IOTs for Austria for the years 2005 (base year) and 2006, at basic prices. The official SUTs have been aggregated to four products and three industries which make them rectangular with more products than industries. The amount of taxes less subsidies on production paid by the agriculture industry has been changed into negative for illustrative purposes. The GRAS, SUT-RAS and SUT-EURO methods are applied to selected tables in Box 18.2.

Box 18.2 Supply, Use and Input-Output Tables for Austria, 2005 and 2006

	Supply 2005	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Total output	Imports	Total Supply
Products	Agriculture	6 826			6 826	2 209	9 035
Products	Manuf. and const.	725	172 430	3 320	176 475	97 313	273 788
Products	Trade to Busin. Services	2	4 433	45 440	49 875	645	50 520
Products	Other services	249	4 345	209 547	214 141	16 958	231 099
	Total	7 802	181 208	258 307	447 317	117 125	564 442

	Supply 2006	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Total output	Imports	Total Supply
Products	Agriculture	7 455			7 455	2 429	9 884
Products	Manuf. and const.	682	190 892	3 695	195 269	105 962	301 231
Products	Trade to Busin. Services	2	4 722	47 528	52 252	575	52 827
Products	Other services	228	4 968	222 262	227 458	18 636	246 094
	Total	8 367	200 582	273 485	482 434	127 602	610 036

	Use 2005	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Final Use: Dom. Demand	Final Use: Exports	Total
Domestic	Agriculture	1 784	2 777	340	1 448	477	6 826
Domestic	Manuf. and const.	987	37 706	20 218	43 014	74 550	176 475
Domestic	Trade to Busin. Services	301	9 761	5 668	27 221	6 924	49 875
Domestic	Other services	452	18 475	57 943	118 725	18 546	214 141
Imports	Agriculture	115	980	141	920	53	2 209
Imports	Manuf. and const.	480	42 057	8 228	28 991	17 557	97 313
Imports	Trade to Busin. Services	1	249	395			645
Imports	Other services	39	3 491	9 476	1 373	2 579	16 958
	Taxes less subsidies on products	- 93	1 024	4 720	18 215	117	23 983
	GVA	3 736	64 688	151 178			219 602
	Total	7 802	181 208	258 307	239 907	120 803	

	Use 2006	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Final Use: Dom. Demand	Final Use: Exports	Total
Domestic	Agriculture	2 000	3 235	262	1 456	502	7 455
Domestic	Manuf. and const.	1 121	45 637	21 410	44 683	82 418	195 269
Domestic	Trade to Busin. Services	280	10 026	6 022	28 331	7 593	52 252
Domestic	Other services	443	19 937	62 302	124 292	20 484	227 458
Imports	Agriculture	115	1 102	131	1 005	76	2 429
Imports	Manuf. and const.	452	47 054	8 599	29 831	20 026	105 962
Imports	Trade to Busin. Services	1	219	355			575
Imports	Other services	42	3 515	10 197	1 515	3 367	18 636
	Taxes less subsidies on products	- 77	955	4 438	18 731	243	24 290
	GVA	3 990	68 902	159 769			232 661
	Total	8 367	200 582	273 485	249 844	134 709	

	IOT (ixi) 2005	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Final Use: Dom. Demand	Final Use: Exports	Total
Domestic	Agriculture	1 789	2 959	484	1 763	807	7 802
Domestic	Manuf. and const.	989	37 781	21 870	46 880	73 688	181 208
Domestic	Services	746	27 980	61 816	141 764	26 001	258 307
Imports	Agriculture	117	1 156	184	1 040	128	2 626
Imports	Manuf. and	470	41 217	8 368	28 372	17 240	95 668
Imports	Services	48	4 403	9 688	1 871	2 821	18 832
	Taxes less subsidies on products	- 93	1 024	4 720	18 215	117	23 983
	GVA	3 736	64 688	151 178			219 602
	Total	7 802	181 208	258 307	239 907	120 803	

	IOT (ixi) 2006	Industries: Agriculture	Industries: Manuf. and const.	Industries: Services	Final Use: Dom. Demand	Final Use: Exports	Total
Domestic	Agriculture	2 005	3 419	393	1 738	813	8 367
Domestic	Manuf. and const.	1 121	45 652	23 297	48 969	81 543	200 582
Domestic	Services	719	29 764	66 306	148 056	28 641	273 485
Imports	Agriculture	117	1 269	170	1 110	149	2 815
Imports	Manuf. and	443	46 129	8 772	29 215	19 694	104 252
Imports	Services	50	4 492	10 340	2 026	3 627	20 535
	Taxes less subsidies on products	- 77	955	4 438	18 731	243	24 290
	GVA	3 990	68 902	159 769			232 661
	Total	8 367	200 582	273 485	249 844	134 709	

18.79 The numerical example of the GRAS method is based on square tables (IOTs) and the SUT-EUTO method relies on square SUTs. For illustrative purposes, this Chapter focuses on the construction of Industry by Industry IOTs instead of using the official Product by Product IOTs because it is more likely to know the projected industry output control totals rather than the projected product output control totals. In addition, it has been assumed fixed product sales structures (Model D) in the estimation of the IOTs.

1. Generalized RAS (GRAS) method

18.80 In this example, the GRAS method is applied to the IOT for 2005 to project the IOT for 2006 when the row and column totals are known for 2006. The estimated IOT for 2006 is then compared to the real 2006 IOT of Box 18.2.

18.81 In order to run the GRAS method, the following steps must be followed:

Step 1 The IOTs ($\boldsymbol{T}$) must be split up into a matrix $\boldsymbol{P}$ with non-negative values and a matrix $\boldsymbol{N}$ with negative values in absolute terms, see Box 18.4. This implies that: $\boldsymbol{T} = \boldsymbol{P} - \boldsymbol{N}$.

Step 2 Assuming a vector *r* of one's as the starting point, calculate: $p_j(r) = \sum_{i=1}^{8} r_i p_{ij}$ and $n_j(r) = \sum_{i=1}^{8} \frac{n_{ij}}{r_i}$

Step 3 Calculate: $s_j = \frac{v_j + \sqrt{v_j^2 + 4p_j(r)n_j(r)}}{2p_j(r)}$ being v_j the projected column totals. Note that, Temurshoev *et al.* (2013) proposed a different formulation when $p_j(r) = 0$.

Step 4 Calculate: $p_i(s) = \sum_{j=1}^{5} p_{ij} s_j$ and $n_i(s) = \sum_{j=1}^{5} \frac{n_{ij}}{s_j}$.

Step 5 Calculate a new vector r such that: $r_i = \frac{u_i + \sqrt{u_i^2 + 4p_i(s)n_i(s)}}{2p_i(s)}$ being u_i the projected row totals. Note that, Temurshoev *et al.* (2013) proposed a different formulation when $p_i(s) = 0$.

Step 6 Repeat Steps 2-5 until the difference between the s_j 's obtained from the $(k+1)$-th iteration and the s_j's obtained from the k-th iteration is less than a certain threshold (for example 10^{-8}) for all the elements. Convergence needs to be guaranteed.

Step 7 Construct the projected table using the following formulation for the k-th iteration: $t_{ij} = r_i(k)p_{ij}s_j(k) - \frac{n_{ij}}{r_i(k)s_j(k)}$

18.82 Box 18.3 shows the numerical results of the first two iterations and the projected IOTs after 11 iterations (or imposing a threshold of 10^{-8}). It is remarkable that the projected IOT for 2006 provides almost exactly the same official GDP of the year 2006 and that its weighted average percentage error is 1.7 per cent when compared against the Industry by Industry IOTs (calculated using Model D, Eurostat (2008), Page 347) for Austria for 2006.

Box 18.3 Results using the GRAS Method

Matrix P

IOT 2005		Industries: Agricul-ture	Industries: Manuf. and const.	Industries: Services	Final use: Dom. Demand	Final use: Exports	Total
Domestic	Agriculture	1 789	2 959	484	1 763	807	7 802
	Manuf. and const.	989	37 781	21 870	46 880	73 688	181 208
	Services	746	27 980	61 816	141 764	26 001	258 307
Imports	Agriculture	117	1 156	184	1 040	128	2 626
	Manuf. and const.	470	41 217	8 368	28 372	17 240	95 668
	Services	48	4 403	9 688	1 871	2 821	18 832
Taxes less subsidies on products			1 024	4 720	18 215	117	24 076
GVA		3 736	64 688	151 178			219 602
Total		7 895	181 208	258 307	239 907	120 803	

Matrix N

IOT 2005		Industries: Agricul-ture	Industries: Manuf. and const.	Industries: Services	Final use: Dom. Demand	Final use: Exports	Total	r(0)
Domestic	Agriculture							1
	Manuf. and const.							1
	Services							1
Imports	Agriculture							1
	Manuf. and const.							1
	Services							1
Taxes less subsidies on products		93					93	1
GVA								1
Total		93						

Iteration 1

p_j(r)	7 895	181 208	258 307	239 907	120 803
s(1)	1.071	1.107	1.059	1.041	1.115

n_j(r)	93					

		p_i(s)	n_i(s)	r(1)
Domestic	Agriculture	8 439		0.991
	Manuf. and const.	197 027		1.018
	Services	273 849		0.999
Imports	Agriculture	2 826		0.996
	Manuf. and const.	103 759		1.005
	Services	20 277		1.013
Taxes less subsidies on products		25 231	87	0.966
GVA		235 666		0.987

Iteration 2

p_j(r)	7851	181215	256691	240090	122205
s(2)	1.077	1.107	1.065	1.041	1.102

n_j(r)	96					

		p_i(s)	n_i(s)	r(2)
Domestic	Agriculture	8 442		0.991
	Manuf. and const.	196 197		1.022
	Services	273 819		0.999
Imports	Agriculture	2 825		0.996
	Manuf. and const.	103 573		1.007
	Services	20 305		1.011
Taxes less subsidies on products		25 246	86	0.966
GVA		236 694		0.983

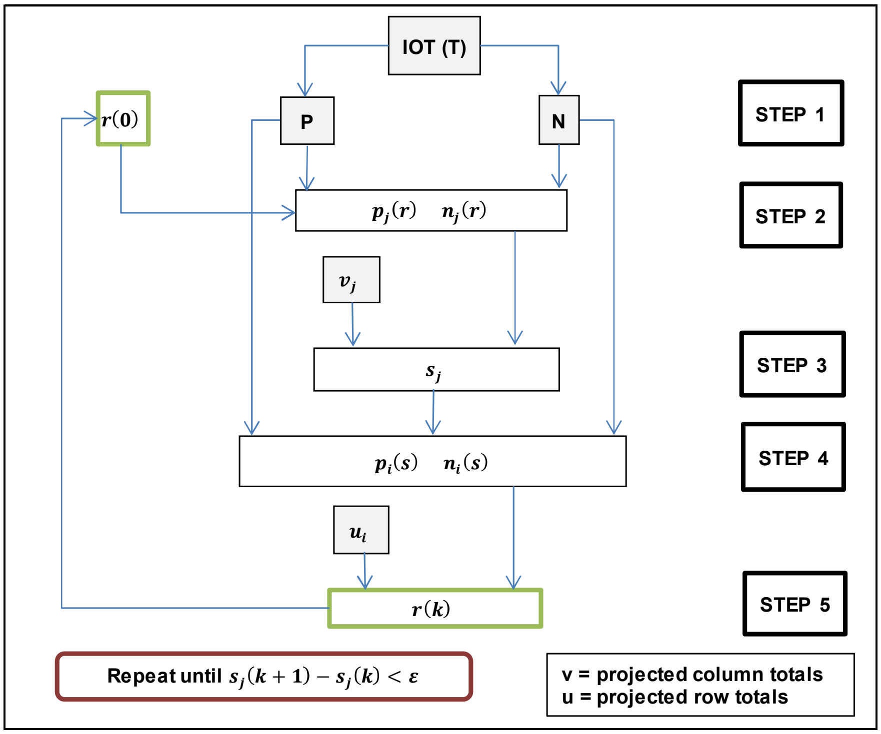
s(2) - s(1)	0.006	0.000	0.007	-0.001	-0.013

After 11 iterations (threshold 0.0000001)

IOT 2006		Industries: Agricul-ture	Industries: Manuf. and const.	Industries: Services	Final use: Dom. Demand	Final use: Exports	Total
Dom	Agriculture	1 914	3 242	520	1 816	876	8 367
	Manuf. and const.	1 106	43 183	23 460	49 833	83 000	200 582
	Services	793	30 636	66 496	147 186	28 374	273 485
Imp	Agriculture	126	1 277	198	1 077	140	2 818
	Manuf. and const.	511	45 941	8 901	29 665	19 028	104 046
	Services	52	4 963	10 574	1 983	3 167	20 738
Taxes less subsidies on products		- 89	1 096	4 876	18 283	124	24 290
GVA		3 955	70 245	158 462			232 661
Total		8 367	200 582	273 485	249 844	134 709	

18.83 Box 18.4 shows a flow diagram of the GRAS method for updating IOTs.

Box 18.4 Flow diagram of the GRAS method



2. SUT-RAS method

18.84 The SUT-RAS method consists of adjusting SUTs to new column totals but unknown row totals. In this case, the SUT-RAS method is applied to the 2005 SUTs in Box 18.2 to project the SUTs to 2006 with information on the column totals for 2006. This means that, for the projection year, the following information must be available: industry outputs; GVA totals by industry; totals of final use categories; total imports; and total taxes less subsidies on products. Note that the version of the SUT-RAS method presented here has been adjusted to separately account for taxes less subsidies on products.

18.85 The matrix can be rectangular as shown in the numerical example. Moreover, we use an integrated I-O framework for the joint projection of SUTs as shown in Box 18.5. This framework can be split up into three different matrices: domestic intermediate and final uses (d); imported intermediate and final uses, extended with an additional row accounting for taxes less subsidies on products (m); and the domestic supply table or transpose of the supply table (v).

18.86 To run the SUT-RAS method, the following steps must be followed:

Step 1 As in the previous case, the initial table, $\boldsymbol{F}$, must be split up into a matrix $\boldsymbol{P}$ with non-negative values and a matrix $\boldsymbol{N}$ with negative values in absolute terms.

This implies that: $\boldsymbol{F} = \boldsymbol{P} - \boldsymbol{N}$. In addition, the matrices $\boldsymbol{P}^d$, $\boldsymbol{P}^m$ and $\boldsymbol{P}^v$ are separately distinguished in matrix $\boldsymbol{P}$ and $\boldsymbol{N}^d$, $\boldsymbol{N}^m$ and $\boldsymbol{N}^v$ in matrix $\boldsymbol{N}$ to denote the part of the matrix accounting for domestic uses (d), imported uses and taxes less subsidies on products (m) and supply of products by industries (v), respectively. The dimensions of the matrices are in this example: (4 by 5), (5 by 5) and (3 by 4), respectively, both in sub-matrices of $\boldsymbol{P}$ and $\boldsymbol{N}$. The vector of product imports for the base year is denoted with $\boldsymbol{m} = \{m_1, m_2 \dots m_5\}$.

Step 2 Set a vector s of one's (5 by 1), another vector r^v of one's (3 by 1) and a scalar $r = 1$, as starting points, calculate vectors r^d *and* r^m with dimensions (4 by 1) and (5 by 1), respectively, as follows:

$$r_i^d = \sqrt{\frac{n_i^d}{p_i^d}}$$

and

$$r_i^m = \sqrt{\frac{\sum_{j=1}^{5} \frac{n_{ij}^m}{s_j} + r\, m_i}{\sum_{j=1}^{5} p_{ij}^m s_j}}$$

where $p_i^d = \sum_{j=1}^{5} p_{ij}^d s_j + \sum_{j=1}^{3} \frac{n_{ij}^v}{r_j^v}$ and $n_i^d = \sum_{j=1}^{5} \frac{n_{ij}^d}{s_j} + \sum_{j=1}^{3} p_{ij}^v r_j^v$

Step 3 Use vectors r^d and r^m obtained from Step 2 to compute new vectors s, $r^v$and r, with dimensions (5 by 1), (3 by 1) and (1 by 1), as follows:

$$r_i^v = \frac{x_i + \sqrt{x_i^2 + 4\left(\sum_{j=1}^{4} \frac{p_{ij}^v}{r_j^d}\right)\left(\sum_{j=1}^{4} n_{ij}^v r_j^d\right)}}{2\sum_{j=1}^{4} \frac{p_{ij}^v}{r_j^d}}$$

$$s_j = \frac{u_j + \sqrt{u_j^2 + 4p_j^s n_j^s}}{2p_j^s}$$

$$r = \frac{MT}{\sum_{i=1}^{5} \frac{m_i}{r_i^m}}$$

where $p_j^s = \sum_{i=1}^{4} r_i^d p_{ij}^d + \sum_{i=1}^{5} r_i^m p_{ij}^m$, $n_j^s = \sum_{i=1}^{4} \frac{n_{ij}^d}{r_i^d} + \sum_{i=1}^{5} \frac{n_{ij}^m}{r_i^m}$ and MT is the overall sum of imports plus taxes less subsidies of the projected year.

Step 4 Repeat Steps 2 and 3 with the new revised vectors s, r^v and r until the difference between the r^d of the $(k+1)$-th iteration and the r^d of the k-th iteration is less than a certain threshold for all the elements. The same must apply to the elements of r^m. Convergence needs to be guaranteed.

Step 5 Construct the projected table $\boldsymbol{F}$ and its components, $\boldsymbol{F}^d$, $\boldsymbol{F}^m$ and $\boldsymbol{F}^v$, using the following formulation for the k-th iteration:

$$f_{ij}^d = r_i^d(k)\, p_{ij}^d\, s_j(k) - \frac{n_{ij}^d}{r_i^d(k)\, s_j(k)}$$

$$f_{ij}^{m} = r_i^{m}(k)\, p_{ij}^{m}\, s_j(k) - \frac{n_{ij}^{m}}{r_i^{m}(k)\, s_j(k)}$$

$$f_{ij}^{v} = \frac{r_i^{v}(k)\, p_{ij}^{v}}{r_j^{d}(k)} - \frac{r_j^{d}(k)\, n_{ij}^{v}}{r_i^{v}(k)}$$

Step 6 Eventually, the elements of the projected vector of imports and taxes less subsidies on products can be derived from either one of these two equivalent mathematical expressions:

$$r\frac{m_i}{r_i^{m}(k)} = \sum_{j=1}^{5} f_{ij}^{m}$$

18.87 Box 18.5 shows the results for the first three iterations and the projected SUTs after 20 iterations. It is remarkable that the projected SUTs for 2006 provides almost exactly the same official GDP of the year 2006 (about 0.4% deviation) and that its weighted average percentage error is 1.1% when compared against the official SUTs of Austria for 2006 in Box 18.2. Eventually, the GVA components are simply added to the projected table since they are assumed to be known.

Box 18.5 Results using the SUT-RAS method

Austria 2005 SUT

Matrix P

		PRODUCTS				INDUSTRIES			FINAL USE		Total
		Agricul-ture	Manuf. and const.	Trade to Busin. Services	Other services	Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture					1784	2777	340	1448	477	6826
	Manuf. and const.					987	37706	20218	43014	74550	176475
	Trade to Busin. Services					301	9761	5668	27221	6924	49875
	Other services					452	18475	57943	118725	18546	214141
Imports	Agriculture					115	980	141	920	53	2209
	Manuf. and const.					480	42057	8228	28991	17557	97313
	Trade to Busin. Services					1	249	395			645
	Other services					39	3491	9476	1373	2579	16958
Taxes less subsidies on products							1024	4720	18215	117	24076
Industries	Agriculture	6826	725	2	249						7802
	Manuf. and const.		172430	4433	4345						181208
	Services		3320	45440	209547						258307
Total		6826	176475	49875	214141	4159	116520	107129	239907	120803	

Matrix N

		PRODUCTS				INDUSTRIES			FINAL USE		Total
		Agricul-ture	Manuf. and const.	Trade to Busin. Services	Other services	Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture										
	Manuf. and const.										
	Trade to Busin. Services										
	Other services										
Imports	Agriculture										
	Manuf. and const.										
	Trade to Busin. Services										
	Other services										
Taxes less subsidies on products						93					93
Industries	Agriculture										
	Manuf. and const.										
	Services										
Total						93					

Pd | Pm | Pv

empty cell

Nd | Nm | Nv

Iteration 1

p_d	n_d	r_d	r_m	p_v	n_v	r_v	p_s	n_s	su (1)	r (1)
6826	6826	1	1	7802		1.072	4159	93	1.073	1.076
176475	176475	1	1	181208		1.107	116520		1.130	
49875	49875	1	1	258307		1.059	107129		1.061	
214141	214141	1	1				239907		1.041	
			1				120803		1.115	

Iteration 2

p_d	n_d	r_d	r_m	p_v	n_v	r_v	p_s	n_s	su (2)	r (2)	devr_d	devr_m
7454	7320	0.991	0.996	7860		1.064	4142	92	1.077	1.072	-0.0090	-0.0042
193060	195158	1.005	0.992	180298		1.112	116292		1.132		0.0054	-0.0085
53440	53019	0.996	0.995	258588		1.058	107142		1.061		-0.0039	-0.0053
227193	226936	0.999	0.997				239927		1.041		-0.0006	-0.0027
			1.012				121011		1.113			

Iteration 3

p_d	n_d	r_d	r_m	p_v	n_v	r_v	p_s	n_s	su (3)	r (3)	devr_d	devr_m
7466	7266.1	0.987	0.993	7890		1.060	4135	92	1.079	1.069	-0.0045	-0.0026
192998	196111	1.008	0.989	179857		1.115	116255		1.133		0.0026	-0.0023
53447	52992	0.996	0.992	258690		1.057	107114		1.062		-0.0003	-0.0024
227183	226718	0.999	0.995				239858		1.042		-0.0005	-0.0021
			1.010				121145		1.112			

(…)

Iteration 20

p_d	n_d	r_d	r_m	p_v	n_v	r_v	p_s	n_s	su (20)	r (20)	devr_d	devr_m
7474	7215	0.982	0.991	7916		1.057	4129	92	1.081	1.067	0.0000	0.0000
192875	197079	1.011	0.987	179386		1.118	116222		1.133		0.0000	0.0000
53457	52977	0.995	0.990	258803		1.057	107080		1.062		0.0000	0.0000
227261	226557	0.998	0.993				239778		1.042			
			1.008				121292		1.111			

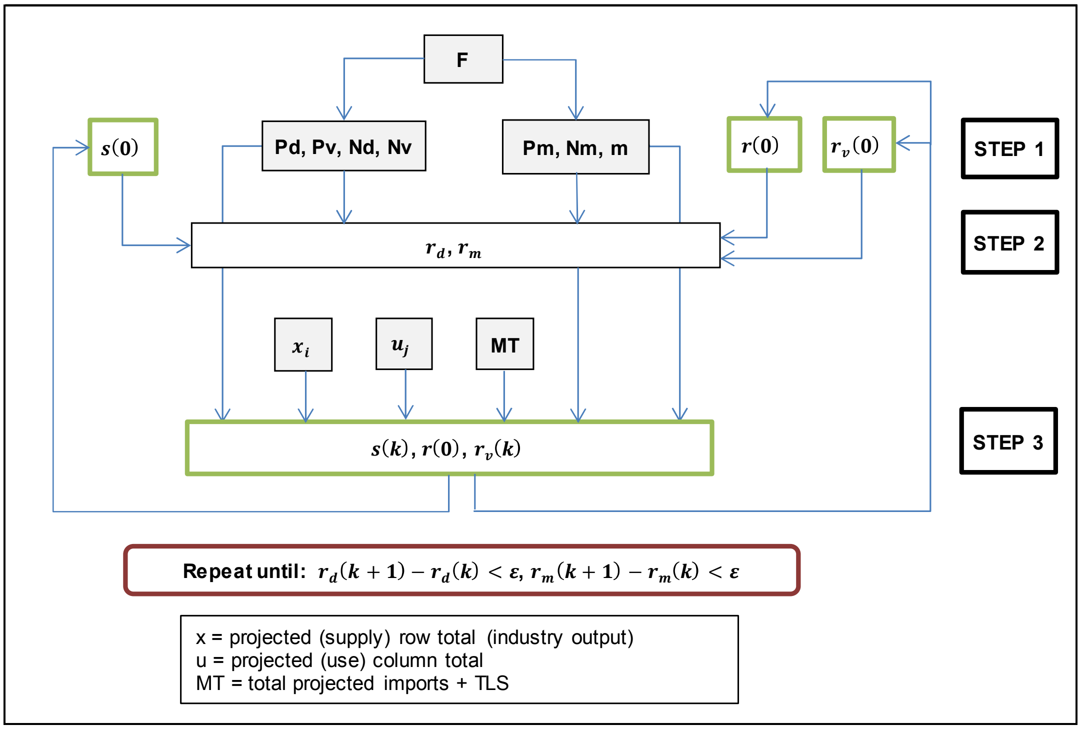
Supply and use framework at basic prices

Austria 2006 SUT-RASed

		PRODUCTS				INDUSTRIES			FINAL USE		Total
		Agricul-ture	Manuf. and const.	Trade to Busin. Services	Other services	Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture					1894	3091	355	1482	520	7343
	Manuf. and const.					1078	43184	21704	45306	83694	194966
	Trade to Busin. Services					324	11009	5992	28236	7655	53217
	Other services					488	20900	61438	123517	20566	226909
Imports	Agriculture					123	1100	148	950	58	2379
	Manuf. and const.					512	47021	8622	29808	19241	105204
	Trade to Busin. Services					1	279	415			695
	Other services					42	3927	9990	1420	2844	18223
Industries	Agriculture	7343	758	2	264						8367
	Manuf. and const.		190737	4979	4866						200582
	Services		3471	48235	221779						273485
Taxes less subsidies on products						-85	1169	5051	19125	131	25390
VA						3990	68902	159769			232661
Total		7343	194966	53217	226909	8367	200582	273485	249844	134709	

18.88 Box 18.6 shows a flow diagram of the SUT-RAS method for updating SUTs and IOTs.

Box 18.6 Flow diagram of the SUT-RAS method



3. SUT-EURO method

18.89 The SUT-EURO method is used to project SUTs on the basis of a base year SUTs. In this numerical example it is used to project the SUTs for Austria for the year 2006 based on the SUTs at basic prices for 2005. The method requires the following information: GVA totals by industry; totals of final use categories; total imports; and total taxes less subsidies on products. In practice, the growth rates of this information are used instead of their actual values as shown in Table 2 in Box 18.7. In addition, the SUT-EURO method assumes that the shares of industries in the production of products, market shares, remain constant, see Table 1 in Box 18.7. The fully fledged matrix can be rectangular as shown in the numerical example, although there must be the same number of industries than of products.

18.90 The initial SUTs consists of the following components all expressed at basic prices:

- Domestic and imported intermediate use matrix (product by industry).
- Domestic and imported final use matrix (product by category of final use).
- Supply matrix (product by industry).
- Vector of total GVA of industries.
- Vector of total taxes less subsidies on products by industries and final use categories.

18.91 Each one of the iterations of the SUT-EURO method consists of two steps, see Box 18.8 for a flow diagram of the entire process.

18.92 The first step of the first iteration defines domestic and imported intermediate and final uses, the vector of GVA, the vector of taxes less subsidies on products, and the Supply Table of the projected SUTs. This first estimation of the (unbalanced) Use Table (Table 5 in Box 18.7) is basically a cell-wise arithmetic average (except for GVA, which is set to the now values of the projected year) resulting from multiplying the corresponding growth rates to the columns (Table 3 in Box 18.7) and rows (Table 4 in Box 18.7) of the initial Use Table.

18.93 The growth rates used in Table 4 in Box 18.7, row scaling, correspond to the GVA growth rates of the corresponding industries for which the product is primary output. The same growth rates for domestically produced products and imported products are also assumed as starting values. Subsequently, the total product outputs from the projected Use Table are allocated row-wise proportionally to the initial Supply Table, that is constant market shares, in order to obtain the first estimation of the Supply Table at basic prices. This table is not shown in Box 18.7.

18.94 As a result, the total industry outputs and total industry inputs will not be equal after this first step, column sums of the projected SUTs. Similarly, the GDP calculated from the use side, 258,432, differs from the GDP calculated from the supply side, 257,346, as it can be derived from the data in Table 5 of Box 18.7.

18.95 Therefore, with the purpose of making the current projected SUTs consistent, it is assumed that the input structures of industries, including domestic and imported inputs, GVA and taxes less subsidies on products, see Table 6 in Box 18.7 and the actual values of final uses of products, see Table 5 in Box 18.7, from the first step are valid. Given this assumption, the fixed product sales structure model determines consistent industry outputs and inputs levels, see Eurostat (2008, Model D, Page 351). This second step ensures consistency of the industry outputs and inputs, and supply and use of products, see Table 7 and Table 8 in Box 18.7, however, it deviates from macroeconomic statistics, GVA by industry, final uses of categories, total GVA, overall sum of taxes less subsidies on products and total imports.

18.96 Eventually, the total product outputs, from the consistent Use Table, are allocated row-wise proportionally to the initial market shares in order to obtain the consistent estimation of the Supply Table at basic prices.

18.97 The growth rates initially used are then adjusted in an iterative procedure in order to make the difference between the actual and projected growth rates, in each of the iterations, to be less than a certain threshold. The observed deviations (devk) are used to correct these rates in such a way that it should ensure that if the model overestimates or underestimates the available macroeconomic statistics, the corresponding growth rates are decreased or increased appropriately. This is done through the correction factors as shown in Row (4) of Table 9 in Box 18.7, which are defined as follows:

$$c_k = \begin{cases} 1 + \dfrac{[(dev_k - 1)\cdot 100]^{\varepsilon}}{100}, if\ dev_k > 1 \\ 1 + \dfrac{[(1 - dev_k)\cdot 100]^{\varepsilon}}{100}, if\ dev_k < 1 \end{cases}$$

where dev_k is actual value / projected value and $\varepsilon = 0.9$.

18.98 The first step of the second iteration computes the projected SUTs components as in the first iteration, that is domestic and imported intermediate and final uses, the vector of GVA, the vector of taxes less subsidies on products, and the Supply Table. As was the case with the first step of the first iteration, the results do not ensure the equality of industry outputs and inputs.

18.99 The consistent industry outputs and inputs are again found using the fixed product sales structure model, which is then used to derive consistent SUTs of the second iteration in exactly the same manner as defined earlier for the first iteration. It is worth noting, the input structures are derived endogenously from the outcomes of the first step of the second iteration. As a result, one obtains a new deviation vector, which quantifies the deviation of the projected growth rates from the macroeconomic statistics.

18.100 If the difference between the actual and projected growth rates is acceptable, the resulting SUTs are the final outcome of the projection of the SUT-EURO method. Otherwise, the steps of the second iteration are repeated until the projected variables look like, closely or perfectly, those of the macroeconomic statistics. It is important to note, each subsequent iteration starts with computing new correction factors, which are then used to correct the growth rates from the previous iteration.

18.101 Box 18.7 shows the results of the projected SUTs after the fiftieth iteration. It can be seen that the deviations are sufficiently small to stop the iterative process. It is important to note that the projected table for the SUTs for 2006 provides almost exactly the same official GDP of the year 2006 (about -0.001% deviation), and that the weighted average percentage error is 1.8% compared against the official SUTs for 2006 as in Box 18.2.

18.102 The convergence in the SUT-EURO method can always be found by changing the tolerance level (ε) until convergence is reached. The last important point concerning the SUT-EURO method is that it requires that the number of industries and products have to be equal. Thus, even if the SUT-EURO method distinguishes between products and industries, strictly speaking, it does not allow for rectangular SUTs estimation.

Box 18.7 Results using the SUT-EURO method

Table 1

Market shares		Products: Agricul-ture	Manuf. and const.	Services
Indust.	Agriculture	1.00	0.00	0.00
	Manuf. and const.	0.00	0.98	0.03
	Services	0.00	0.02	0.97
Total		1.00	1.00	1.00

Table 2

	TLS	VA			Final Use		Imports
Growth	1.013	1.068	1.065	1.057	1.041	1.115	1.089

Iteration 1

Table 3 (1)

		Industries: Agricul-ture	Manuf. and const.	Services	Final Use: Dom. Demand	Exports	Total
Domestic	Agriculture	1905	2958	359	1508	532	7262
	Manuf. and	1054	40162	21367	44796	83132	190511
	Services	804	30075	67226	151991	28402	278498
Imports	Agriculture	123	1044	149	958	59	2333
	Manuf. and	513	44797	8696	30192	19578	103775
	Services	43	3984	10432	1430	2876	18764
Taxes less subsidies on products		-99	1091	4988	18969	130	25080
GVA		3990	68902	159769	0	0	232661
Total		8332	193013	272986	249844	134709	

Table 4 (1)

		Industries: Agricul-ture	Manuf. and const.	Services	Final Use: Dom. Demand	Exports	Total
Domestic	Agriculture	1905	2966	363	1546	509	7290
	Manuf. and	1051	40162	21535	45816	79406	187971
	Services	796	29841	67226	154240	26917	279019
Imports	Agriculture	123	1047	151	983	57	2359
	Manuf. and	511	44797	8764	30880	18701	103652
	Services	42	3953	10432	1451	2726	18603
Taxes less subsidies on products		-94	1037	4780	18448	118	24290
GVA		3958	68535	160168	0	0	232661
Total		8293	192336	273419	253364	128435	

Table 5 (1)

		Industries: Agricul-ture	Manuf. and const.	Services	Final Use: Dom. Demand	Exports	Total
Domestic	Agriculture	1905	2962	361	1527	521	7276
	Manuf. and	1053	40162	21451	45306	81269	189241
	Services	800	29958	67226	153115	27660	278759
Imports	Agriculture	123	1045	150	970	58	2346
	Manuf. and	512	44797	8730	30536	19139	103714
	Services	42	3968	10432	1440	2801	18684
Taxes less subsidies on products		-97	1064	4884	18709	124	24685
GVA		3990	68902	159769	0	0	232661
Total		8328	192858	273003	251604	131572	

Table 6 (1)

		Industries: Agricul-ture	Manuf. and const.	Services
Domestic	Agriculture	0.23	0.02	0.00
	Manuf. and	0.13	0.21	0.08
	Services	0.10	0.16	0.25
Imports	Agriculture	0.01	0.01	0.00
	Manuf. and	0.06	0.23	0.03
	Services	0.01	0.02	0.04
Taxes less subsidies on products		-0.01	0.01	0.02
GVA		0.48	0.36	0.59
Total		1.00	1.00	1.00
Output		8351	194527	273058

Table 7 (1)

Consistent		Industries: Agricul-ture	Manuf. and const.	Services	Final Use: Dom. Demand	Exports	Total
Domestic	Agriculture	1911	2987	361	1527	521	7307
	Manuf. and	1056	40510	21455	45306	81269	189596
	Services	802	30217	67239	153115	27660	279034
Imports	Agriculture	123	1054	150	970	58	2355
	Manuf. and	513	45184	8732	30536	19139	104104
	Services	43	4002	10434	1440	2801	18720
Taxes less subsidies on products		-97	1073	4885	18709	124	24695
GVA		4001	69498	159801	0	0	233301
Total		8351	194527	273058	251604	131572	

Table 8 (1)

Consistent		Industries: Agricul-ture	Manuf. and const.	Services	Total
Products	Agriculture	7307	0	0	7307
	Manuf. and	779	185250	3567	189596
	Services	265	9277	269491	279034
Total		8351	194527	273058	475937

Table 9 (1)

	VA Agricul-ture (1)	VA Manuf. and const. (2)	VA Services (3)	Dom. Demand (4)	Exports (5)	Total value added (6)	Taxes less subsidies on products (7)	Imports (8)
Actual	1.0680	1.0651	1.0568	1.0414	1.1151	1.0595	1.0128	1.0895
Project	1.0709	1.0744	1.0570	1.0488	1.0891	1.0624	1.0297	1.0688
Deviation	0.9973	0.9914	0.9998	0.9930	1.0238	0.9973	0.9836	1.0193
Corrected	0.9969	0.9913	0.9997	0.9928	1.0219	0.9969	0.9844	1.0181

(to be continued)

Box 18.7 Results using the SUT-EURO method (continued)

Iteration 2

Table 3 (2)

		Industries			Final Use		Total
		Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture	1899	2932	359	1497	544	7231
	Manuf. and	1051	39812	21361	44471	84949	191644
	Services	802	29813	67206	150889	29023	277733
Imports	Agriculture	122	1035	149	951	60	2318
	Manuf. and	511	44406	8693	29973	20006	103589
	Services	43	3949	10429	1420	2939	18779
Taxes less subsidies on products		-99	1081	4987	18832	133	24934
GVA		3978	68302	159721	0	0	232000
Total		8306	191331	272904	248033	137654	

Table 4 (2)

		Industries			Final Use		Total
		Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture	1899	2957	362	1542	508	7267
	Manuf. and	1042	39812	21347	45417	78715	186333
	Services	796	29832	67206	154194	26909	278936
Imports	Agriculture	125	1066	153	1000	58	2402
	Manuf. and	521	45608	8923	31439	19039	105530
	Services	43	4024	10621	1477	2775	18940
Taxes less subsidies on products		-93	1021	4706	18160	117	23911
GVA		3946	68321	159668	0	0	231935
Total		8279	192640	272986	253229	128120	

Table 5 (2)

		Industries			Final Use		Total
		Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture	1899	2944	361	1519	526	7249
	Manuf. and	1046	39812	21354	44944	81832	188988
	Services	799	29822	67206	152541	27966	278334
Imports	Agriculture	124	1050	151	976	59	2360
	Manuf. and	516	45007	8808	30706	19523	104559
	Services	43	3987	10525	1448	2857	18859
Taxes less subsidies on products		-96	1051	4846	18496	125	24423
GVA		3962	68311	159695	0	0	231968
Total		8293	191985	272945	250631	132887	

Table 6 (2)

		Industries		
		Agricul-ture	Manuf. and const.	Services
Domestic	Agriculture	0.23	0.02	0.00
	Manuf. and	0.13	0.21	0.08
	Services	0.10	0.16	0.25
Imports	Agriculture	0.01	0.01	0.00
	Manuf. and	0.06	0.23	0.03
	Services	0.01	0.02	0.04
Taxes less subsidies on products		-0.01	0.01	0.02
GVA		0.48	0.36	0.59
Total		1.00	1.00	1.00
Output		8340	194395	272684

Table 7 (2)

Consistent		Industries			Final Use		Total
		Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture	1910	2981	360	1519	526	7297
	Manuf. and	1052	40312	21334	44944	81832	189474
	Services	803	30197	67141	152541	27966	278649
Imports	Agriculture	124	1063	151	976	59	2374
	Manuf. and	519	45572	8799	30706	19523	105119
	Services	43	4037	10515	1448	2857	18900
Taxes less subsidies on products		-96	1064	4842	18496	125	24431
GVA		3984	69169	159542	0	0	232695
Total		8340	194395	272684	250631	132887	

Table 8 (2)

Consistent		Industries			Total
		Agricul-ture	Manuf. and const.	Services	
Products	Agriculture	7297	0	0	7297
	Manuf. and	778	185131	3565	189474
	Services	265	9265	269120	278649
Total		8340	194395	272684	475420

Table 9 (2)

	VA Agricul-ture	VA Manuf. and const.	VA Services	Dom. Demand	Exports	Total value added	Taxes less subsidies on products	Imports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Actual	1.0680	1.0651	1.0568	1.0414	1.1151	1.0595	1.0128	1.0895
Project	1.0665	1.0693	1.0553	1.0447	1.1000	1.0596	1.0187	1.0791
Deviation	1.0014	0.9961	1.0014	0.9969	1.0137	0.9999	0.9942	1.0096
Corrected	1.0017	0.9958	1.0017	0.9965	1.0133	0.9998	0.9939	1.0096

(…)

From iteration 50

Table 7 (50)

Consistent		Industries			Final Use		Total
		Agricul-ture	Manuf. and const.	Services	Dom. Demand	Exports	
Domestic	Agriculture	1905	2983	360	1512	533	7294
	Manuf. and	1045	40162	21211	44522	82669	189610
	Services	803	30298	67225	152193	28441	278961
Imports	Agriculture	125	1073	152	979	60	2390
	Manuf. and	522	45985	8859	30812	19956	106135
	Services	43	4073	10586	1453	2920	19076
Taxes less subsidies on products		-96	1063	4827	18369	127	24290
GVA		3990	68901	159767	0	0	232659
Total		8338	194538	272988	249842	134708	

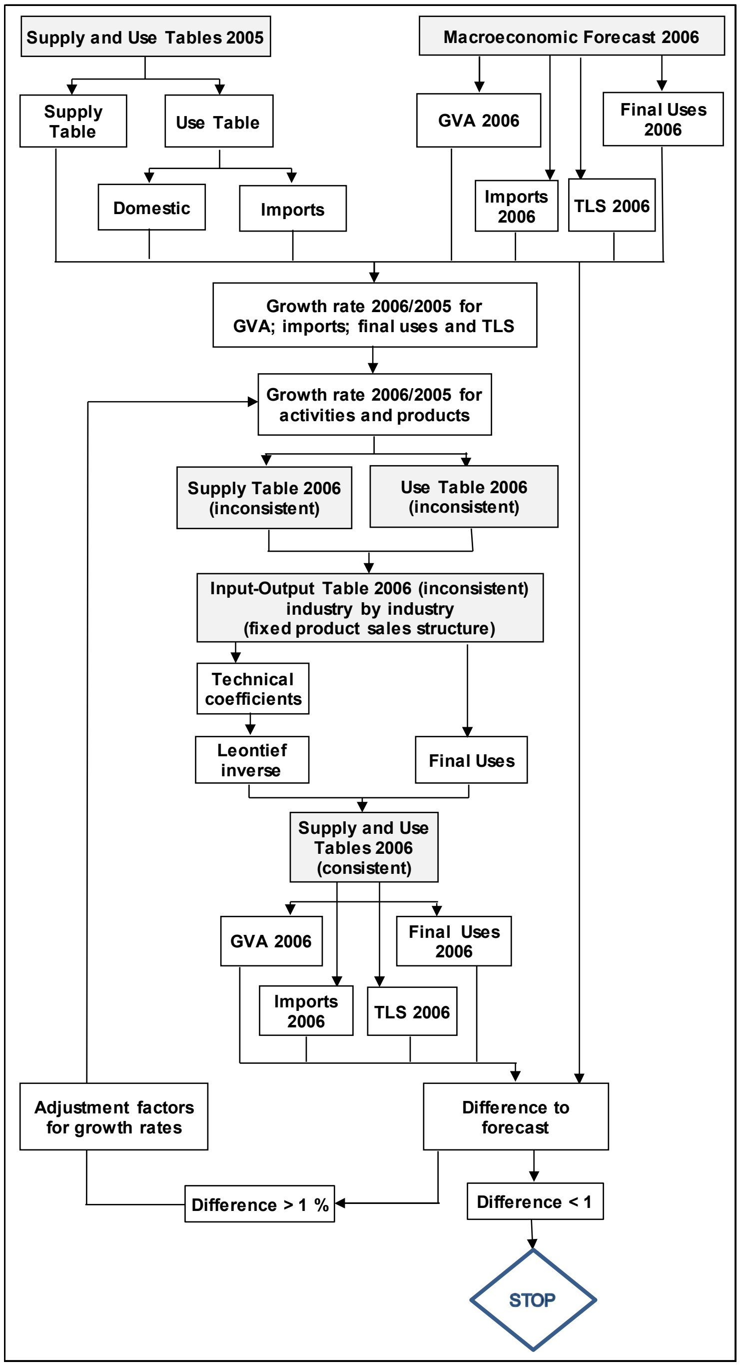
Table 8 (50)

Consistent		Industries			Total	Imports	Total supply
		Agricul-ture	Manuf. and const.	Services			
Products	Agriculture	7294	0	0	7294	2390	9683
	Manuf. and	779	185264	3567	189610	106135	295745
	Services	265	9275	269421	278961	19076	298037
Total		8338	194538	272988	475864	127601	603465

Table 9 (50)

	VA Agricul-ture	VA Manuf. and const.	VA Services	Dom. Demand	Exports	Total value added	Taxes less subsidies on products	Imports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Actual	1.0680	1.0651	1.0568	1.0414	1.1151	1.0595	1.0128	1.0895
Project	1.0680	1.0651	1.0568	1.0414	1.1151	1.0595	1.0128	1.0894
Deviation	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Box 18.8 Flow diagram of the SUT-EURO method



E. Criteria to consider when choosing a method

18.103 There are various reasons for projection of SUTs and IOTs for policy research analysis and there a many methods available for such purposes. The choice of method is not trivial and is mainly influenced by a number of factors including: the scope of the SUTs and IOTs, the price valuation, the classification and methodology, the availability of information, the minimum information loss, and the overall objective of the projection. These are elaborated below.

18.104 *Scope.* The projections can be either for rectangular SUTs or for IOTs but presently, the variety of methods available for carrying out projections is larger for IOTs than for SUTs.

18.105 *Price valuation.* The SNA distinguishes between basic prices and purchasers' prices, amongst other price components, which would influence the choice of method.

18.106 *Classification and methodology.* The use of projection methods to convert SUTs and IOTs from older to newer classifications of industries and products and/or from older to newer systems of economic accounts strongly influences the choice of method due to the different dimensions between the initial and target tables.

18.107 *Availability of information*. There is a broad spectrum of methods depending on the amount of information available to carry out the projections. It can vary from missing row and column totals to having external data, either conflicting or not, on certain elements of the target tables and/or the additional external constraints. Also, relative reliabilities can be allocated to the elements of the initial tables and constraint constants. The amount of information used will determine whether projections, estimations or semi-automated compilations are undertaken.

18.108 *Minimum information loss principle*. This principle guarantees the structures of the target tables deviates the least with respect to the structures of the initial tables. However, this conservative approach may not be realistic enough to project a table close to the officially compiled table. Indeed, there is a gap between the projected tables and the actual tables that can be interpreted as structural changes deviating from the prior structures. Alternatively, there are other less conservative methods that rely on modelling assumptions (such as, for example, Leontief price and/or quantity models, time series, econometrics, etc.), that try to capture the actual performance of the elements of the target tables, for example, input coefficients. As a matter of fact, whether they perform better than the more conservative methods only has to do with the actual compilation practices of NSOs.

18.109 *The objective of the projection.* The projection problem might not be the same between the projection of SUTs and IOTs or matrices of trade margins and transport margins. Additionally, it might not be the same for updating tables or regionalizing tables, or if projection methods are applied within the context of estimation and/or balancing of SUTs.

Chapter 19. Extensions of SUTs and IOTs as part of satellite systems

A. Introduction

19.1 The SUTs and IOTs can be extended within the framework of satellite systems to the SNA in a number of ways to address specific concerns or to focus on specific activities of the economy. Some of the extensions elaborated in this Chapter are described also in the 2008 SNA Chapters 28 and 29 which deal with the Input-Output and other matrix-based analysis and the Satellite accounts and other extensions. Satellite systems form a very useful, and important, extension of the National Accounts and involve the rearrangement of existing National Accounts information to allow an area of particular economic or social importance to be analysed in much more detail with additional dimensions not reflected within the core National Accounts. Satellite accounts are reflected with greater prominence in the 2008 SNA.

19.2 The 2008 SNA distinguishes two types of satellite accounts:

- The first type involves some rearrangement of central classifications and the possible introduction of complementary elements. Such satellite accounts mostly cover accounts specific to given fields such as education, tourism and environmental protection expenditures and may be seen as an extension of the key sector accounts just referred to. They may involve some differences from the central system such as an alternative treatment of ancillary activities but they do not change the underlying concepts of the SNA in a fundamental way.
- The second type is mainly based on concepts that are alternatives to those of the SNA. These include, for example, a different production boundary, an enlarged concept of consumption or capital formation, an extension of the scope of assets, and so on. Often a number of alternative concepts may be used at the same time. This second type of analysis may involve, like the first, changes in classifications, but in the second type the main emphasis is on the alternative concepts. Using those alternative concepts may give rise to partial complementary aggregates, the purpose of which is to supplement the central system.

19.3 The use of IOTs to provide evidence on GVCs and globalization more generally is now widespread. However, globalization may question the relevance of long-standing assumptions about the relative homogeneity of the production functions (through the I-O technical coefficients). Such assumptions are challenging when considering the size of firms (small and large businesses), the new types of businesses such as factoryless goods producers or the affiliation to multinational enterprise groups. Therefore initiatives started at international level to investigate further extensions of the SUTs in breaking down the industries of the table by some enterprise characteristics.

19.4 Section B of this Chapter provides an overview of some of the possible extensions to the SUTs and IOTs together with their analytical and policy relevance. The examples of extensions described in this Chapter are the Social Accounting Matrix (SAM) in Section C, the Extended- IOTs (E-IOTs) in Section D. Other examples of satellite systems, like EU KLEMS, WORLD KLEMS are presented in Section E.

B. Overview of possible extensions

19.5 Satellite systems reflect the need to expand the analytical capacity of the National Accounts for selected areas of social concern in a flexible manner without overburdening or disrupting the central system. On the one hand, satellite systems are linked with the central framework of National Accounts and therefore to the main body of integrated economic statistics. On the other hand, as they are more specific to a given field or topic, they are also linked to the information system specific to this field or topic. As they preserve close connections with the central accounts, they facilitate analyses of specific fields in the context of macroeconomic accounts and analysis. Satellite systems can be established for many fields of functional analysis such as culture, education, health, social protection, tourism, environmental protection, research and development.

19.6 The extensions to the SUTs and IOTs are made to address specific concerns or to focus on specific activities of the economy. A major driver for these extensions is the need to analysing sustainable development and to better understand the links between the three pillars of sustainable development, namely the economic, environmental and social dimensions. The SUTs and IOTs can play an important role in delivering a suitable database for studying sustainable development.

19.7 Extending the SUTs can provide better measures for relevant policy questions regarding the role of certain types of businesses (such as foreign affiliates, SMEs, MNEs, etc.). Extended SUTs could also deal with the heterogeneity problems encountered in the current tables due to aggregation across all types of businesses. Such tables could provide more evidence on the role and integration of types of businesses within the GVCs. Examples of current initiatives in this field will be given.

1. Disaggregation of the Use Table

19.8 The disaggregation of final uses in the Use Table can further increase the analytical uses of the tables. Examples of this further disaggregation include the disaggregation of final uses by purposes - linked to the functional classifications COICOP, COFOG, COPNI and COPP (see Chapter 6). Also, the disaggregation of GFCF by product and investing industry is required for the compilation of capital stock data. The same information on investment is also required for the calculation of the valuation matrix for non-deductible VAT. The classification of individual consumption by purpose shows household expenditure on, among others, food, health and education services all of which are important indicators of national welfare; the classification of the functions of government shows government expenditure on, among others, health and education services as well as on defence and prison services; the classification of outlays of producers by purpose provide information on ancillary activities which might deliver important services to the associated unit

2. Beyond the concept of production

19.9 The concept of production in National Accounts may be too narrow for analysing social, economic and environmental issues in a comprehensive way. For example, when describing the social dimension of sustainability, all activities of the population have to be considered. It was shown in the 1960s that a useful general activity analysis can be introduced which interprets all household activities as the production of services (Becker 1964, Lancaster 1966). Such a concept is useful for social as well as for environmental studies. Household activities do not only produce “goods” in form of goods and services but also lead to “bads” such as wastes and air pollutants. A comprehensive activity concept could also expand the production boundary and the corresponding concept of capital. For example, consumer durables could become part of capital formation, and the depreciation of these goods is part of household costs.

3. Beyond the economic concept of transactions

19.10 In National Accounts, the description of transactions focuses on transactions which are actually carried out in monetary units. In special cases such as barter transactions, non-monetary transactions are valued using comparable market values. This approach cannot be sufficient if a comprehensive activity analysis is planned. The physical flows of materials from nature to the economy have to be described as well as all transformation processes within the economy and the material flows back to nature. In the traditional framework, only a part of the material flows are valued in monetary units, while all other transactions are excluded. Furthermore, all service flows within the household sector are not taken into account. This narrow economic concept of transactions needs to be extended to achieve a comprehensive database for sustainability studies.

4. Limits of monetary valuation

19.11 In the 1960s and 1970s, many economists attempted to describe economic activities in a comprehensive way using the concept of economic welfare (Nordhaus and Tobin 1972, Reich and Stahmer 1993). The measure of economic welfare includes not only the traditional economic transactions but also a comprehensive valuation of all household activities and the internalization of environmental costs of economic activities even if costs were not incurred. In the 1980s, further stimulation for comprehensive valuation was given to measuring environmentally adjusted GDP for depletion of natural resources and degradation of the environment. The aim of these approaches was to calculate a sustainable level of economic activity

19.12 Further pressure for comprehensive valuation occurred in the 1980s with discussions on environmentally-adjusted GDP. The aim of the proposed approaches was to calculate a sustainable level of economic activity. Different versions of this measure were presented in the Handbook on Integrated Environmental and Economic Accounting (SEEA) of the United Nations (United Nations 1993, van Dieren 1995). The concepts discussed revealed fundamental differences in comparison to the welfare measures presented in the 1970s. The aim of economic activities cannot only be defined as the maximization of present welfare of the own population but rather as a path of development which takes into account the welfare in other countries and the needs of future generations too. It was A Long Goodbye (Raymond Chandler) to the dream of an overall welfare measurement (Radermacher and Stahmer 1996).

19.13 The debate on how to estimate a sustainable level of economic activities also illustrated dealing with sustainability in a national accounting framework has severe drawbacks. Sustainability paths could often only be reached after a longer period of adjusting economic processes. Thus, modelling of future scenarios seems to be unavoidable, which cannot be adequately reflected in the past period-oriented national accounting system. Furthermore, the international inter-relationships, especially the global impacts of economic activities and the indirect environmental impacts of imported goods and services abroad have to be taken into account (Ewerhart and Stahmer 1998).

19.14 Consequently, national accountants may arrive at a more modest approach of additional monetary quantification. In any case, it seems to be useful to value those non-monetary flows which might have similarities to market transactions and, thus, could be quantified in monetary terms by using comparable market values. Examples of such imputations are estimates at market values for the flows of natural resources from nature to the economy, and for the services provided by households as far as they could also be delivered by third persons. This concept is described as in the 1993 version of the SEEA (United Nations 1993, Stahmer 1995).

19.15 Of course, such a limited concept of imputed monetary values cannot be sufficient for an extensive description of the social, environmental and economic dimensions of human activities. Household activities not following the third-person criterion, as well as the impacts of economic activities on the natural environment (like climatic changes) cannot adequately be analysed. The third-person criterion states that an activity is said to be productive or to fall within the "general production boundary" if its performance can be delegated to a third person and yields the same desired results. In the following paragraphs, some other types of IOTs which can play a complementary role are discussed.

19.16 Two notable more recent developments have made significant strides in moving forward:

- A multi-year process of revision to SEEA was initiated by the United Nations Statistical Commission. The SEEA 2012 - Central Framework was jointly published by the European Commission, Food and Agricultural Organization (FAO), IMF, OECD, United Nations and the World Bank (United Nations *et al.* 2012). More detail is covered below.
- The Commission on the Measurement of Economic Performance and Social Progress, known as the Stiglitz-Sen-Fitoussi Commission, published a report in 2009 with 12 recommendations on how to better measure economic performance, social well-being and sustainability. In this report, the limitations of GDP are discussed as an indicator of economic performance and social progress as well as assessing alternative measurements of performance. The report highlighted the need to look beyond GDP when evaluating progress of society. Box 19.1 briefly summarises the measurement of economic performance and social progress covered this report.

Box 19.1 Measurement performance and social progress – Overview of 2009 Report

The report has three main chapters:

- Classical GDP issues;
- Quality of life; and
- Sustainable development and environment.

The report distinguishes between an assessment of current well-being and an assessment of sustainability, and whether this can last over time.

The first main message of the report is that time has come to adapt the SNA to better reflect the structural changes which have characterized the development of modern economies. The growing share of services and the production of increasingly complex products make measurement of output more difficult than in the past. Capturing quality changes of products is a challenge and vital to measuring appropriately real income and the well-being of the population.

The second main message concerns the government. Government services play an important role in most economies of today. They provide collective services such as security, and services of the more individual nature, such as health services and education. Traditionally, government output is based on inputs and government output is financed with tax money. Therefore, productivity changes of government services are ignored as no reliable measure for government output is available. As a consequence, economic growth and real income of the Nation are underestimated if positive changes in productivity in the public sector are observed and vice versa.

Another key message from the report is that it is time for our measurement system to shift the emphasis from measuring economic production to measuring people's well-being. This means working towards the development of a statistical system that complements measures of market activity with measures that capture well-being of the population and sustainable development.

Summary of the recommendations were as follows:

- When evaluating material well-being, look at income and consumption rather than production.
- Emphasize the household perspective.
- Consider income and consumption jointly with wealth.
- Give more prominence to the distribution of income, consumption and wealth.
- Broaden income measures to non-market activities.
- Quality of life depends on people's objective conditions and capabilities.
- Quality-of-life indicators in all the dimensions covered should assess inequalities in a comprehensive way.
- Surveys should be designed to assess the links between various quality-of-life domains for each person, and this information should be used when designing policies in various fields.
- Statistical offices should provide the information needed to aggregate across quality-of-life dimensions, allowing the construction of different indexes.
- Measures of both objective and subjective well-being provide key information about people's quality of life.
- Sustainability assessment requires a well identified dashboard of indicators.
- The environmental aspects of sustainability deserve a separate follow-up based on a well-chosen set of physical indicators.

5. Uses of physical accounting

19.17 A complete description of the interactions between nature and human beings can only be done by using physical units such as tonnes, joules, etc. Such physical accounting can show the: material flows from nature to the economy; different steps of transformation within the economy; and material flows back to nature.

19.18 Physical accounting also allows consistent balancing of all metabolic processes of living beings such as plants, animals and human beings. A concept for treating human beings as an integral part of nature seems to be urgently needed. These considerations have already led to physical accounting as an integral part of the

SEEA (SEEA, 2012). The SEEA-2012 consists of three volumes: the SEEA Central Framework, the SEEA Experimental Ecosystem Accounting, and the SEEA Extensions and Applications. Chapter 13 of this Handbook provides the framework for compiling SUTs in physical units and extending IOTs to cover environmental issues.

19.19 The SEEA Central Framework organises and integrates the information on the various stocks and flows of the economy and the environment in a series of tables and accounts, and comprises the following basic types of tables and accounts:

- Physical flow accounts;
- Accounts for environmental activities and related flows; and
- Asset accounts for environmental assets in physical and monetary terms.

19.20 To complement the SEEA Central Framework, supplementary publications covering various aspects of the SEEA family have been published. These publications provide more details on specific subjects, for instance, water and energy.

19.21 The SEEA Experimental Ecosystem Accounting covers the benefits which arise from ecosystems which form a dynamic complex of biotic communities. Examples include terrestrial ecosystems such as the rainforest and marine ecosystems such as coral reefs.

19.22 The SEEA Extensions and Applications includes detailed description of how monetary I-O models can be extended with physical data from the SEEA physical flow accounts, for example, to estimate the worldwide environmental pressures linked to domestic consumption activities (environmental footprints).

6. Extended SUTs: Country examples

19.23 Under the OECD Expert Group on Extended Supply and Use Tables some countries have undertaken projects to investigate or produce extended SUTs. The extension relates to further split of column (industries) and rows (products) in the SUTs. Most of those projects rely on micro data linking of different existing official data sources. Confidentiality and reliability of data is an important issue in this kind of project. Furthermore for some organizations some agreement between different bodies may be needed to investigate several datasets. Some examples of extended SUTs projects are given hereafter.

19.24 Some countries that have undertaken experiment or plan to do it will restrict their approach to a split on the economic activity level and not on the product level because of data availability. Austria and United Kingdom are of this type. In the Use Table, the intermediate consumption part is usually the one in focus while the GVA components may not be easily split when they do not rely on survey data but on a model-based approach such as for consumption of fixed capital.

19.25 When compiling extended SUTs plausible assumptions have to be established as not all data are directly available from data sources. The level of detail of the available information related to products and industries is therefore essential so that assumptions at the detail level make sense.

19.26 Within the framework of National Accounts, Statistics Austria breaks down the Supply Table, the intermediate consumption part of the Use Table and the intermediate consumption part of the Imports Use Table by activities into the following dimensions: foreign owned/domestic owned and further to exporters/on-exporters. The experiment conducted has been conclusive. In Statistics Denmark, a study was conducted to have extended SUTs where the columns are broken down by size, ownership and exporters status. The project has limitations in terms of industry coverage due to the lack of information from the data sources used (breakdown for industries like agriculture, financial industries or some services-industries was not possible).

19.27 In Costa Rica, the extended SUTs and extended IOTs is meant to show explicitly the industry information of free zones and other economic activities whose production is mainly oriented to external markets. Due to the economic importance of free zones more data are available or made available to National Accounts from those businesses. The breakdown between free zone and definitive regimen are available as well for IOTs. For both the Use Table and IOTs, a further split is foreseen between domestically produced products and imported products.

19.28 The US Bureau of Economic Analysis created experimental tables comparing industry-specific shares of the components of total output of globally engaged firms located in the US that are part of a multi-national enterprise (MNE) with those of firms that are part of an enterprise entirely located in the United States. It meant to understand the degree to which heterogeneity is accounted for in SUTs for the US. The ultimate study will require data linking procedures between the BEA and the Census Bureau.

19.29 The definition of extended SUTs is not singular in terms of which criteria to use for the breakdown of the industries and products of the SUT. It could be the size of businesses, the foreign affiliate status, or the exporter status. Once one or several criteria have been defined then the definition of the clusters is not harmonised between the different initiatives. Size class can be apprehended through turnover or employment for example. Defining a business as an exporter relies on its share of exports over the total output which could be set as 10 per cent in one country or 25 per cent in another.

C. Social accounting matrix

19.30 SUTs and IOTs provide a detailed picture of the structure of the economy but they do not show the inter-relationship between GVA, final uses and incomes. By extending SUTs with the institutional sectors accounts, the entire circular flow of income can be shown in a SAM.

19.31 The 2008 SNA describes the SAM in its broadest form, namely as a means of presenting National Accounts data in the form of a matrix: “A social accounting matrix (SAM) is a presentation of the SNA in matrix terms that permits the incorporation of extra details of special interest”. (2008 SNA, paragraph 2.164)

19.32 The SAM is a presentation of a country's National Accounts in a square matrix that elaborates the linkages between SUTs and the institutional sector accounts and the flows mentioned earlier. The SAM is a square matrix in which each account is represented by a row and a column. Each cell shows the payment from the account of its column to the account of its row. Additional data are needed to define stocks.

19.33 The SAM allows for extensions of the National Accounts for a fuller understanding of the socio-economic system that captures the inter-dependencies of institutional groups. SAMs provide both a conceptual framework and a data system that can support analyses of socio-economic policy issues and can also be used to evaluate the socio-economic impact of exogenous changes. SAMs are currently in widespread use. Due to its accounting consistency and comprehensiveness in recording data for the whole economy, the SAM has become the preferred database of Computable General Equilibrium (CGE) Models. They are also for various types of empirical multiplier models and impact studies.

19.34 At the end of the 1940s and beginning of the 1950s, Richard Stone proposed a presentation of the results of National Accounts not only in T-Accounts but also in a matrix format (Stone 1961), and such a matrix was called a SAM. In the 1960s, Richard Stone and his team developed the Cambridge Growth Model (Stone and Brown 1962). In this context, he also published a first SAM for Great Britain 1960 and improved the conceptual framework of a matrix presentation of the National Accounts. Stone especially stressed the importance of using different statistical units, for example, products, establishments and institutional units in the system for describing the variety of economic activities in the most suitable way.

19.35 According to this concept, it is necessary to link the different parts of the accounting system by special transition matrices from one statistical unit to another. The early SAMs were built as a matrix representation of the National Account and came to the World Bank in the 1960s with Graham Pyatt, who left Cambridge and developed SAMs, mainly at the World Bank and together with Erik Thorbecke became the leading proponents and developers of SAMs (Pyatt and Thorbecke 1976).

19.36 These considerations were the starting point for the concepts of the 1968 SNA. Since then the SUTs became an integral part of the National Accounting system. During the 1970s and 1980s, the term SAM changed its meaning. It was now used for a type of National Accounts matrix especially describing the inter-relationships of income and transfer flows between the different institutional units (Pyatt 1999). These concepts were especially used in developing countries (Pyatt and Round 1985). The promising experiences in these countries encouraged national accountants to propose socio-economic analysis as integral part of the revised concepts of National Accounts (Keuning, de Ruijter 1988, Keuning 1991, Pyatt 1985, Pyatt 1991).

19.37 Great support for implementing the SAM concepts not only in developing countries but also in developed countries was given by the work done by Steven Keuning and his team at Statistics Netherlands. They presented the concepts and numerical examples of a System of Economic and Social Accounting Matrices and Extensions (SESAME) which comprises a whole family of SAM modules (Keuning 1996, Keuning 2000, Timmerman and van de Ven 2000). This strategy had been successful such that the 1993 SNA and 2008 SNA contain chapters on SAMs showing its usefulness and the great variety of its applications.

19.38 The construction of a SAM with any significant degree of disaggregation requires the availability of some key datasets, such as:

- National Accounts with institutional sector accounts;
- SUTs;
- Statistics from household surveys;
- government budget accounts;
- trade statistics; and
- balance of payments statistics.

19.39 Many compilers begin by assembling SUTs and SAMs from the National Accounts. This defines a set of control totals for the disaggregate tables. In contrast, compiling detailed SUTs and SAMs can be part of a process to improve the estimates of the National Accounts. Estimates from primary and secondary sources are often inconsistent and balancing methods have to be used to adjust the initial estimates for consistency. Ideally, the National Accounts are based on a large rectangular SUTs and a full set of institutional sector accounts which are balanced at the same time.

19.40 The framework of a large SAM is shown in Table 19.1. The information for the first two rows and columns is derived from the SUTs and the rest is extracted from the institutional sector accounts.

19.41 Table 19.2 provides a numerical example for a SAM with:

- three products (agricultural products, industrial products, and services);
- three industries (agriculture, industry, and services); and
- three institutional sectors (households, corporations, and government).

19.42 The columns of the table represent expenditures while the rows reflect the corresponding revenues and the total for each column should match the total for the corresponding row.

19.43 The table allows the generation of income in the production process to be studied in great detail and it helps to verify at the same time the allocation of primary income among different institutions. The secondary distribution of income shows how the balance of the primary income of an institutional sector and the total economy's national income are allocated by redistributive transactions such as taxes on income, taxes on wealth, social contributions, social benefits and current transfers. The use of disposable income shows how much is spent by the various institutions on consumption and saving.

Table 19.1 Structure of social accounting matrix

				PRODUCTION		FACTORS OF PRODUCTION	INSTITUTIONS			INVESTMENT		FINANCE	RST OF THE WORLD		TOTAL RECEIPTS
				1. Goods and services (CPC)	2. Production (ISIC)	3. Generation of income	4. Allocation of primary income	5. Secondary distribution of	6. Use of disposable income	7. Change of capital	8. Gross fixed capital formation	9. Finance	10.Rest of the world	11. Rest of the world	
				Agricultural products Industrial products Services	Agriculture Industry Services	Compensation of employees Net mixed income Net operating surplus Other taxes less subsidies on prod	Households Corporations Government	Households Corporations Government	Households Corporations Government	Households Corporations Government	Agriculture Industry Services	Currency and deposits Loans Other financial assets	Current	Capital	
				1 2 3	4 5 6	7 8 9 10	11 12 13	14 15 16	17 18 19	20 21 22	23 24 25	26 27 28	29	30	31
PRODUCTION	1. Goods and services (CPC)	Agricultural products Industrial products Services	1 2 3	Trade and transport margins	Intermediate consumption at purchasers' prices				Final cosumption expenditure at purchasers' prices	Changes in inventories at purchasers' prices	Gross fixed capital formation at purchasers'		Exports of goods and services		Total use of products at purchasers' p.
PRODUCTION	2. Production (ISIC)	Agriculture Industry Services	4 5 6	Output at basic pices											Output of industries at basic prices
FACTORS OF PRODUC-TION	3. Generation of income	Compensation of empl. Net mixed income Net operating surplus Other net taxes on pro.	7 8 9 10		Net value added at basic prices								Wages and salaries from ROW		Net value added at basic prices
INSTITUTIONS	4. Allocation of primary income	Households Corporations Government	11 12 13	Taxes less subsidies on products		Gross generated income	Property income						Property income from RoW		Primary income
INSTITUTIONS	5. Secondary distribution of income	Households Corporations Government	14 15 16				Gross national income	Redistribtion through taxes and transfers					Current transfers from RoW		Redistributed income
INSTITUTIONS	6. Use of disposbale income	Households Corporations Government	17 18 19					Gross disposable income	Change of corporation pensions						Disposable income
INVESTMENT	7. Change of capital	Households Corporations Government	20 21 22						Gross savings	Transfer of capital		Borrowing		Capital transfers from RoW	Capial receipts
INVESTMENT	8. Gross fixed capital formation (ISIC)	Agriculture Industry Services	23 24 25		Consumption of fixed capital					Net fixed capital formation					Gross fixed capital formation
FINAN-CE	9. Finance	Currency and deposits Loans Other financial assets	26 27 28							Lending				Net lending of RoW	Net aquisitions of financial assets
REST OF THE WORLD	10. Rest of the world	Current	29	Imports of goods and services		Wage and salaries to ROW	Property income to RoW	Transfers to RoW							Total current receipts from RoW
REST OF THE WORLD	11. Rest of the world	Capital	30							Capital transfers to RoW			Current external balance		Total capital receipts from RoW
TOTAL EXPENDITURES			31	Supply of products at purchasers' prices	Output of industries at basic prices	Net value added at basic prices	Primary income	Disposable income	Adjusted disposable income	Capital outlays	Gross fixed capital formation	Net liabilities of financial assets	Total current expenditure on exports	Total capital expenditure to ROW	

Table 19.2 Numerical example of a Social Accounting Matrix

billions of Euro

				PRODUCTION						FACTORS OF PRODUCTION				INSTITUTIONS									INVESTMENT						FINANCE			RST OF THE WORLD		TOTAL RECEIPTS
				1. Goods and services (CPC)			2. Production (ISIC)			3. Generation of income				4. Allocation of primary income			5. Secondary distribution of			6. Use of disposable income			7. Change of capital			8. Gross fixed capital formation			9. Finance			10.Rest of the world	11. Rest of the world	
				Agricultural products	Industrial products	Services	Agriculture	Industry	Services	Compensation of employees	Net mixed income	Net operating surplus	Other taxes less subsidies on prod	Corporations	Government	Households	Corporations	Government	Households	Corporations	Government	Households	Corporations	Government	Households	Agriculture	Industry	Services	Currency and deposits	Loans	Other financial assets	Current	Capital	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
PRODUCTION	1. Goods and services (CPC)	Agricultural products	1				2	42	4												0	23	-1	0	0	0	0	3				5		78
		Industrial products	2				16	738	200												29	583	2	-1	0	7	81	302				605		2,562
		Services	3	14	333	-347	8	236	583												357	590	0	0	0	0	8	39				78		1,899
	2. Production (ISIC)	Agriculture	4	46	0	3																												49
		Industry	5	0	1,504	75																												1,579
		Services	6	1	12	2,013																												2,026
FACTORS OF PRODUC-TION	3. Generation of income	Compensation of empl.	7				10	398	692																							4		1,104
		Net mixed income	8				7	26	147																							1		181
		Net operating surplus	9				0	55	176																									231
		Other net taxes on pro.	10				-2	5	8																									11
INSTITUTIONS	4. Allocation of primary income	Corporations	11							0	0	177	0	264	42	98																93		674
		Government	12	-1	161	46				0	0	-3	12	14	0	1																-7		223
		Households	13							1,099	181	57	0	293	5	1																9		1,645
	5. Secondary distribution of income	Corporations	14											19			13	8	95													0		135
		Government	15												154		40	151	600													5		950
		Households	16													1,545	80	389	1													3		2,018
	6. Use of disposbale income	Corporations	17														1																	1
		Government	18															385																385
		Households	19																1,310	15														1,325
INVESTMENT	7. Change of capital	Corporations	20																	-14			0	14	0				286	207	310		2	805
		Government	21																		-1		35	-29	6				29	-17	0		18	41
		Households	22																			129	7	15	0				0	43	-1		-1	192
	8. Gross fixed capital formation (ISIC)	Agriculture	23				8																0	0	-1									7
		Industry	24					79															11	0	-1									89
		Services	25						216														54	3	71									344
FINAN-CE	9. Finance	Currency and deposits	26																				240	49	-25								51	315
		Loans	27																				126	6	0								101	233
		Other financial assets	28																				294	-17	142								-110	309
REST OF THE WORLD	10. Rest of the world	Current	29	18	552	109				5	0	0	-1	84	22	0	1	17	12															819
	11. Rest of the world	Capital	30																				37	1	0							23		61
TOTAL EXPENDITURES			31	78	2,562	1,899	49	1,579	2,026	1,104	181	231	11	674	223	1,645	135	950	2,018	1	385	1,325	805	41	192	7	89	344	315	233	309	819	61	

Germany 2000

D. Extended Input-Output Tables

19.44 The IOTs play an important role in providing a rich data source for studying sustainable development and the impact of environmental policies. Experience over the past three decades have illustrated that it is best to use IOTs with differing units to facilitate special studies on different aspects of sustainability. For example:

- IOTs in monetary units are especially useful for analysing economic problems;
- IOTs in physical units (tons, etc.) can be used for ecological studies; and
- IOTs in time units might serve as a database for social studies.

19.45 A comprehensive analysis of sustainability would require an integrated analysis of all three types of tables.

19.46 Extended Input-Output Tables (E-IOTs) comprise useful information of satellite systems which are integrated into the National Accounts. They often include information on investment, capital and labour. However, additional information on energy, emissions, natural resources, waste, sewage and water are also needed and could be added to the tables as well.

19.47 Environmentally Extended Input-Output Tables (EE-IOTs) and models have become a powerful tool in supporting environmental and economic analyses and policies. When, for example, IOTs are extended to include environmental information, they provide a solid foundation for environmental policy analysis. Life cycle analysis of products and their impact on the environment and sustainable use of natural resources are two prominent applications for EE-IOTs. Additionally, EE-IOTs can be integrated into broader models such as CGE models.

19.48 The EE-IOTs framework with links to other socio-economic data allows for the estimation of environmental impacts and external costs of different economic sector activities, final consumption activities and consumption of natural resources, for example, Exiopol, 2014.

19.49 Table 19.3 provides an example of E-IOTs of Germany for the year 2009. Germany is well-advanced in developing satellite systems which can be integrated into the system of SUTs and IOTs. The Product by Product IOTs of Germany comprise 65 production activities and 65 products. The EIOTs includes information in values and quantities.

19.50 The E-IOTs incorporate seven additional satellite systems:

- Input-Output Table (billions of Euros)
- Gross fixed capital formation (billions of Euros)
- Capital stock (billions of Euros)
- Employment (1,000 Persons)
- Energy use (Petajoule)
- Air emissions (1,000 tons)
- Global warming, acid deposition and tropospheric ozone formation (1,000 tons)
- Waste, sewage and water (1,000 tons, Millions cubic metres)

19.51 The first part of the E-IOTs contains the traditional part of the National Accounts. This includes the domestic production of goods and services (Rows 1-6), taxes less subsidies on products (Row 8) and GVA at basic prices (Rows 10-13).

19.52 The next three sets of matrices (i.e. GFCF, Capital stock and Employment) below the IOTs are derived from satellite systems which are integrated into the I-O framework. These matrices provide useful information for the various industries on investment (for example, machinery and buildings), capital stock (for example, machinery and buildings) and employment (for example, number of wage and salary earners and self-employed).

19.53 The next sets of matrices of the E-IOTs satellite system (i.e. Energy, Air emissions, Global warming and Waste, sewage and water) contain information on energy consumption, emissions and other residuals (for example, waste, sewage) of the various production and consumption activities.

19.54 It should be noted that the first three matrices (IOTs, investment and capital stock) are in monetary values, the employment matrix is in number of persons, and the last four matrices contain quantities (i.e. petajoules for energy, tons for emissions and waste, and cubic metres for sewage and water).

19.55 For the presentation in this Handbook, the economic activities of the original IOTs are aggregated into six industry groups as shown in Table 19.3. The monetary IOTs in Table 19.3 are shown in rows 1-22. The output of domestic products is shown in rows 1-6 and the import of goods and services are shown in rows 8-13. The separate IOTs for domestic output and imports are an integral part of the E-IOTs.

Table 19.3 Extended Input-Output Table with satellite systems

INPUT-OUTPUT TABLE (Billions of Euro)

No.	PRODUCTS	PRODUCTS: Agricul-ture	Manufac-turing	Construc-tion	Trade, trans. and comm.	Finance and business services	Other services	FINAL USE: Final consumption: House-holds	Govern-ment	Gross fixed capital formation	Changes in invento-ries	Exports	Less Imports	Total output at basic prices
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Agriculture	3	31		1	0	1	17		0	4	7	- 23	42
(2)	Manufacturing	11	641	63	77	14	42	362	15	152	- 28	790	- 689	1 451
(3)	Construction work	1	11	18	8	28	10	5		153		1	0	234
(4)	Trade, transport and comm.	4	148	18	212	42	42	323	17	41	6	112	- 57	907
(5)	Finance and business services	6	148	31	130	285	56	315	3	27	0	72	- 62	1 010
(6)	Other services	0	18	3	12	17	48	147	472	2	0	2	- 1	721
(7)	Products at basic prices	26	996	133	440	386	200	1 169	506	375	- 18	985	- 833	4 365
(8)	Taxes less subsidies on products	2	10	2	12	17	24	151	6	34		0		257
(9)	Products at purchasers' prices	27	1 007	135	452	402	224	1 319	513	409	- 18	984	- 1 090	4 365
(10)	Compensation of employees	6	308	69	294	191	364							1 232
(11)	Other net taxes on production	- 6	- 2	0	- 1	5	- 7							- 12
(12)	Consumption of fixed capital	8	79	5	60	160	63							375
(13)	Net operating surplus	7	60	25	101	252	77							523
(14)	Gross value added at basic prices	15	445	99	454	608	497							2 117
(15)	Total input at basic prices	42	1 451	234	907	1 010	721							
	IMPORTS (Billions of Euro)													
(16)	Agriculture	1	11		0	0	1	8		0	1	2		23
(17)	Manufacturing	4	246	15	21	3	12	112	8	57	30	179		689
(18)	Construction work	0	0	0	0	0	0	0		0				0
(19)	Trade, transport and comm.	0	9	1	31	4	2	5	2	2	0	1		57
(20)	Finance and business services	0	16	1	6	24	5	3		2		6		62
(21)	Other services		0		0	0	1	0		0		0		1
(22)	Products at basic prices	5	283	17	58	31	21	128	9	61	31	189		833
	GROSS FIXED CAPITAL FORMATION (Billions of Euro)													
(23)	Buildings	2	20	2	19	82	28							153
(24)	Machinery and equipment	5	49	4	45	116	37							255
(25)	Total	7	69	5	64	198	65							409
	CAPITAL STOCK (Billions of Euro)													
(26)	Buildings	167	1 039	81	777	6 998	2 243							11 305
(27)	Machinery and equipment	104	646	51	484	532	241							2 058
(28)	Total	271	1 685	132	1 261	7 530	2 484							13 363
	EMPLOYMENT (1 000 persons)													
(29)	Wage and salary earners	295	6 787	1 948	9 821	5 693	11 356							35 900
(30)	Self-employed	359	275	463	1 297	1 017	1 059							4 470
(31)	Total	654	7 062	2 411	11 118	6 710	12 415							40 370
	ENERGY (Petajoule)													
(32)	Coal and coal products	0	1 714	1	1	0	6	17			- 41	40	- 1 115	623
(33)	Brown coals, lignite products	0	1 617	0	0	0	1	21			- 9	24	- 3	1 651
(34)	Crude oil		4 294								- 7	5	- 4 172	119
(35)	Gasolines	3	91	4	25	20	15	868			4	248	- 182	1 096
(36)	Diesel fuels	106	123	79	476	93	74	387			0	355	- 342	1 351
(37)	Jet fuels				434		4				10	176	- 429	195
(38)	Heating oil, light	25	188	14	87	26	85	514			13	100	- 441	611
(39)	Fuel oil, heavy		336		17	0	0				- 13	217	- 131	425
(40)	Other petroleum products	2	1 190	101	35	2	3	48			- 1	161	- 382	1 158
(41)	Natural gas and other gases	12	1 797	12	125	49	184	936			228	465	- 3 083	726
(42)	Renewable Energy	6	1 178	5	45	7	6	299			1	18	- 10	1 554
(43)	Electric power, other energy	23	2 641	14	289	76	197	678			127	198	- 1 618	2 624
(44)	Total	178	15 167	230	1 535	273	574	3 767			311	2 006	- 11 909	12 134
	AIR EMISSIONS (1 000 tons)													
(45)	Carbon dioxide (CO2)	9 260	550 893	9 162	80 990	12 077	24 173	222 268						908 823
(46)	Methane (CH4)	1 247	925	1	49	3	10	79						2 313
(47)	Nitrous oxide (N2O)	137	62	0	2	0	0	4						206
(48)	Nitrogen oxides (NOx)	153	538	46	398	33	45	314						1 526
(49)	Sulfur dioxide (SO2)	3	373	1	41	2	8	42						469
(50)	Organic compounds (NMVOC)	13	574	6	40	3	7	310						952
(51)	Ammonia (NH3)	541	16	0	2	0	0	20						579
(52)	Particulate matter (PM10)	47	42	7	43	2	3	48						192
(53)	Hydroflurocarbons (HFC)		12				0							12
(54)	Perflurorocarbons PFC		0											0
(55)	Sulfur hexafluoride (SF6)		0											0
(56)	Total	11 402	553 435	9 222	81 565	12 120	24 246	223 084						915 073
	GLOBAL WARMING, ACID DEPOSITION AND TROPOSPHERIC OZONE FROMATION (1 000 tons)													
(57)	Greenhouse gases 1)	77 990	589 463	9 232	82 710	12 195	24 482	225 115						1 021 188
(58)	Acid deposition 2)	110	749	33	320	25	39	261						1 537
(59)	Tropospheric ozone formation 3)	1 413	2 036	52	487	38	61	703						4 792
	WASTE, SEWAGE AND WATER													
(60)	Waste (1 000 tons)	804	122 849	194 098	4 945	5 510	3 931	36 033						368 171
(61)	Sewage (Million cbm)	21	26 970	38	173	193	137	3 118						30 650
(62)	Water from waterworks (Million cbm)	136	- 3 725	14	194	216	154	3 011						0
(63)	Water from nature (Million cbm)	303	37 608	25	9	10	7	25						37 986

Germany 2009   ☐ = Values   ☐ = Quantities   ☐ = Empty cells

Source: GENESIS-Online Databank of the Federal Statistical Office of Germany (Destatis)

Note: 1) Carbon dioxide (CO2 = 1), methane (CH4 = 21) and nitrous oxide (N2O = 310) transformed with the factors to greenhouse gases in CO2-equivalents. 2) Sulfur dioxide (SO2 = 1) and nitrogen oxides (NOx = 0.7) were transformed with the factors to acid depositions in SO2-equivalents. 3) Carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), methane (CH4), nitrogen oxides (NOx) cause ozone formation.

(a) Gross fixed capital formation, capital stock and labour

19.56 The first three satellite systems in Table 19.3 include information on investment and the use of capital and labour in the various industries. The matrix on GFCF identifies how much the various industries have invested in buildings and machinery in this particular year. The second matrix on capital stock shows how much capital was used up in the various activities. The third matrix reflects the actual employment in industries.

(b) Energy

19.57 The matrix on energy use has been derived from energy balances which are available for most nations. It reflects the total energy use of the economy in petajoule, which is equivalent to total supply of energy from domestic production and imports and comprises all primary and secondary energy sources. Conceptually, the energy use found in the balances need to be adjusted to fit into a National Accounts framework. The availability of energy accounts of the SEEA-2012 would facilitate enormously the use of energy data into an extended I-O framework.

(c) Air emissions

19.58 The matrix of the satellite system on air emissions of pollutants is derived from the energy use of the previous table. Included are 11 different gases, among them the most important gases which contribute to global warming, acid deposition and tropospheric ozone formation.

(d) Global warming, acid deposition and tropospheric ozone formation

19.59 The matrix on Global warming, acid deposition and tropospheric ozone formation contains information on the emissions to air that are harmful to the global climate. In particular, the matrix provides information on the emission of greenhouse gasses derived in CO2-equivalents based on Carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O); acide deposition derived in SOx-equivalents based on Sulphur oxides (SOx) and nitrogen oxides (NOx); and tropospheric ozone formation based on carbon monoxide (CO), non-methane volatile organic compounds, methane (CH4) and nitrogen oxides (NOx).

(e) Waste, sewage and water

19.60 The last matrix in Table 19.3 provides information on the generation of waste and sewage by the various economic activities and households together the use of water from waterworks and from nature by economic activities. The Eurostat database includes information on 38 different types of hazardous and non-hazardous wastes and 46 different sources of waste water generation.

19.61 This information is used to calculate a water footprint which consists of three components:

- The blue water footprint is the volume of freshwater that evaporated from the global blue water resources (surface water and ground water) to produce the goods and services consumed by all activities.
- The green water footprint is the volume of water evaporated from the global green water resources (rainwater stored in the soil as soil moisture).
- The grey water footprint is the volume of polluted water that associates with the production of all goods and services by industries and private households.

19.62 The last category can be estimated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains at or above agreed water quality standards. The information on waste, sewage and water has been extracted from the Genesis databank of the Federal Statistical Office of Germany.

E. Other examples of satellite systems

19.63 Satellite systems for the National Accounts can be established for many areas of functional analysis such as culture, education, health, social protection, tourism, environmental protection, research and development, non-profit institutions, unpaid Household work, volunteering labour, human capital, transport, among other topics of interest. These satellite systems expand the analytical capacity of National Accounts. Another satellite system is the growth and productivity analysis of the project EU KLEMS and WORLD KLEMS.

19.64 EU KLEMS is an industry level, growth and productivity research project financed by the European Commission. EU KLEMS stands for EU level analysis of capital (K), labour (L), energy (E), materials (M) and service (S) inputs. The EU KLEMS includes measures of output and input growth and derived variables such as multi-factor productivity at the industry level.

19.65 The measures were developed for 25 Member States of the European Union and selected countries of the rest of the world covering 30 to 72 industries for the period from 1970 to 2007. The new database EU KLEMS allows for the evaluation of the development of productivity in the European Union using a comparative industry approach. The database includes measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level.

19.66 The basic tables cover 30 countries, among them 25 Member States of the European Union and five countries from the rest of the world, namely Australia, Canada, Japan, Korea and the USA. Also included are aggregate tables for the European Union (EU 25) and the Eurozone countries covering data for values, prices, volumes growth accounting and additional tables, reflecting the above input measures. Productivity measures were also developed in line with growth accounting techniques.

19.67 The database forms an important input to policy evaluation, in particular for the assessment of the goals concerning competitiveness and economic growth potential (EU KLEMS, 2014).

19.68 The WORLD KLEMS initiative promotes the analysis of growth and productivity patterns around the world with a similar growth accounting framework. Through harmonising concepts, common standards and classifications helps to develop comparable data across countries and helps to establish a firm grounding in the international statistical systems (WORLD KLEMS, 2014).

Chapter 20. Modelling Applications of Input-Output Tables

A. Introduction

20.1 It is widely accepted that the basis of I-O analysis was founded by Wassily Leontief in the 1930s linking micro and macro economics. As Leontief stated, “In practical terms, the economic system to which input-output analysis is applied may be as large as a nation or even the entire world economy, or as small as the economy of a metropolitan areas or even a single enterprise. In all instances the approach is essentially the same” (Leontief, 1986).

20.2 The core of I-O analysis is formulated through the existence of IOTs, which describe the flow of goods and services between all industries of an economy over a period of time. The IOTs provide information on production structures and can be arranged to cover all inputs which are used in production: intermediate inputs, labour, capital and land. I-O analysis provides approaches to systematically quantify the mutual inter-relationships among the producers and consumers in the economy. The basis of I-O recognises that production processes are always inter-dependent and forms a system of production of products by means of products but also a system of value added chains in inter-dependent markets. With globalization, there is more competition and inter-dependent production processes, greater division of labour as well as of diversity and complexity of products. Thus the exchange of intermediate inputs becomes more important, thereby further increasing the role of I-O analysis.

20.3 The structure of each industry’s production activity is represented by appropriate structural coefficients that describe relationships between the inputs it absorbs and the output it produces. The inter-dependence among the industries and institutional sectors can be expressed by a set of linear equations which express the balances between total input and total output of each good and service produced.

20.4 The main applications of I-O analysis have been long discussed - see Leontief (1986), United Nations (1996), Kurz, Dietzenbacher and Lager (1998), ten Raa (2006), Eurostat (2008), Miller and Blair (2009), Suh (2010), Murray (2013) as well as various other publications including the Economic Systems Research, the Journal of the International Input-Output Association.

20.5 This Chapter provides an overview of the various modelling applications that can be done on the basis of IOTs. In particular, it provides the description of a number of modelling applications based on a specific numerical example of IOTs presented in Section B. Each of the following sections in this Chapter covers different models.

B. Numerical example of IOTs as a starting point

20.6 The SUTs and IOTs can provide a very detailed picture of an economy. The disaggregation of activities in SUTs and IOTs helps to establish detailed information on the inter-dependencies in production between the various industries of the economy. These tables present information on the supply and use of goods and services for industries' intermediate consumption and categories of final use (final consumption, capital formation and exports). The tables also provide details on the generation of income for each industry distinguishing the components of GVA, in the form of consumption of employees, other taxes on production, consumption of fixed capital and net operating surplus. Therefore, SUTs and IOTs can form the basis of many models and a wide-range of economic analyses.

20.7 The presentation of I-O estimates and I-O models in this chapter is based on an empirical example. Table 19.3 shows the extended IOTs for the year 2009 for Germany which is used as the reference case to illustrate the links to the satellite systems extending the traditional set of IOTs. The original IOTs for Germany have been aggregated to show six products and six industries. The first part of the table, Rows (1) to (22) consist of the traditional IOTs. The table includes the rows for production activities and final use separating domestic products and imported products as well as showing taxes less subsidies on products and GVA. The subsequent matrices are satellite systems which are integrated into the I-O framework. These matrices provide useful information in values and quantities for production activities and final use, and include:

- Gross fixed capital formation
- Capital stock
- Employment
- Energy
- Emissions
- Global warming and acid deposition
- Solid waste

20.8 It is worth noting that these extensions have been transformed from an industry to a product classification.

20.9 The IOTs in Table 20.1 will be used for analysis. The only difference between the extended IOTs and the IOTs for domestic output shown in Table 20.1 is that the imported goods and services were aggregated to form one row vector of imports.

20.10 In Table 20.1, the use of domestic goods and services is shown in Rows (1) to (6) while the use of aggregated imports is reported in Row (8). The inputs comprise domestic products in Rows (1) to (6), imported products in Row (8), net taxes on products in Row (9) and the components of GVA in Rows (11) to (14).

Table 20.1 Input-Output Table at basic prices

Billions of Euro

		PRODUCTS						FINAL USE					Total output at basic prices
		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services	Final consumption		Gross fixed capital formation	Changes in inventories	Exports	
								Households	Governmnet				
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agriculture	(1)	3	20				1	9			3	5	42
Manufacturing	(2)	7	394	48	56	11	30	250	7	95	- 58	611	1 451
Construction	(3)	1	11	18	8	28	10	5		153		1	234
Trade, transport and comm.	(4)	4	139	17	181	38	40	317	15	39	6	111	907
Finance and business services	(5)	6	131	30	124	261	51	313	3	25		66	1 010
Other services	(6)		18	3	12	17	47	147	472	2		2	721
Total at basic prices	(7)	21	713	116	382	355	179	1 041	497	314	- 49	795	4 365
Imports	(8)	5	283	17	58	31	21	128	9	61	31	189	833
Taxes less subsidies on products	(9)	2	10	2	12	17	24	151	6	34			257
Total at purchasers' prices	(10)	27	1 007	135	452	402	224	1 319	513	409	- 18	984	5 455
Compensation of employees	(11)	6	308	69	294	191	364						1 232
Other taxes less subsidies on production	(12)	- 6	- 2		- 1	5	- 7						- 12
Consumption of fixed capital	(13)	8	79	5	60	160	63						375
Net operating surplus/Net mixed income	(14)	7	60	25	101	252	77						523
GVA	(15)	15	445	99	454	608	497						2 117
Total input at basic prices	(16)	42	1 451	234	907	1 010	721	1 319	513	409	- 18	984	

Germany 2009

C. Distinction between price, volume, quantity, quality and physical units

20.11 In applied economics, the following monetary IOTs are used:

- IOTs in current prices;
- IOTs in volume terms (of a base year); and
- IOTs in volume terms (in previous years' prices).

20.12 These monetary IOTs are also often supplemented with information in physical units as well as with PSUTs.

20.13 The nature of estimates in current prices will be different from those estimates in volume terms in a fundamental way. The IOTs in current prices can be regarded as the aggregation of actual economic transactions that take place in a given year. The economic transactions are derived from an accounting framework of SUTs in current prices. However, the IOTs in volume terms describe the economic situation of a particular year in the prices of another year. It is assumed that all agents would trade the reported goods and services and primary inputs at prices of another year. In reality, all the economic transactions of the current year would not take place in an identical manner in prices of any other year.

20.14 The price of a product is defined as the value of one unit of that product. For a single comparable product, the value of an economic transaction, v, is equal to the price per unit of quantity, p, multiplied by the number of the units of quantity, q.

$$v = p \times q$$

20.15 A quantity index is built from information on quantities such as the number or total weight of goods or the number of services; the quantity index has no meaning from an economic point of view if it involves adding quantities that are not commensurate, although it is often used as a proxy for a volume index.

20.16 Quantities of different products cannot be aggregated without a certain weighting mechanism. For aggregating products, the term volume is used instead of quantity. The price and volume measures have to be constructed for each aggregate of transactions in products within the accounts, so that:

$$\text{Value index} = \text{Price index } \times \text{Volume index}$$

20.17 Each and every change in the value of a given transaction must be attributed either to a change in price or to a change in volume or to a combination of both. A price index reflects an average of the proportionate change in the prices of a specified set of goods and services between two periods of time, and there are three main types:

- Laspeyres price index is a weighted arithmetic average of price relatives using the values of the earlier period as weights.
- Paasche price index is the harmonic average of price relatives using the values of the later period as weights.
- Fisher's Ideal price index is the geometric mean of the Laspeyres and Paasche price indices.

More detail is available in Chapter 9 on the compilation of SUTs in volume terms.

20.18 In principle, the price component should only include changes in price. The price changes for a given transaction can only occur as a result of prices changes for individual products. All other changes should be reflected in the changes in volumes. The corresponding Laspeyres, Paasche and Fisher's Ideal volume indices use the same approach as above but instead of price relatives they will use volume relatives.

20.19 Box 20.1 shows the relationship of quantity, price, value and volume and the corresponding indices for a small numerical example.

Box 20.1 Quantities, prices, values and volumes in IOTs

This box shows how quantities, prices, values and volumes are related in the IOTs.

IOT of previous year (base year)

Quantities, prices and values are known

Table 1: Quantities in base year

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	4	7	2	9	22
Manuf. and const.	9	72	19	112	212
Services	5	17	8	106	136
Labour	4	13	23		40
NOS					
Input					

Table 2: Prices in base year

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	4	4	4	4	
Manuf. and const.	2	2	2	2	
Services	3	3	3	3	
Wage rate	5	7	9		
NOS					
Input					

Table 3: IOT of base year (values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	16	28	8	36	88
Manuf. and const.	18	144	38	224	424
Services	15	51	24	318	408
Comp. of employees	20	91	207		318
NOS	19	110	131		260
Input	88	424	408	578	1 498

= Net operating surplus is compiled as residual.

IOT of following year (current year)

Quantities, prices and values are known

Table 4: Quantities in current year

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	5	9	3	11	28
Manuf. and const.	10	76	21	116	223
Services	6	21	11	110	148
Labour	5	14	24		43
NOS					
Input					

Table 5: Prices in current year

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	5	5	5	5	
Manuf. and const.	3	3	3	3	
Services	4	4	4	4	
Wage rate	6	9	13		
NOS					
Input					

Table 6: IOT of current year (values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	25	45	15	55	140
Manuf. and const.	30	228	63	348	669
Services	24	84	44	440	592
Comp. of employees	30	126	312		468
NOS	31	186	158		375
Input	140	669	592	843	2 244

Table 7: IOT of current year at prices of base year (volumes)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	20	36	12	44	112
Manuf. and const.	20	152	42	232	446
Services	18	63	33	330	444
Comp. of employees	25	98	216		339
NOS	29	97	141		267
Input	112	446	444	606	1 608

Table 8: Price index (Base year = 100)

Price index = Table 5 / Table 2

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	125.0	125.0	125.0	125.0	
Manuf. and const.	150.0	150.0	150.0	150.0	
Services	133.3	133.3	133.3	133.3	
Comp. of employees	120.0	128.6	144.4		
NOS					
Input					

Table 9: Volume index (Base year = 100)

Volume index = Table 7 / Table 3

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	125.0	128.6	150.0	122.2	127.3
Manuf. and	111.1	105.6	110.5	103.6	105.2
Services	120.0	123.5	137.5	103.8	108.8
Comp. of	125.0	107.7	104.3		106.6
NOS	152.6	88.2	107.6		102.7
Input	127.3	105.2	108.8	104.8	107.3

Table 10: Value index (Base Year = 100)

Value index = Table 6 / Table 3

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	156.3	160.7	187.5	152.8	159.1
Manuf. and	166.7	158.3	165.8	155.4	157.8
Services	160.0	164.7	183.3	138.4	145.1
Comp. of employees	150.0	138.5	150.7		147.2
NOS	163.2	169.1	120.6		144.2
Input	159.1	157.8	145.1	145.8	149.8

20.20 In Box 20.1, Table 1-6 show quantities, prices and values for products in the first three rows. GVA is compiled as a residual variable as some components of GVA (for example, wages and salaries) reflect a quantity and price component, whereas other components (for example, net operating surplus) do not have same characteristics.

20.21 In Box 20.1, Table 7 IOT of the current year is compiled by multiplying the quantities of the current year with the prices of the base year (previous year). The price index of the current year in Table 8 is calculated by dividing the prices of the current year (Table 5) by the prices of the base year (Table 2). The volume index in Table 9 was derived by dividing the IOT of the current year at prices of the base year (Table 7) by the IOT of the base year (Table 3). Finally, the value index in Table 10 is compiled by dividing the IOT of the current year (Table 6) by the IOT of the base year (Table 3).

20.22 Using the "double deflation" approach, GVA in volume terms equals deflated output less deflated intermediate consumption.

20.23 In the economy, most products are available in several varieties of differing quality, each with its own price, and differing over time. The products of different quality are sufficiently different to each other to make them distinguishable.

20.24 Changes in quality over time need to be recorded as changes in volumes and not as changes in price. If the composition of a transaction changes as a result from a shift from or to higher quality of the same product, the shift should be recorded as changes in volume.

20.25 The volume index can therefore be broken down into the following three components of changes due to:

- changes in the quality of the products;
- changes in the characteristics of the products; and
- compositional changes in the aggregate.

20.26 Another form of measurement is the use of physical units to record flows of materials and energy that enter and leave the economy and flows of materials and energy within the economy itself - these measures are called physical flows.

20.27 The different physical flows (natural inputs, products and residuals) are recorded by compiling SUTs in physical units of measurement, commonly known as PSUTs (see Chapter 13), and are based on the monetary SUTs with extensions to incorporate a column for the environment, and rows for natural inputs and residuals. Thus, for each product measured in physical terms (for example, cubic metres of timber), the quantity of output and imports (total supply of products) must equal the quantity of intermediate consumption, households' final consumption, gross capital formation and exports (total use of products). The equality between supply and use also applies to the total supply and use of natural inputs and the total supply and use of residuals.

20.28 For estimates compiled in monetary terms, as explained earlier, the changes over time in the values of goods and services can be decomposed into two components: changes in prices and changes in volumes. However, these volumes are not equivalent to measures of the physical volume (i.e. solids, liquids or gases) but instead relate to an economic notion of volume which encompasses the changes in both quantity and quality of goods, services and assets. Thus, for example, the economic notion of volume would include the increase in the number of cars produced (or their mass) as well as improvements in the quality of the cars.

20.29 For accounts compiled in physical terms, the unit of measurement will vary depending on the type of asset concerned. Thus, flows of energy are generally measured by final use energy content such as joules; stocks and flows of water are generally measured by volume such as cubic metres; and stocks and flows of other materials are generally measured in mass units such as tonnes.

20.30 A common principle is that within a single account in physical terms only one unit of measurement should be used so that aggregation and reconciliation is possible across all accounting entries. It is noted, however, that in combined presentations of physical and monetary data, a range of measurement units are likely to be used.

D. Input coefficients

20.31 I-O analysis starts with the calculation of I-O coefficients. Table 20.2 shows the input coefficients for the IOTs shown in Table 20.1. These coefficients are calculated by dividing each entry of the IOTs by the corresponding column total. The input coefficients of production activities can be interpreted as the corresponding cost shares for products and primary inputs in total output.

20.32 As the input coefficients cover all inputs, including net operating surplus, they add up to unity. The same holds true for the input coefficients of the categories of final uses. In this case, the input coefficients represent the composition by product of final uses.

Table 20.2 Input coefficients of Input-Output Table

		PRODUCTS						FINAL USE				
		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services	Final consumption		Gross fixed capital formation	Changes in inventories	Exports
								Households	Governmnet			
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Agriculture	(1)	0.0692	0.0139		0.0004	0.0001	0.0008	0.0071		0.0000	-0.1886	0.0054
Manufacturing	(2)	0.1686	0.2716	0.2048	0.0619	0.0110	0.0414	0.1894	0.0146	0.2323	3.2475	0.6205
Construction	(3)	0.0219	0.0077	0.0749	0.0088	0.0278	0.0139	0.0035		0.3746		0.0009
Trade, transport and comm.	(4)	0.0838	0.0956	0.0739	0.2000	0.0377	0.0552	0.2407	0.0293	0.0943	-0.3404	0.1124
Finance and business services	(5)	0.1443	0.0906	0.1284	0.1370	0.2584	0.0712	0.2370	0.0050	0.0607	0.0207	0.0673
Other services	(6)	0.0095	0.0122	0.0138	0.0132	0.0166	0.0659	0.1113	0.9210	0.0055	-0.0146	0.0016
Imports	(7)	0.1095	0.1950	0.0737	0.0641	0.0303	0.0287	0.0969	0.0179	0.1502	-1.7247	0.1921
Taxes less subsidies on products	(8)	0.0361	0.0071	0.0078	0.0133	0.0164	0.0339	0.1142	0.0122	0.0824		-0.0001
Compensation of employees	(9)	0.1342	0.2122	0.2939	0.3248	0.1893	0.5055					
Other taxes less subsidies on production	(10)	-0.1406	-0.0017	-0.0008	-0.0009	0.0045	-0.0102					
Consumption of fixed capital	(11)	0.1892	0.0544	0.0217	0.0661	0.1580	0.0876					
Net operating surplus	(12)	0.1743	0.0414	0.1080	0.1113	0.2499	0.1063					
Total input at basic prices	(13)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

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20.33 For intermediate consumption of domestic products by production activities, the input coefficients of a sector are defined as:

(1) $a_{ij} = x_{ij}/x_j$ Input coefficients for domestic intermediates

Monetary Input-Output Table

a_{ij} = monetary input coefficient for domestic products

x_{ij}= value of domestic product i used by sector j

x_j = value output of sector j

Physical Input-Output Table

a_{ij}= physical input coefficient for domestic products

x_{ij} = quantity of domestic product i used by sector j

x_j = quantity of output of sector j

20.34 For imported intermediates, the input coefficients of a production activity are defined as:

(2) $c_{ij} = m_{ij}/x_j$ Input coefficients for imported intermediates

Monetary Input-Output Table	***Physical Input-Output Table***
c_{ij} = monetary input coefficient for imported products	c_{ij}= physical input coefficient for imported products
m_{ij}= value of product i imported by sector j	m_{ij} = quantity of imported product i imported by sector j
x_j = value output of sector j	x_j = quantity of output of sector j

20.35 For GVA, the input coefficients of a production activity are defined as:

(3) $v_{kj} = z_{kj}/x_j$ Input coefficients for primary inputs

Monetary Input-Output Table	***Physical Input-Output Table***
v_{kj}= monetary input coefficient for primary inputs	v_{kj}= physical input coefficient for primary input
z_{kj} = value of primary input k used by sector j	z_{kj} = quantity of primary input k used by sector j
x_j = value output of sector j	x_j= quantity of output of sector j

20.36 Table 20.2 shows a comprehensive picture of input coefficients for the complete IOT. In Columns (1) to (6) the input coefficients for industries, and in Columns (7) to (11), the input coefficients for the categories of final uses. For simplicity and space, in the equations, only the input coefficients for production activities (industry groupings 1 to 6) are shown but the same principle underlying the equations should be extended for the other groupings.

E. Output coefficients

20.37 Table 20.3 shows the corresponding output coefficients for the monetary IOT. These output coefficients can be interpreted as the market shares of products in total output. For GVA, they reflect the distribution of primary inputs among production activities. The output coefficients are calculated by dividing each entry of the IOTs by the corresponding row total. The output coefficients show not only the distribution of products but also the distribution of taxes less subsidies on products and primary inputs.

20.38 For domestic products the output coefficients are:

(4) $o_{ij} = x_{ij}/x_i$ Output coefficients for domestic products

Monetary Input-Output Table	***Physical Input-Output Table***
o_{ij} = monetary output coefficient for domestic products	o_{ij} = physical output coefficient for domestic products
x_{ij}= value of domestic product i for sector j	x_{ij}= quantity of domestic product i for sector j
x_i = value output of product i	x_i= quantity of output of product i

Table 20.3 Output coefficients of Input-Output Table

		PRODUCTS						FINAL USE					Total output at basic prices
		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services	Final consumption		Gross fixed capital formation	Changes in inventories	Exports	
								Households	Governmnet				
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agriculture	(1)	0.0692	0.4785		0.0092	0.0026	0.0132	0.2216		-0.0004	0.0803	0.1258	1.0000
Manufacturing	(2)	0.0049	0.2716	0.0331	0.0387	0.0077	0.0206	0.1721	0.0052	0.0654	-0.0401	0.4209	1.0000
Construction	(3)	0.0039	0.0475	0.0749	0.0341	0.1201	0.0426	0.0198		0.6535		0.0036	1.0000
Trade, transport and comm.	(4)	0.0039	0.1531	0.0191	0.2000	0.0420	0.0439	0.3502	0.0166	0.0425	0.0067	0.1221	1.0000
Finance and business services	(5)	0.0060	0.1301	0.0298	0.1230	0.2584	0.0508	0.3096	0.0026	0.0245	-0.0004	0.0656	1.0000
Other services	(6)	0.0006	0.0245	0.0045	0.0166	0.0232	0.0659	0.2038	0.6552	0.0031	0.0004	0.0022	1.0000
Imports	(7)	0.0055	0.3399	0.0207	0.0698	0.0368	0.0248	0.1535	0.0110	0.0737	0.0371	0.2271	1.0000
Taxes less subsidies on products	(8)	0.0059	0.0400	0.0071	0.0471	0.0644	0.0949	0.5856	0.0242	0.1310		-0.0003	1.0000
Compensation of employees	(9)	0.0046	0.2499	0.0559	0.2389	0.1552	0.2956						1.0000
Other taxes less subsidies on production	(10)	0.4837	0.1973	0.0162	0.0691	-0.3685	0.6023						1.0000
Consumption of fixed capital	(11)	0.0213	0.2107	0.0136	0.1600	0.4260	0.1685						1.0000
Net operating surplus	(12)	0.0141	0.1149	0.0484	0.1930	0.4830	0.1466						1.0000

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20.39 Table 20.3 shows a comprehensive picture of output coefficients for the complete IOT. In Rows (1) to (6), the output coefficients for products, and in Rows (7) to (12), the output coefficients for the components of primary inputs. Similar to Table 20.2, for simplicity and space, in the equations, only the output coefficients for products (products 1 to 6) are shown but the same principle underlying the equations should be extended for the other groupings.

F. Quantity model of I-O analysis

20.40 The I-O model is the linear model which is based on Leontief production functions and a given vector of final uses. The objective is to calculate the unknown activity (output) levels for the individual industries (endogenous variables) for the given final uses (exogenous variables).

20.41 For an economy with three industries, the balance between total input and outputs for products can be described by the equations below, whereby the product is first produced (output) which is then used intermediate use and final use (inputs).

(5) $x_{11} + x_{12} + x_{13} + x_{1d} = x_1$ Definition equations
(6) $x_{21} + x_{22} + x_{23} + x_{2d} = x_2$
(7) $x_{31} + x_{32} + x_{33} + x_{3d} = x_3$

Monetary Input-Output Table	***Physical Input-Output Table***
x_{ij} = value of product i for use in sector j	x_{ij} = quantity of product i for use in sector j
x_{id}= value of product i for final use	x_{id} = quantity of product i for final use
x_j = value of output of sectors j	x_j= quantity of output of sectors j

20.42 We assume that all industries' production functions are linear Leontief production functions. All inputs (intermediate consumption, capital, labour, land) are used in fixed proportions in relation to output. It is assumed that a substitution of inputs is impossible. Therefore, changing prices have no influence on the technical input coefficients.

(8) $a_{ij} = x_{ij}/x_j$ Input coefficients for intermediate consumption

20.43 The input coefficients for intermediate consumption are shown in Table 20.4. The requirements for intermediate consumption can be defined as the set of input coefficients weighted with the corresponding output level.

(9) $x_{ij} = a_{ij}x_j$ Requirements for intermediate consumption

20.44 Assuming that the industries' production operates with fixed technical input coefficients, the equation system (5) to (7) can be rewritten by replacing x_{ij} by $a_{ij}x_j$. These equations serve to make explicit the dependence of inter-industry flows on the total output of each industry.

(10) $a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + x_{1d} = x_1$ I-O system

(11) $a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + x_{2d} = x_2$

(12) $a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + x_{3d} = x_3$

Table 20.4 Input coefficients for domestic intermediate consumption

PRODUCTS		Agricul-ture (1)	Manufac-turing (2)	Construc-tion (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)
Agriculture	(1)	0.0692	0.0139	0.0000	0.0004	0.0001	0.0008
Manufacturing	(2)	0.1686	0.2716	0.2048	0.0619	0.0110	0.0414
Construction	(3)	0.0219	0.0077	0.0749	0.0088	0.0278	0.0139
Trade, transport and comm.	(4)	0.0838	0.0956	0.0739	0.2000	0.0377	0.0552
Finance and business services	(5)	0.1443	0.0906	0.1284	0.1370	0.2584	0.0712
Other services	(6)	0.0095	0.0122	0.0138	0.0132	0.0166	0.0659
Total	(7)	0.4974	0.4916	0.4958	0.4214	0.3516	0.2483

20.45 The above set of equations is transformed into the following Leontief equation system with the following features:

- final uses (exogenous variable) is isolated on the right-hand side of the equation;
- "net" output (output less intra-industry internal consumption) is identified on the diagonal of the matrix; and
- inputs have a negative sign, output have a positive sign.

20.46 If the vector of final uses and the technical coefficients are known, the Leontief equation system is simply a set of linear equations with unknown output levels. The objective is to derive the activity levels of industries for the given level of use.

(13) $(1 - a_{11})x_1 - a_{12}x_2 - a_{13}x_3 = x_{1d}$ Leontief matrix

(14) $-a_{21}x_1 + (1 - a_{22})x_2 - a_{23}x_3 = x_{2d}$

(15) $-a_{31}x_1 - a_{33}x_2 + (1 - a_{32})x_3 = x_{3d}$

20.47 On the diagonal of the Leontief matrix shown in Table 20.5, the "net" output (positive sign) of each industry is reported. It reflects the total output of a product less the input requirements of this production activity for the production of the same product (for example, seeds for wheat production in agriculture). The other coefficients in the matrix represent input requirements (negative sign). For example, for the industry, 'Agriculture', the intra-industry input requirements of 0.0692 product units of its own kind are reported. The internal input requirements for agricultural products in agriculture are approximately 6.9 per cent of output. Therefore, the net output of this industry is below unity (0.9308).

Table 20.5 Leontief matrix

PRODUCTS		Agriculture (1)	Manufacturing (2)	Construction (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)
Agriculture	(1)	0.9308	-0.0139	0.0000	-0.0004	-0.0001	-0.0008
Manufacturing	(2)	-0.1686	0.7284	-0.2048	-0.0619	-0.0110	-0.0414
Construction	(3)	-0.0219	-0.0077	0.9251	-0.0088	-0.0278	-0.0139
Trade, transport and comm.	(4)	-0.0838	-0.0956	-0.0739	0.8000	-0.0377	-0.0552
Finance and business services	(5)	-0.1443	-0.0906	-0.1284	-0.1370	0.7416	-0.0712
Other services	(6)	-0.0095	-0.0122	-0.0138	-0.0132	-0.0166	0.9341

20.48 In matrix terms, we define:

(16) $Ax + y = x$

(17) $x - Ax = y$

(18) $(I - A)x = y$

20.49 The solution of this linear equation system is:

(19) $x = (I - A)^{-1}y$

Monetary Input-Output Table

A= matrix of monetary input coefficients for intermediate consumption

I = unit matrix

$(I - A)$= Leontief matrix

$(I - A)^{-1}$ = Leontief Inverse

y = vector of final uses (values)

x = vector of output (values)

Physical Input-Output Table

A= matrix physical input coefficients for intermediate consumption

I = unit matrix

$(I - A)$= Leontief matrix

$(I - A)^{-1}$= Leontief Inverse

y = vector of final uses (quantities)

x = vector of output (quantities)

20.50 In matrix algebra, the vectors are denoted in small letters and matrices in capital letters. Vector A_x reflects the requirements for intermediate consumption, while vector y represents the exogenous aggregate of final uses. The matrix $(I - A)$ is called the Leontief matrix. On the diagonal of this matrix, the "net" output is given for each industry with positive coefficients while the rest of the matrix is covering the input requirements with negative coefficients. The Leontief Inverse $((I - A)^{-1}$ reflects the direct and indirect requirements for intermediate consumption and one unit of output for final uses.

20.51 The inverse can be approximated by the power series of A matrices:

(20) $(I - A)^{-1} = I + A + A^2 + A^3 + \cdots + A^n$ Power series approximation

20.52 The cumulative input coefficients in Table 20.6 reflect the direct and indirect requirements for domestic intermediate consumption for one unit of final uses. The difference between Table 20.5 and Table 20.6 corresponds to the indirect input requirements of the economy required for one unit of a product for final uses.

Table 20.6 Leontief Inverse

		PRODUCTS					
		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services
PRODUCTS		(1)	(2)	(3)	(4)	(5)	(6)
Agriculture	(1)	1.0786	0.0211	0.0050	0.0024	0.0008	0.0021
Manufacturing	(2)	0.2801	1.4040	0.3273	0.1207	0.0411	0.0776
Construction	(3)	0.0383	0.0207	1.0935	0.0214	0.0429	0.0217
Trade, transport and comm.	(4)	0.1650	0.1838	0.1548	1.2805	0.0757	0.0920
Finance and business services	(5)	0.2834	0.2155	0.2615	0.2578	1.3775	0.1339
Other services	(6)	0.0225	0.0252	0.0273	0.0246	0.0267	1.0756
Total	(7)	1.8679	1.8704	1.8695	1.7074	1.5648	1.4029

20.53 In this notation of the inverse, the unit matrix (I) denotes on the diagonal one unit of the product for final uses. The matrix A represents the direct input requirements of the producer for intermediate consumption and the matrices A^2 until A^n the indirect requirements for intermediate consumption in the previous stages of production. The column sum of the inverse can be interpreted as output multiplier which reflects the cumulative output of the economy which are induced by one additional unit of final uses of a certain product. In the case of 'Manufacturing' (1.8704), this has the highest output multiplier. If final uses for industrial products would increase by 1.0 million, the cumulative output of 1.870 million would be induced in the economy.

20.54 The solution of the I-O system $(I - A)^{-1}y = x$ in equation (19) is included in Table 20.7 which is calibrated to the IOT in the base year before analytical use. The objective of this calculation is to retain the IOTs shown in Table 20.1 with the I-O model. The inverse is multiplied with the vector of final uses to estimate the output levels. This model is often used to study the impact of exogenous changes of final uses on the economy, for example, a prominent application of the quantity model of I-O analysis is the evaluation of a Keynesian public expenditure program to fight a recession or unemployment. There are other prominent uses such as government is mainly interested in the employment effect and not necessarily in output.

Table 20.7 Quantity I-O model based on monetary data

PRODUCTS		Agriculture (1)	Manufacturing (2)	Construction (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)	Final use (7)	Output (8)
		Leontief inverse $(I-A)^{-1}$						y	x
Agriculture	(1)	1.0786	0.0211	0.0050	0.0024	0.0008	0.0021	18	42
Manufacturing	(2)	0.2801	1.4040	0.3273	0.1207	0.0411	0.0776	905	1 451
Construction	(3)	0.0383	0.0207	1.0935	0.0214	0.0429	0.0217	159	234
Trade, transport and comm.	(4)	0.1650	0.1838	0.1548	1.2805	0.0757	0.0920	488	907
Finance and business services	(5)	0.2834	0.2155	0.2615	0.2578	1.3775	0.1339	406	1 010
Other services	(6)	0.0225	0.0252	0.0273	0.0246	0.0267	1.0756	623	721

G. Price model of I-O analysis

20.55 Prices are determined in an I-O system from a set of equations which states that the price which each sector of the economy receives per unit of output must equal the total outlays incurred in the course of its production. The outlays comprise not only payments for inputs purchased from the same and from other industries as well as imports but also the GVA, which essentially represents payments made to the external factors, for example, capital, labour, and land including residual profits.

20.56 In the IOT, the costs of production are reported for each industry in the corresponding column of the matrix. The transposed columns are reported in the following system.

(21) $x_{11}p_1 + x_{21}p_2 + x_{31}p_3 + z_1q_1 = x_1p_1$ Price model

(22) $x_{12}p_1 + x_{22}p_2 + x_{32}p_3 + z_2q_2 = x_2p_2$

(23) $x_{13}p_1 + x_{23}p_2 + x_{33}p_3 + z_3q_3 = x_3p_3$

Monetary Input-Output Table	***Physical Input-Output Table***
x_{ij} = domestic intermediates (volumes)	x_{ij}= domestic intermediates (quantities)
x_j = output of sector j (volumes)	x_j = output of sector j (quantities)
p_i = index price of product i	p_i= price of product i
z_j = primary input to sector j (volumes)	z_j= primary input to sector j (quantities)
q_i = factor index price for primary input in sector i	q_i= factor price for primary input in sector i

20.57 Again, this assumes that all three industries are operating with Leontief production functions. Moreover, by calculating implicit prices, this assumes that the conditions for full competition (many suppliers, many purchasers, free access to markets, full information) are valid.

(24) $a_{ij} = x_{ij}x_j$ Input coefficients for intermediate consumption

(25) $v_j = z_jx_j$ Input coefficients for primary input

20.58 The requirements for intermediate consumption can be defined as the input coefficient weighted with the corresponding output level.

(26) $x_{ij} = a_{ij}x_j$ Requirements for products

(27) $z_j = v_j x_j$ Requirements for primary inputs

Monetary Input-Output Table	***Physical Input-Output Table***
a_{ij} = input coefficient for products	a_{ij}= input coefficient for products
z_j= requirements for primary input (volumes)	z_j= requirements for primary input (quantity)
v_j= input coefficient for primary input	v_j= input coefficient for primary input

20.59 In the next step, the input coefficients for intermediates and primary input are introduced into the equation system.

(28) $a_{11}x_1p_1 + a_{21}x_1p_2 + a_{31}x_1p_3 + v_1x_1q_1 = x_1p_1$ Price model

(29) $a_{12}x_2p_1 + a_{22}x_2p_2 + a_{32}x_3p_3 + v_2x_2q_2 = x_2p_2$

(30) $a_{13}x_3p_1 + a_{23}x_3p_2 + a_{33}x_3p_3 + v_3x_3q_3 = x_3p_3$

20.60 By dividing each row of the equation system by the output levels x_i, these equations are:

(31) $a_{11}p_1 + a_{21}p_2 + a_{31}p_3 + v_1q_1 = p_1$

(32) $a_{12}p_1 + a_{22}p_2 + a_{32}p_3 + v_2q_2 = p_2$

(33) $a_{13}p_1 + a_{23}p_2 + a_{33}p_3 + v_3q_3 = p_3$

20.61 If the equations system is solved for the exogenous variable 'Wages per unit of output' v_iq_i, this generates the Leontief equations for the price model.

(34) $(1 - a_{11})p_1 - a_{12}p_2 - a_{13}p_3 = v_1q_1$ Leontief equations

(35) $-a_{21}p_1 + (1 - a_{22})p_2 - a_{23}p_3 = v_2q_2$

(36) $-a_{31}p_1 - a_{32}p_2 + (1 - a_{33})p_3 = v_3q_3$

20.62 The price model in matrix notation is defined as:

(37) $A^Tp + diag(q)v^T = p$ Price model

(38) $p - A^Tp = diag(q)v^T$

(39) $(I - A^T)p = diag(q)v^T$

20.63 The solution of the linear equation system is:

(40) $p = (I - A^T)^{-1}w^T$

Monetary Input-Output Table	***Physical Input-Output Table***
A^T= transposed matrix of input coefficients for intermediate consumption	A^T= transposed matrix of input coefficients for intermediate consumption

I = unit matrix

$(I - A^T)$ = transposed Leontief matrix

$(I - A^T)^{-1}$= transposed Leontief inverse

w^T = column vector of input coefficients for primary inputs

p = column vector of index prices for products

I = unit matrix

$(I - A^T)$ = transposed Leontief matrix

$(I - A^T)^{-1}$= transposed Leontief inverse

$w^T = diag(q)v^T$ primary inputs per unit of output

v^T = column vector of input coefficients for primary inputs

$diag(q)$ = diagonal matrix of unit factor prices

p = column vector of product prices

20.64 The objective of the price model is to calculate the unknown product prices (price indices) for exogenously given primary input coefficients which are weighted with the factor price.

20.65 The results for the reference country Germany for the year 2009 are presented in Table 20.8. In this example, it is assumed that the factor price for all primary inputs in all industries is 1.0.

20.66 It should be borne in mind that for the monetary IOTs of Germany no information on quantities and prices (see right-hand side of Box 20.2 and Box 20.3) is available. Therefore, the input coefficients for primary input have to be weighted with a unit price index. The price model may be used to study the impact of changes in primary inputs (input coefficients, factor prices) on product prices. When the price model is applied, it is assumed that all conditions of perfect competition are fulfilled. Higher prices for primary inputs will cause higher product prices in competitive markets. The approach is capable to simulate the impact of cost-driven inflation, for example, the price model could be used to study the impact of an increase of the tax on gasoline on other product prices.

Table 20.8 Price I-O model based on monetary data

PRODUCTS		Agricul-ture (1)	Manufac-turing (2)	Construc-tion (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)	Input coefficient for primary inputs (7)	Price index (8)
		Transposed Leontief inverse $(I-A')^{-1}$						w	Price index
Agriculture	(1)	1.0786	0.2801	0.0383	0.1650	0.2834	0.0225	0.5026	1.0000
Manufacturing	(2)	0.0211	1.4040	0.0207	0.1838	0.2155	0.0252	0.5084	1.0000
Construction	(3)	0.0050	0.3273	1.0935	0.1548	0.2615	0.0273	0.5042	1.0000
Trade, transport and comm.	(4)	0.0024	0.1207	0.0214	1.2805	0.2578	0.0246	0.5786	1.0000
Finance and business services	(5)	0.0008	0.0411	0.0429	0.0757	1.3775	0.0267	0.6484	1.0000
Other services	(6)	0.0021	0.0776	0.0217	0.0920	0.1339	1.0756	0.7517	1.0000

Box 20.2 Quantity I-O model

This box shows how the I-O model may be applied to quantities and values.

PHYSICAL INPUT-OUTPUT TABLES

Quantities and unit wage rates for labour are known.

Table 1: Input-output table (quantities)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	4.0	6.8	2.0	8.4	21.2
Manuf. and const.	10.0	76.0	20.0	114.0	220.0
Services	4.0	18.0	8.0	110.5	140.5
Labour	5.0	14.0	24.0		43.0

Table 2: Prices

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture					
Manuf. and const.					
Services					
Labour	10.00	13.00	20.00		

Table 3: Input-output table (values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture					
Manuf. and const.					
Services					
Labour	50.00	182.00	480.00		
Input					

Table 4: Input coefficients (quantities/quantities)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	0.1887	0.0309	0.0142		
Manuf. and const.	0.4717	0.3455	0.1423		
Services	0.1887	0.0818	0.0569		
Labour	0.2358	0.0636	0.1708		

Table 5: Leontief matrix

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	0.8113	-0.0309	-0.0142		
Manuf. and const.	-0.4717	0.6545	-0.1423		
Services	-0.1887	-0.0818	0.9431		

Assumption: Final demand of product B increases by 10%

Table 6: Leontief inverse

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	1.2764	0.0639	0.0289		
Manuf. and const.	0.9942	1.6069	0.2576		
Services	0.3416	0.1522	1.0885		

Table 7: Quantity input-output model

	Leontief inverse			Final use	Output
Agriculture	1.2764	0.0639	0.0289	8.4	21.9
Manuf. and const.	0.9942	1.6069	0.2576	125.4	238.3
Services	0.3416	0.1522	1.0885	110.5	142.2

Table 8: Projected input-output table (quantities)

	Agriculture	Manuf. and const.	Services	Final use	TO
Agriculture	4.1	7.4	2.0	8.4	21.9
Manuf. and const.	10.3	82.3	20.2	125.4	238.3
Services	4.1	19.5	8.1	110.5	142.2
Labour	5.2	15.2	24.3		44.6
Input					

Table 9: Growth rates in %

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	3.4	8.3	1.2		3.4
Manuf. and const.	3.4	8.3	1.2	10.0	8.3
Services	3.4	8.3	1.2		1.2
Labour	3.4	8.3	1.2		3.8
Input					

MONETARY INPUT-OUTPUT TABLES

Quantities, prices and values are known.

Table 1: Input-output table (quantities)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	4.0	6.8	2.0	8.4	21.2
Manuf. and const.	10.0	76.0	20.0	114.0	220.0
Services	4.0	18.0	8.0	110.5	140.5
Labour	5.0	14.0	24.0		43.0

Table 2: Prices

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	5.00	5.00	5.00	5.00	
Manuf. and const.	2.00	2.00	2.00	2.00	
Services	4.00	4.00	4.00	4.00	
Labour	10.00	13.00	20.00		

Table 3: Input-output table (values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	20.00	34.00	10.00	42.00	106.00
Manuf. and const.	20.00	152.00	40.00	228.00	440.00
Services	16.00	72.00	32.00	442.00	562.00
Labour	50.00	182.00	480.00		712.00
Input	106.00	440.00	562.00	712.00	

Table 4: Input coefficients (values/values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	0.1887	0.0773	0.0178	0.0590	
Manuf. and const.	0.1887	0.3455	0.0712	0.3202	
Services	0.1509	0.1636	0.0569	0.6208	
Labour	0.4717	0.4136	0.8541		

Table 5: Leontief matrix

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	0.8113	-0.0773	-0.0178		
Manuf. and const.	-0.1887	0.6545	-0.0712		
Services	-0.1509	-0.1636	0.9431		

Assumption: Final demand of product B increases by 10%

Table 6: Leontief inverse

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	1.2764	0.1597	0.0361		
Manuf. and const.	0.3977	1.6069	0.1288		
Services	0.2733	0.3044	1.0885		

Table 7: Quantity input-output model

	Leontief inverse			Final use	Output
Agriculture	1.2764	0.1597	0.0361	42.00	109.64
Manuf. and const.	0.3977	1.6069	0.1288	250.80	476.64
Services	0.2733	0.3044	1.0885	442.00	568.94

Table 8: Projected input-output table (values)

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	20.69	36.83	10.12	42.00	109.64
Manuf. and const.	20.69	164.66	40.49	250.80	476.64
Services	16.55	78.00	32.40	442.00	568.94
Labour	51.72	197.15	485.93		734.80
Input	109.64	476.64	568.94	734.80	

Table 9: Growth rates in %

	Agriculture	Manuf. and const.	Services	Final use	Output
Agriculture	3.4	8.3	1.2		3.4
Manuf. and const.	3.4	8.3	1.2	10.0	8.3
Services	3.4	8.3	1.2		1.2
Labour	3.4	8.3	1.2		3.2
Input	3.4	8.3	1.2	3.2	

Box 20.3 Price I-O model

PHYSICAL INPUT-OUTPUT TABLES

Quantities and unit wage rates for labour are known.

Table 1: Input-output table (quantities)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	4.0	6.8	2.0	8.4	21.2
Manuf. and const.	10.0	76.0	20.0	114.0	220.0
Services	4.0	18.0	8.0	110.5	140.5
Labour	5.0	14.0	24.0		43.0

Table 2: Prices

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture					
Manuf. and const.					
Services					
Labour	10.00	13.00	20.00		

Table 3: Input-output table (values)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture					
Manuf. and const.					
Services					
Labour	50.00	182.00	480.00		
Input					

Table 4: Input coefficients (quantities/quantities)

	Agricul-ture	Manuf. and const.	Services
Agriculture	0.1887	0.0309	0.0142
Manuf. and const.	0.4717	0.3455	0.1423
Services	0.1887	0.0818	0.0569
Labour	0.2358	0.0636	0.1708

Table 5: Transposed input coefficients intermediates

Agriculture	0.1887	0.4717	0.1887
Manuf. and const.	0.0309	0.3455	0.0818
Services	0.0142	0.1423	0.0569

Table 6: Transposed Leontief matrix

Agriculture	0.8113	-0.4717	-0.1887
Manuf. and const.	-0.0309	0.6545	-0.0818
Services	-0.0142	-0.1423	0.9431

Assumption: Price of labour in industry increases by 10%

Table 7: Price input-output model

	Transposed inverse			Primary inputs v diag(q)	Product prices
Agriculture	1.2764	0.9942	0.3416	2.3585	5.08
Manuf. and const.	0.0639	1.6069	0.1522	0.9100	2.13
Services	0.0289	0.2576	1.0885	3.4164	4.02

Table 8: Projected input-output table (values)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	20.33	34.56	10.16	42.69	107.74
Manuf. and const.	21.33	162.10	42.66	243.15	469.25
Services	16.09	72.38	32.17	444.35	564.99
Labour	50.00	200.20	480.00		730.20
Input	107.74	469.25	564.99	730.20	

Table 9: Growth rates in %

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	1.6	1.6	1.6	1.6	1.6
Manuf. and const.	6.6	6.6	6.6	6.6	6.6
Services	0.5	0.5	0.5	0.5	0.5
Labour	0.0	10.0	0.0		2.6
Input	1.6	6.6	0.5	2.6	

MONETARY INPUT-OUTPUT TABLES

Quantities, prices and values are known.

Table 1: Input-output table (quantities)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	4.0	6.8	2.0	8.4	21.2
Manuf. and const.	10.0	76.0	20.0	114.0	220.0
Services	4.0	18.0	8.0	110.5	140.5
Labour	5.0	14.0	24.0		43.0

Table 2: Prices

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	5.00	5.00	5.00	5.00	
Manuf. and const.	2.00	2.00	2.00	2.00	
Services	4.00	4.00	4.00	4.00	
Labour	10.00	13.00	20.00		

Table 3: Input-output table (values)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	20.00	34.00	10.00	42.00	106.00
Manuf. and const.	20.00	152.00	40.00	228.00	440.00
Services	16.00	72.00	32.00	442.00	562.00
Labour	50.00	182.00	480.00		712.00
Input	106.00	440.00	562.00	712.00	

Table 4: Input coefficients (values/values)

	Agricul-ture	Manuf. and const.	Services
Agriculture	0.1887	0.0773	0.0178
Manuf. and const.	0.1887	0.3455	0.0712
Services	0.1509	0.1636	0.0569
Labour	0.4717	0.4136	0.8541

Table 5: Transposed input coefficients intermediates

Agriculture	0.1887	0.1887	0.1509
Manuf. and const.	0.0773	0.3455	0.1636
Services	0.0178	0.0712	0.0569

Table 6: Transposed Leontief matrix

Agriculture	0.8113	-0.1887	-0.1509
Manuf. and const.	-0.0773	0.6545	-0.1636
Services	-0.0178	-0.0712	0.9431

Assumption: Price of labour in industry increases by 10%

Table 7: Price input-output model

	Transposed inverse			Primary inputs w	Product price indexes
Agriculture	1.2764	0.3977	0.2733	0.4717	1.0164
Manuf. and const.	0.1597	1.6069	0.3044	0.4550	1.0665
Services	0.0361	0.1288	1.0885	0.8541	1.0053

Table 8: Projected input-output table (values)

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	20.33	34.56	10.16	42.69	107.74
Manuf. and const.	21.33	162.10	42.66	243.15	469.25
Services	16.09	72.38	32.17	444.35	564.99
Labour	50.00	200.20	480.00		730.20
Input	107.74	469.25	564.99	730.20	

Table 9: Growth rates in %

	Agricul-ture	Manuf. and const.	Services	Final use	Output
Agriculture	1.6	1.6	1.6	1.6	1.6
Manuf. and const.	6.6	6.6	6.6	6.6	6.6
Services	0.5	0.5	0.5	0.5	0.5
Labour	0.0	10.0	0.0		2.6
Input	1.6	6.6	0.5	2.6	

H. Input-output models with input and output coefficients

20.67 The I-O models that are mainly used in empirical research are based on input coefficients and are generally called Leontief I-O models. However, there is also a family of I-O models which are based on output coefficients. These models were developed by Ambica K. Ghosh (Ghosh 1958) and are often called Ghosh I-O models.

20.68 The **use-side Leontief** models reflect x = Ax + f, where x is the output vector, A the Leontief matrix of technical coefficients and f the supply demand vector. The **supply-side Ghosh** models reflect x'B + v' = x', where B is the Ghosh allocation coefficients matrix and v is the added value vector, the prime indicating the transposition operation. Both models can be used to study the impact of changes in final use and primary inputs on output as well as price and cost effects. The dual character of Leontief models and Ghosh models is discussed in Oosterhaven (1996), Dietzenbacher (1997), de Mesnard (2009) and Rueda-Cantuche (2011). I-O models may also be used to estimate forward and backward linkages of industries. The input coefficients reflect production functions and cost structures of activities, whereas the output coefficients reflect distribution parameters for products and primary inputs reflecting market shares and sales structure.

20.69 Using of input coefficients and output coefficients in I-O analysis is demonstrated for the four basic I-O models with input and output coefficients. The four I-O models have a dual character with an underlying symmetry. Each I-O model with input coefficients has a complement with output coefficients. Leontief and Ghosh models are similar but opposite in structure, almost as mirror images of one another. Leontief models use fixed input coefficients whilst the Ghosh models rely on fixed output coefficients. The four models are summarised as follows:

- The Leontief quantity model is a use-driven model which is often used to study the impact of an exogenous change of final uses on output. It is based on the accounting identities for total output along the rows of IOTs and uses fixed intermediate and primary input coefficients.
- The Leontief price model is sometimes also called cost push I-O price model and allows simulating cost-driven inflationary processes by simulating the impact of price changes of primary inputs on product prices (inflation). The primary input prices are assumed to be exogenous whereas the prices for outputs are determined by the solution of the model.
- The traditional Ghosh quantity model was formulated as a supply-driven model and was developed to study the impact of an increase in primary inputs on output and final use. The Ghosh quantity model starts with the accounting identities for total input along the columns of an IOT. Instead of exogenous final use, the Ghosh quantity model has exogenous primary inputs and produces a solution for endogenous total inputs. Final use forms a residual and taken as granted. The input ratios for intermediate consumption vary arbitrarily and essential production requirements are ignored.
- The traditional Ghosh price model was designed as a demand-driven price model. The single price for each column of final use is exogenous and the prices for intermediate consumption and primary inputs are endogenous variables. The model describes the cumulative effects of changes in final output prices on unit revenues per industry and prices of primary inputs such as labour and the use of capital. If the price of a specific product of final use is increasing then the price for all inputs of an industry would increase at the same rate causing a strange impact on inflation.

20.70 The outcome of the traditional Ghosh models compared with Leontief models has a poor economic meaning creating many disagreements. In order to overcome the criticism and implausibility of the Ghosh models, Dietzenbacher (1997) proposed an alternative interpretation by suggesting that the model be viewed not as a quantity model but as a price model, following Miller and Blair (2009, page 551). De Mesnard (2009, p. 364 and 370) also showed that the so-called equation of the Ghosh model (x'B + v' = x') is actually that of the Ghosh model in physical terms, hence it cannot be compared to the equation of the Leontief model (x = Ax + f).

20.71 It remains to be seen in empirical research whether the input coefficients or output coefficients are more stable over time and behave according to expectations. However, there are good reasons why I-O models with output coefficients are rarely used in empirical research as they lack a proper microeconomic foundation. I-O models with input coefficients are well established in economic analysis. At best, such models reflect the cost structure of industries and input structure of final use components. However, it is the rigidity of the underlying Leontief production functions which provides an obstacle to many applications.

I. Central model of I-O analysis

20.72 I-O analysis has often been used to study the impact of final use on output (quantity model) and value added changes on prices (price model). Appropriate extensions of the I-O system also allow evaluation of the direct and indirect impact of economic policies on other economic variables such as labour, capital, energy and emissions (joint product). Most of these policy issues, for example, labour policy, structural policy and fiscal policy have to be analysed with macroeconomic models which provide a minimum of industrial and product disaggregation.

20.73 The following extension of the I-O equation system offers multiple approaches for analysis:

(41) $Z = D(I - A)^{-1}\hat{Y}$ Central equation of I-O analysis

D = matrix of input coefficients for specific variable in economic analysis (intermediate consumption, labour, capital, energy, etc.)

I = unit matrix

A = matrix of input coefficients for intermediate consumption

$\hat{Y}$ = diagonal matrix for final use

Z = matrix with results for direct and indirect requirements (intermediates, labour, capital, energy, emissions, etc.)

20.74 Matrix D includes the input coefficients of the variable under investigation (intermediates, labour, capital, energy, emissions, etc.). The diagonal matrix Y denotes exogenous final use for goods and services. The matrix Z incorporates the results for the direct and indirect requirements (intermediates, labour, capital, energy) or joint outputs (emissions) for the produced goods and services of final use.

20.75 In essence, this approach allows assessing the total (direct and indirect) primary energy requirements or carbon dioxide emissions for the production of a vehicle which occur for all stages of production to provide the product (vehicle) for a final user. It should be noted that this approach focuses on domestic emissions only and not the total emissions. The part related to emissions related to imported products is missing which can be addressed using total IOTs instead of the domestic part only and applying domestic technology assumption.

20.76 Corresponding calculations of the labour and capital content of products are also feasible with this equation. Direct contributions of final users (for example direct emissions of carbon dioxide by private households) must be added as column vector to the results of matrix *Z* to account for the total emissions to final use.

20.77 This type of analysis is based on the restrictive assumptions of I-O models. Although these assumptions could be viewed as weakly based, this I-O analysis at least offers opportunities to assess the magnitude of the expected effects in the short-term, in terms of allocating responsibility for emissions to final use by linking final use products and emissions of industries. In Table 20.9, a corresponding calculation is presented for the emission of three disposals to nature, namely the gases, carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). The variable at the bottom of Table 20.9 reflects also the direct emissions of private households.

Table 20.9 Emission model

		PRODUCTS						FINAL USE					Total output at basic prices
		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business	Other services	Final consumption: Households	Final consumption: Governmnet	Gross fixed capital	Changes in inventories	Exports	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Direct emissions (1.000 tons)											
Carbon dioxide (CO_2)	(1)	9 260	550 893	9 162	80 990	12 077	24 173	222 268					908 823
Methane (CH_4)	(2)	1 247	925	1	49	3	10	79					2 313
Nitrous oxide (N_2O)	(3)	137	62		2			4					206
		Output (Billions of Euro)											
Output at basic prices	(4)	42	1 451	234	907	1 010	721						
		Emission coefficients (1.000 tons per billions of Euro)											
Carbon dioxide (CO_2)	(5)	219.813	379.615	39.115	89.336	11.957	33.541						
Methane (CH_4)	(6)	29.609	0.637	0.004	0.054	0.003	0.014						
Nitrous oxide (N_2O)	(7)	3.257	0.043	0.001	0.002	0.000	0.000						
		Inverse $(I-A)^{-1}$											
Agriculture	(8)	1.0786	0.0211	0.0050	0.0024	0.0008	0.0021						
Manufacturing	(9)	0.2801	1.4040	0.3273	0.1207	0.0411	0.0776						
Construction	(10)	0.0383	0.0207	1.0935	0.0214	0.0429	0.0217						
Trade, transport and comm.	(11)	0.1650	0.1838	0.1548	1.2805	0.0757	0.0920						
Finance and business services	(12)	0.2834	0.2155	0.2615	0.2578	1.3775	0.1339						
Other services	(13)	0.0225	0.0252	0.0273	0.0246	0.0267	1.0756						
		Direct and indirect emissions per unit of output $B(I-A)^{-1}$											
Carbon dioxide (CO_2)	(14)	363.803	558.261	186.001	165.476	41.586	76.668						
Methane (CH_4)	(15)	32.126	1.530	0.371	0.219	0.059	0.132						
Nitrous oxide (N_2O)	(16)	3.526	0.129	0.031	0.016	0.005	0.011						
		Diagonal matrix of final demand Y											
Agriculture	(17)	18.003	0.000	0.000	0.000	0.000	0.000						
Manufacturing	(18)	0.000	904.835	0.000	0.000	0.000	0.000						
Construction	(19)	0.000	0.000	158.546	0.000	0.000	0.000						
Trade, transport and comm.	(20)	0.000	0.000	0.000	487.822	0.000	0.000						
Finance and business services	(21)	0.000	0.000	0.000	0.000	405.957	0.000						
Other services	(22)	0.000	0.000	0.000	0.000	0.000	623.171						
		Emission content of final demand (1.000 tons) $Z = B(I-A)^{-1}Y + Eh$											
Carbon dioxide (CO_2)	(23)	6 550	505 134	29 490	80 723	16 882	47 777	222 268					908 823
Methane (CH_4)	(24)	578	1 384	59	107	24	82	79					2 313
Nitrous oxide (N_2O)	(25)	63	117	5	8	2	7	4					206

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20.78 In Table 20.9, the actual direct emissions (Rows (1) to (3)) and total output levels of production (Row (4)) are reported. In Rows (5) to (7) the corresponding emission coefficients have been calculated. The lowest carbon dioxide emission coefficient with 11.957 (1.000 tons emissions per one billion Euro) is reported for 'Business services' in Column (5). However, the results in Row (14) reveal that including indirect emissions results in a higher value of emission coefficient of 41.586 for 'Business services'. The estimates in Column (5) and Row (14) include all direct and indirect emission of carbon dioxide which can be related to the production of one unit of output of 'Business services' on all stages of production.

20.79 As shown in Row (17) of Table 20.9, the industry 'Agriculture' is delivering goods and services in the magnitude of 18.003 billion of Euros to final use. The calculation reveals that in the course of production 6.550 million tons of carbon dioxide has been emitted in Germany on all stages of production to produce these agricultural products for final use.

20.80 The industry 'Manufacturing' has the largest emissions at this level of aggregation and it includes mining and electricity. In the table, it is shown that the manufacturing industry is directly responsible for emission of 550.893 million tons of carbon dioxide in the own plants, Row (1) of Table 20.9. In terms of the number of tons of carbon dioxide emitted on all stages of production to produce the manufactured goods for final use (904.825 billion Euro), then 505.134 million tons of carbon dioxide emission can be attributed to products of manufacturing for final use. The corresponding interpretation of the results is valid for all industries of the economy. This approach allows for the reallocation of the emissions of carbon dioxide to the products purchased by final use. Again, it should be noted that this approach comprise only emissions on domestic territory and not emissions released during production of imported products used in the production processes.

20.81 The total emissions of carbon dioxide are reported in Column (12) of Table 20.9 with 908.823 million tons for the economy. Column (7) of Table 20.9 shows that household consumption is responsible for direct emission of 222.268 million tons carbon dioxide. The results in the last part of Table 20.9 include estimates for emissions attributed to final use categories. The direct emissions of household consumption have to be added as a separate column vector to the matrix Z to attain the national emission total of 908.823 million tons carbon dioxide, see Row (23) in Table 20.9.

20.82 This example demonstrates how extended I-O based systems may be used effectively to evaluate environmental policies. This tool will allow analyses of whether national emissions reduction targets are met and how they comply with the Kyoto Agreement and the targets of the Inter-governmental Panel on Climate Change. At the same time, other important fields of economic analysis can be covered with the same data base such as the impact of employment policies, substitution of labour and capital, productivity analysis, energy issues, environmental problems or structural policies.

J. Indicators

20.83 In general, in the neo-classical microeconomic approach, it is assumed that the production function relates the amount of inputs used by an industry to the maximum amount that can be produced by that industry with its primary inputs.

(42) $x_j = f(x_{ij}, L_j, C_j)$ Production function

x_j = output of industry j (products)

x_{ij} = inter-industry flow (goods, services) from sector i to sector j (intermediate consumption)

L_j = labour requirements of sector j

C_j = capital requirements of sector j

f = technology

20.84 In I-O analysis, a fundamental assumption is that for a given period the inter-industry flows of products (x_{ij}) from industry i to industry j and primary inputs (L, C) depend on the total output of industry j (x_j). If constant returns to scale and fixed relations of all inputs are assumed, then a set of technical input coefficients that is reflecting the technology can be produced. In most production processes, different products are produced but also different skills of labour and different types of capital goods are required. Therefore, the set of input coefficients in a broader notation of the matrix A encompass input coefficients for products (intermediate consumption), capital and labour (primary inputs).

(43) $a_{ij} = z_{ij}/x_j$ Technical input coefficients

a_{ij} = input coefficient

z_{ij} = input of type i in sector j (products, capital, labour)

x_j = output of sector j (product)

20.85 Using the definitions of the technical input coefficients, the production can be specified in the following form:

(44) $x_j = \min\left(z_{1j}/a_{1j}, z_{2j}/a_{2j}, \dots, z_{nj}/a_{nj}\right)$ Leontief production function

20.86 A number of input variables for various branches have been summarised in Table 20.10. They represent input requirements for products (intermediate consumption), labour, capital and energy. The following set of coefficients for emissions has a different character. In each production, and consumption activity, certain pollutants are emitted as joint products (disposals to nature). The corresponding emission coefficients for carbon dioxide and nitrous oxide are summarised using international standard weights to identify the impact on global warming and acid deposition.

Table 20.10 Input indicators for production activities per unit of output

		PRODUCTS					
		Agriculture	Manufacturing	Construction	Trade, trans.and comm.	Finance and business service	Other services
		(1)	(2)	(3)	(4)	(5)	(6)
		INTERMEDIATE CONSUMPTION (bn Euro)					
Domestic goods and services	(1)	0.497	0.492	0.496	0.421	0.352	0.248
Imported goods and services	(2)	0.109	0.195	0.074	0.064	0.030	0.029
Intermediate consumption	(3)	0.607	0.687	0.569	0.485	0.382	0.277
		TAXES LESS SUBSIDIES ON PRODUCTS (bn Euro)					
Taxes less subsidies on products	(4)	0.036	0.007	0.008	0.013	0.016	0.034
		VALUE ADDED (bn Euro)					
Compensation of employees	(5)	0.134	0.212	0.294	0.325	0.189	0.505
Other net taxes on production	(6)	-0.141	-0.002	-0.001	-0.001	0.004	-0.010
Consumption of fixed capital	(7)	0.189	0.054	0.022	0.066	0.158	0.088
Operating surplus, net	(8)	0.174	0.041	0.108	0.111	0.250	0.106
Value added at basic prices	(9)	0.357	0.306	0.423	0.501	0.602	0.689
		GROSS FIXED CAPITAL FORMATION (bn Euro)					
Machinery	(10)	0.052	0.014	0.007	0.021	0.081	0.040
Buildings	(11)	0.125	0.033	0.017	0.050	0.115	0.051
Total	(12)	0.177	0.047	0.023	0.070	0.196	0.090
		CAPITAL STOCK (bn of Euro)					
Machinery	(13)	3.963	0.716	0.348	0.857	6.929	3.112
Buildings	(14)	2.466	0.445	0.216	0.533	0.527	0.335
Total	(15)	6.430	1.161	0.564	1.391	7.456	3.446
		EMPLOYMENT (Persons)					
Wage and salary earners	(16)	7,002	4,677	8,317	10,833	5,637	15,757
Self-employed	(17)	8,522	189	1,977	1,431	1,007	1,469
Total	(18)	15,524	4,866	10,293	12,264	6,643	17,227
		ENERGY (Petajoule)					
Coal and coal products	(19)	0.009	1.181	0.002	0.001	0.000	0.008
Brown coals and lignite products	(20)	0.002	1.114	0.001	0.000	0.000	0.001
Crude oil	(21)		2.959				
Gasolines	(22)	0.083	0.063	0.019	0.028	0.020	0.021
Diesel fuels	(23)	2.525	0.084	0.338	0.525	0.092	0.103
Jet fuels	(24)				0.478		0.005
Heating oil, light	(25)	0.582	0.130	0.060	0.096	0.026	0.118
Fuel oil, heavy	(26)		0.231		0.019	0.000	0.000
Other petroleum products	(27)	0.043	0.820	0.433	0.039	0.002	0.004
Natural gas and other gases	(28)	0.291	1.238	0.050	0.138	0.049	0.256
Renewable Energy	(29)	0.142	0.812	0.019	0.050	0.007	0.008
Electric power and other energy	(30)	0.542	1.820	0.058	0.319	0.075	0.273
Total	(31)	4.220	10.452	0.980	1.694	0.270	0.797
		EMISSIONS (1.000 tons)					
Carbon dioxide (CO2)	(32)	219.813	379.615	39.115	89.336	11.957	33.541
Methane (CH4)	(33)	29.609	0.637	0.004	0.054	0.003	0.014
Nitrous oxide (N2O)	(34)	3.257	0.043	0.001	0.002	0.000	0.000
Nitrogen oxides (NOx)	(35)	3.624	0.371	0.195	0.440	0.033	0.062
Sulfur dioxide (SO2)	(36)	0.064	0.257	0.005	0.045	0.002	0.011
Organic compounds (NMVOC)	(37)	0.313	0.395	0.024	0.044	0.003	0.010
Ammonia (NH3)	(38)	12.835	0.011	0.001	0.003	0.000	0.001
Particulate matter (PM10)	(39)	1.125	0.029	0.029	0.047	0.002	0.004
Hydroflurocarbons (HFC)	(40)		0.008				0.001
Perflurorocarbons PFC	(41)		0.000				
Sulfur hexafluoride (SF6)	(42)		0.000				
Total	(43)	270.640	381.366	39.373	89.969	11.999	33.642
		GLOBAL WARMING AND ACID DEPOSITION (1.000 tons)					
Greenhouse gases	(44)	1851.272	406.193	39.412	91.233	12.074	33.971
Acid deposition	(45)	2.600	0.516	0.141	0.352	0.025	0.054
Tropospheric ozone formation	(46)	33.545	1.403	0.223	0.537	0.038	0.085
		WASTE, SEWAGE AND WATER					
Waste (1.000 tons)	(47)	19.073	84.654	828.662	5.455	5.455	5.455
Sewage (Mio. cbm)	(48)	0.504	18.585	0.161	0.191	0.191	0.191
Water from waterworks (Mio. cbm)	(49)	3.228	-2.567	0.058	0.214	0.214	0.214
Water from nature (Mio. cbm)	(50)	7.200	25.915	0.105	0.010	0.010	0.010

Germany 2009

K. Multipliers

20.87 Three of the most frequently used types of multipliers in I-O analysis are those that estimate the effects of the exogenous changes of final use on:

- outputs of the industries (and products) in the economy;
- GVA and income earned by the households; and
- employment, that is expected to be generated by the new activity levels.

20.88 In the standard I-O model, the final use categories are considered exogenous variables. However, household final consumption expenditure and GFCF in many respects depend on income of private households (and businesses). In the Type I multiplier analysis, household final consumption expenditure and consequently private household activities are exogenous. A more refined Type II multiplier analysis for wages and private consumption tries to include the household sector as an endogenous activity. It is assumed that the income earned by private households from wages and salaries is spent to a large extent as household final consumption expenditure. This additional income induces higher incomes, which again induces more household final consumption expenditure until a new equilibrium is reached.

20.89 Box 20.4 provides analysis of the Type I and Type II multiplier links for the output multiplier, income multiplier and employment multiplier to the I-O model.

1. Output multipliers

20.90 An output multiplier for an industry j is defined as the total value of production in all industries of the economy that is necessary for all stages of production in order to produce one unit of product j for final use. The output multiplier in Table 20.11 corresponds to the column sum of the Leontief Inverse as shown in Table 20.6.

Table 20.11 Output multipliers (Leontief Inverse)

		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services
		(1)	(2)	(3)	(4)	(5)	(6)
Agriculture	(1)	1.0786	0.0211	0.0050	0.0024	0.0008	0.0021
Manufacturing	(2)	0.2801	1.4040	0.3273	0.1207	0.0411	0.0776
Construction	(3)	0.0383	0.0207	1.0935	0.0214	0.0429	0.0217
Trade, transport and comm.	(4)	0.1650	0.1838	0.1548	1.2805	0.0757	0.0920
Finance and business services	(5)	0.2834	0.2155	0.2615	0.2578	1.3775	0.1339
Other services	(6)	0.0225	0.0252	0.0273	0.0246	0.0267	1.0756
Total		1.8679	1.8704	1.8695	1.7074	1.5648	1.4029

20.91 If a government agency, for example, were trying to determine in which industry of the economy to spend additional money, a comparison of output multipliers would indicate where this spending has the greatest impact in terms of the total value of output generated throughout the economy. In this case, it would be the industry "Manufacturing" with an output multiplier of $O_4 = 1.8704$. If the elements of the inverse $(I - A)^{-1}$ are represented as α_{ij} , then the output multiplier is defined as:

(45) $O_j = \sum_{i=1}^{n} \alpha_{ij}$ Output multiplier

20.92 The output multiplier in Row (8) of Table 20.11 represents for each industry one unit of final use (1.0) and the direct and indirect requirements for domestic intermediate consumption, for example, for agriculture, 0.8679. Multipliers of this sort may overstate or understate the effect on the economy, for example, if some industries are operating at capacity and a substitution towards imported inputs could take place. Another critical element is the internal consumption of an industry on the diagonal of its own products.

20.93 Depending upon the statistical sources, the aggregation of survey results may have a distinctive influence on the magnitude of the reported internal consumption.

2. Income multipliers

20.94 Income multipliers attempt to identify the impacts of final use changes on income received by households (labour supply). The central equation (41) of the I-O models is used to calculate the direct and indirect requirements for wages which are incorporated in one unit of output for final use. This calculation is equivalent to an assessment of the wage content of products.

(46) $Z = B(I - A)^{-1}$ Direct and indirect requirements for wages

B = vector of input coefficients for wages

I = unit matrix

A = matrix of input coefficients for intermediate consumption

Z = vector with results for direct and indirect requirements for wages

Box 20.4 Multipliers in the I-O model

The Type I and Type II multiplier links for the output multiplier, income multiplier and employment multiplier to the I-O model are shown below.

Input-output table — Billions of Euro

PRODUCTS		PRODUCTS: Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business	Other services	FINAL USE: Final consumption: Households	Final consumption: Governmnet	Gross fixed capital formation	Changes in inventories	Exports	Output
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agriculture	(1)	3	20				1	9			3	5	42
Manufacturing	(2)	7	394	48	56	11	30	250	7	95	- 58	611	1 451
Construction	(3)	1	11	18	8	28	10	5		153		1	234
Trade, transport and comm.	(4)	4	139	17	181	38	40	317	15	39	6	111	907
Finance and business services	(5)	6	131	30	124	261	51	313	3	25		66	1 010
Other services	(6)		18	3	12	17	47	147	472	2		2	721
Total at basic prices	(7)	21	713	116	382	355	179	1 041	497	314	- 49	795	4 365
Imports	(8)	5	283	17	58	31	21	128	9	61	31	189	833
Taxes less subsidies on products	(9)	2	10	2	12	17	24	151	6	34			257
Total at purchasers' prices	(10)	27	1 007	135	452	402	224	1 319	513	409	- 18	984	5 455
Compensation of employees	(11)	6	308	69	294	191	364						1 232
Other taxes less subsidies on production	(12)	- 6	- 2		- 1	5	- 7						- 12
Consumption of fixed capital	(13)	8	79	5	60	160	63						375
Net operating surplus	(14)	7	60	25	101	252	77						523
GVA	(15)	15	445	99	454	608	497						2 117
Input	(16)	42	1 451	234	907	1 010	721	1 319	513	409	- 18	984	

Employment — 1.000 Persons

Employment	(17)	654	7 062	2 411	11 118	6 710	12 415		40 370

Germany 2009

Empty cells

Type I multiplier analysis

with exogenous final demand

Input coefficients (A)

0.0692	0.0139	0.0000	0.0004	0.0001	0.0008
0.1686	0.2716	0.2048	0.0619	0.0110	0.0414
0.0219	0.0077	0.0749	0.0088	0.0278	0.0139
0.0838	0.0956	0.0739	0.2000	0.0377	0.0552
0.1443	0.0906	0.1284	0.1370	0.2584	0.0712
0.0095	0.0122	0.0138	0.0132	0.0166	0.0659

Leontief inverse $(I\text{-}A)^{-1}$

1.0786	0.0211	0.0050	0.0024	0.0008	0.0021
0.2801	1.4040	0.3273	0.1207	0.0411	0.0776
0.0383	0.0207	1.0935	0.0214	0.0429	0.0217
0.1650	0.1838	0.1548	1.2805	0.0757	0.0920
0.2834	0.2155	0.2615	0.2578	1.3775	0.1339
0.0225	0.0252	0.0273	0.0246	0.0267	1.0756

Type II multiplier analysis

with endogenous households consumption and labour income

Input coefficients (A)

0.0692	0.0139	0.0000	0.0004	0.0001	0.0008	0.0071
0.1686	0.2716	0.2048	0.0619	0.0110	0.0414	0.1894
0.0219	0.0077	0.0749	0.0088	0.0278	0.0139	0.0035
0.0838	0.0956	0.0739	0.2000	0.0377	0.0552	0.2407
0.1443	0.0906	0.1284	0.1370	0.2584	0.0712	0.2370
0.0095	0.0122	0.0138	0.0132	0.0166	0.0659	0.1113
0.1342	0.2122	0.2939	0.3248	0.1893	0.5055	0.0000

Leontief inverse $(I\text{-}A)^{-1}$

1.0852	0.0293	0.0149	0.0124	0.0071	0.0142	0.0195
0.4430	1.6090	0.5737	0.3691	0.1974	0.3811	0.4879
0.0516	0.0374	1.1136	0.0416	0.0557	0.0464	0.0398
0.3570	0.4254	0.4453	1.5733	0.2599	0.4496	0.5750
0.5138	0.5053	0.6098	0.6091	1.5984	0.5628	0.6896
0.0931	0.1140	0.1341	0.1322	0.0944	1.2070	0.2113
0.5151	0.6479	0.7788	0.7854	0.4939	0.9591	1.5419

Output multiplier

The output multiplier for sector j is defined as the total value of production in all sectors of the economy that is necessary to produce one dollar's worth of final demand of product j.

Type I:

Column sum of input coefficient for intermediates					
0.4974	0.4916	0.4958	0.4214	0.3516	0.2483
Output multiplier OM = column sum of Leontief inverse					
1.8679	1.8704	1.8695	1.7074	1.5648	1.4029

Type II:

Column sum of input coefficient for intermediates						
0.6316	0.7038	0.7896	0.7461	0.5409	0.7538	0.7890
Output multiplier OM = column sum of Leontief inverse						
3.0587	3.3683	3.6702	3.5232	2.7068	3.6203	3.5649

Income multiplier

The income multiplier for sector j is defined as the total value of all wages in all sectors of the economy that is necessary to produce one dollar's worth of final demand of product j.

Type I:

Input coefficient for compensation of employees w					
0.1342	0.2122	0.2939	0.3248	0.1893	0.5055
Income multiplier IM = $w(I\text{-}A)^{-1}$					
0.3340	0.4202	0.5051	0.5093	0.3203	0.6220

Type II:

Input coefficient for compensation of employees w						
0.1342	0.2122	0.2939	0.3248	0.1893	0.5055	0.0000
Income multiplier IM = $w(I\text{-}A)^{-1}$						
0.5151	0.6479	0.7788	0.7854	0.4939	0.9591	0.5419

Employment multiplier

The employment multiplier for sector j is defned as the total number of persons employed in all sectors of the economy that is necessary to produce one million dollar's worth of final demand of product j.

Type I:

Input coefficient for employment m					
15.524	4.866	10.293	12.264	6.643	17.227
Employment multiplier EM = $m(I\text{-}A)^{-1}$					
22.796	11.494	17.034	18.686	11.194	21.180

Type II:

Input coefficient for employment m						
15.524	4.866	10.293	12.264	6.643	17.227	0.000
Employment multiplier EM = $m(I\text{-}A)^{-1}$						
28.928	19.208	26.307	28.037	17.076	32.599	18.359

20.95 In Table 20.12, various multipliers are summarised for products which are delivered to final use. In our numerical example, the industry “Agriculture” has a relatively small direct input coefficients for wages, as shown by $b_1 = 0.134$ in Table 20.10, reflecting that a significant proportion of the working population in agriculture is self-employed.

Table 20.12 Multipliers for products

		PRODUCTS					
		Agriculture	Manufacturing	Construction	Trade, trans.and comm.	Finance and business service	Other services
		(1)	(2)	(3)	(4)	(5)	(6)
		DOMESTIC PRODUCTION (bn Euro/bn Euro)					
Final demand of domestic products	(1)	1.000	1.000	1.000	1.000	1.000	1.000
Intermediate demand of domestic products	(2)	0.868	0.870	0.870	0.707	0.565	0.403
Imported products	(3)	0.195	0.297	0.164	0.116	0.059	0.058
Taxes less subsidies on products	(4)	0.049	0.018	0.018	0.023	0.025	0.041
Products at purchasers' prices	(5)	1.112	1.185	1.051	0.847	0.649	0.501
		VALUE ADDED (bn Euro/bn Euro)					
Compensation of employees	(6)	0.334	0.420	0.505	0.509	0.320	0.622
Other net taxes on production	(7)	-0.151	-0.005	-0.001	-0.001	0.006	-0.011
Consumption of fixed capital	(8)	0.278	0.129	0.096	0.135	0.228	0.127
Operating surplus, net	(9)	0.295	0.141	0.218	0.217	0.362	0.164
Value added at basic prices	(10)	0.756	0.686	0.818	0.861	0.916	0.902
		GROSS FIXED CAPITAL FORMATION (bn Euro/bn Euro)					
Machinery	(11)	0.088	0.043	0.038	0.050	0.115	0.057
Buildings	(12)	0.186	0.085	0.069	0.099	0.166	0.078
Total	(13)	0.274	0.128	0.107	0.149	0.281	0.135
		CAPITAL STOCK (bn of Euro/bn Euro)					
Machinery	(14)	6.664	2.825	2.664	3.064	9.740	4.425
Buildings	(15)	3.038	0.902	0.624	0.891	0.805	0.524
Total	(16)	9.702	3.727	3.288	3.956	10.545	4.949
		EMPLOYMENT (1.000 persons/bn Euro)					
Wage and salary earners	(17)	12.921	10.491	14.242	16.472	9.560	19.257
Self-employed	(18)	9.875	1.004	2.791	2.214	1.634	1.922
Total	(19)	22.796	11.494	17.034	18.686	11.194	21.180
		ENERGY (Petajoule/bn Euro)					
Coal	(20)	0.341	1.658	0.389	0.144	0.049	0.101
Lignite	(21)	0.314	1.564	0.365	0.135	0.046	0.087
Crude oil	(22)	0.829	4.154	0.968	0.357	0.122	0.230
Natural gas	(23)	0.118	0.100	0.052	0.050	0.034	0.033
Nuclear fuels	(24)	2.876	0.298	0.518	0.722	0.190	0.191
Water power	(25)	0.079	0.088	0.074	0.613	0.036	0.049
Briquettes	(26)	0.692	0.222	0.135	0.151	0.054	0.152
Coke	(27)	0.068	0.328	0.079	0.052	0.011	0.020
Petroleum products	(28)	0.300	1.169	0.749	0.159	0.058	0.081
Electricity	(29)	0.705	1.788	0.502	0.347	0.137	0.392
Produced gas	(30)	0.392	1.154	0.297	0.165	0.048	0.078
Steam, hot water	(31)	1.177	2.650	0.739	0.656	0.213	0.477
Total	(32)	7.891	15.173	4.869	3.550	0.997	1.891
		EMISSIONS (1.000 tons/bn Euro)					
Carbon dioxide (CO_2)	(33)	363.803	558.261	186.001	165.476	41.586	76.668
Methane (CH_4)	(34)	32.126	1.530	0.371	0.219	0.059	0.132
Nitrous oxide (N_2O	(35)	3.526	0.129	0.031	0.016	0.005	0.011
Sulfur dioxide (SO_2)	(36)	4.103	0.690	0.431	0.630	0.107	0.152
Nitrogen oxides (NO_x)	(37)	0.149	0.371	0.097	0.089	0.017	0.036
Carbon monoxide (CO)	(38)	0.457	0.571	0.165	0.106	0.025	0.046
Organic compounds (NMVOC)	(39)	13.848	0.286	0.070	0.036	0.012	0.029
Dust particles	(40)	1.232	0.074	0.055	0.068	0.010	0.014
Total	(41)	0.002	0.011	0.003	0.001	0.000	0.001
		GLOBAL WARMING AND ACID DEPOSITION (1.000 tons/bn Euro)					
Greenhouse gases	(42)	2,131.379	630.364	203.533	175.135	44.363	82.822
Acid deposition	(43)	3.021	0.854	0.399	0.531	0.091	0.143
Tropospheric ozone formation	(44)	36.686	2.791	0.966	0.956	0.190	0.331
		WASTE, SEWAGE AND WATER					
Waste (1.000 tons/bn Euro)	(45)	78.594	138.761	936.398	36.517	47.149	31.694
Sewage (Mio. cbm/bn Euro)	(46)	5.845	26.188	6.346	2.545	1.053	1.695
Water from waterworks (Mio. cbm/bn Euro)	(47)	2.866	-3.444	-0.665	0.034	0.216	0.087
Water from nature (Mio. cbm/bn Euro)	(48)	15.033	36.542	8.638	3.162	1.089	2.041

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20.96 However, if we calculate the income multiplier for wages (direct and indirect wage requirements per unit of output) for this industry, $z_1 = 0.334$ as shown in Table 20.12, we can verify that the 'wage content' of agricultural products is threefold. Thus, the intermediate consumption inputs of agriculture incorporate a significant amount of wages.

20.97 Similarly, 'Other services' have the highest direct ($b_6 = 0.505$) and direct and indirect ($b_6 = 0.622$) wage requirements. This general approach allows assessing the wage, labour, capital or energy content of the various components of final use.

3. Employment multipliers

20.98 When employment multipliers are calculated, the major difference to the calculation of the wage content of products is that the physical labour input coefficients are used instead of monetary labour input coefficients.

(47) $Z = E(I - A)^{-1}$ Direct and indirect requirements for labour

E = matrix of input coefficients for labour (1.000 persons per Mill. DM of output)

Z = matrix with results for direct and indirect requirements for labour (persons)

20.99 For each industry, the employment multipliers represent jobs created per unit of currency of additional final use. The labour intensive industry 'Agriculture' has the highest employment multiplier, $z_1 = 22.796$. If the final use for agricultural products would be increased by one billion Euros, 22.796 positions (wage and salary earners and self-employed) would be created in this industry. However, the largest difference between direct employment coefficients and employment multipliers (direct and indirect employment) is observed in "Manufacturing".

4. Capital multipliers

20.100 The satellite systems as shown in Table 19.3 include information on labour and capital which is required for the production of the various industries. The matrix for labour distinguishes in two rows, wage and salary earners and the self-employed, whilst the matrix for the capital stock provides data for machinery and buildings. This data base allows assessment of the labour and capital content of products and also assessment of the direct and indirect substitution of labour and capital, provided that a time series of IOTs with the corresponding satellite systems are available.

20.101 Monetary input coefficients for capital are used to calculate the capital content of products using the following equation:

(48) $Z = C(I - A)^{-1}$ Direct and indirect requirements for capital

C = matrix of input coefficients for capital requirements per unit of output

Z = matrix with results for direct and indirect requirements of capital

20.102 The calculation reveals that the highest capital multiplier (capital intensity) is for "Business services". The direct capital requirements in this industry are $c_1 = 7.456$ as shown in Table 20.10.

20.103 The capital multipliers in Table 20.12 reflect the direct and indirect capital requirements on all stages of production. To produce one million Euros of "Business services" for final use, 10.545 billions of Euros capital (buildings, machinery) are required ($z_1 = 10.545$) on all stages of production.

5. Primary input content of final use

20.104 The multipliers allow assessment of the primary input content of final use by product and by category. The results are presented in Table 20.13 for the primary input content of final use by category.

20.105 For the various products of final use, the multipliers for primary inputs $B(I-A)^{-1}$ are multiplied with a diagonal matrix of final use total for products.

(49) $\boldsymbol{Z} = \boldsymbol{B}(\boldsymbol{I} - \boldsymbol{A})^{-\mathbf{1}}\hat{\mathrm{Y}}$ Direct and indirect requirements for primary inputs

$\boldsymbol{B}$ = matrix of input coefficients for primary input

$\boldsymbol{I}$ = unit matrix

$\boldsymbol{A}$ = matrix of input coefficients for intermediate consumption

$\hat{\mathrm{Y}}$ = Diagonal matrix for final use by product

$\boldsymbol{Z}$ = matrix with results for direct and indirect requirements for primary inputs

(50) $\boldsymbol{Z} = \boldsymbol{B}(\boldsymbol{I} - \boldsymbol{A})^{-\mathbf{1}}\boldsymbol{Y}$ Direct and indirect requirements for primary inputs

$\boldsymbol{B}$ = matrix of input coefficients for primary input

$\boldsymbol{Y}$ = matrix of final use by category

$\boldsymbol{Z}$ = matrix with results for direct and indirect requirements for primary inputs

Table 20.13 Input content of final use by category

		CATEGORIES OF FINAL USE					Total
		Final consumption		Gross fixed capital formation	Changes in inventories	Exports	
		Households	Governmnet				
		(1)	(2)	(3)	(4)	(5)	(6)
		FINAL USES (bn Euro)					
Total	(1)	1 041	497	314	- 49	795	2 598
		INPUT CONTENT OF FINAL USES					
		INTERMEDIATES (bn Euro)					
Domestic products	(2)	690	209	258	- 44	653	1 767
Imported products	(3)	140	31	59	- 16	199	414
Taxes less subsidies on products	(4)	26	20	6	- 1	15	67
Products at purchasers' prices	(5)	856	260	323	- 60	868	2 247
		VALUE ADDED (bn Euro)					
Compensation of employees	(6)	464	305	146	- 20	337	1 232
Other net taxes on production	(7)	- 3	- 5	- 1	0	- 3	- 12
Consumption of fixed capital	(8)	168	63	38	- 6	111	375
Operating surplus, net	(9)	245	83	64	- 6	136	523
Value added at basic prices	(10)	874	446	248	- 32	581	2 117
		INVESTMENT (bn Euro)					
Machinery	(11)	72	28	15	- 2	40	153
Buildings	(11)	118	39	27	- 4	75	255
Total	(12)	190	67	42	- 6	115	409
		CAPITAL STOCK (Millions of Euro)					
Machinery	(13)	5 449	2 182	1 045	- 126	2 755	11 305
Buildings	(14)	868	270	237	- 37	720	2 058
Total	(15)	6 317	2 452	1 282	- 163	3 475	13 363
		EMPLOYMENT (1.000 Persons)					
Wage and salary earners	(16)	13 855	9 444	4 091	- 465	8 975	35 900
Self-employed	(17)	1 852	953	653	- 12	1 024	4 470
Total	(18)	15 707	10 397	4 744	- 477	9 999	40 370
		ENERGY (Terajoule)					
Coal and coal products	(19)	495	62	224	- 95	1 035	1 722
Brown coals and lignite products	(20)	465	55	211	- 89	975	1 618
Crude oil	(21)	1 235	145	560	- 237	2 591	4 294
Gasolines	(22)	57	17	20	- 5	69	159
Diesel fuels	(23)	420	104	141	- 3	290	952
Jet fuels	(24)	236	33	44	- 1	125	437
Heating oil, light	(25)	149	76	49	- 10	160	424
Fuel oil, heavy	(26)	106	13	46	- 19	207	353
Other petroleum products	(27)	379	50	233	- 66	738	1 333
Natural gas and other gases	(28)	666	204	264	- 100	1 144	2 179
Renewable Energy	(29)	372	48	163	- 65	729	1 247
Electric power and other energy	(30)	1 021	255	396	- 146	1 713	3 240
Total	(31)	5 603	1 062	2 351	- 835	9 776	17 958
		EMISSIONS (1.000 Tons)					
Carbon dioxide (CO2)	(32)	220 519	42 977	89 043	- 30 261	364 278	686 555
Methane (CH4)	(33)	791	77	212	21	1 133	2 234
Nitrous oxide (N2O)	(34)	74	6	18	5	100	202
Nitrogen oxides (NOx)	(35)	469	87	159	- 22	521	1 212
Sulfur dioxide (SO2)	(36)	133	21	54	- 21	239	427
Organic compounds (NMVOC)	(37)	196	28	84	- 31	365	642
Ammonia (NH3)	(38)	221	16	39	30	253	560
Particulate matter (PM10)	(39)	57	8	18	0	60	144
Hydroflurocarbons (HFC)	(40)	3	1	2	- 1	7	12
Perflurorocarbons PFC	(41)	0	0	0	0	0	0
Sulfur hexafluoride (SF6)	(42)	0	0	0	0	0	0
Total emissions	(43)	222 463	43 221	89 629	- 30 280	366 956	691 989
		GLOBAL WARMING AND ACID DEPOSITION (1.000 tons)					
Greenhouse gases	(44)	259 955	46 575	98 998	- 28 424	418 968	796 073
Acid deposition	(45)	461	82	165	- 36	603	1 276
Tropospheric ozone formation	(46)	1 456	192	455	- 33	2 019	4 089
		WASTE, SEWAGE AND WATER					
Waste (1.000 tons)	(47)	70 728	16 676	159 154	- 7 600	93 179	332 137
Sewage (Mio. cbm)	(48)	8 012	1 038	3 585	- 1 489	16 387	27 532
Water from waterworks (Mio. cbm)	(49)	- 745	17	- 422	210	- 2 071	- 3 011
Water from nature (Mio. cbm)	(50)	10 953	1 288	4 944	- 2 057	22 833	37 961

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L. Inter-industrial linkage analysis

20.106 In the I-O analysis framework, the production by a particular industry has two kinds of effects on other industries in the economy. If an industry j increases its output, more inputs (purchases) are required including more intermediate consumption from other industries.

20.107 The term 'backward linkage' is used to indicate the inter-connection of a particular industry to other industries from which it purchases inputs (use side). On the other hand, increased output of industry j indicates that additional amounts of products are available to be used as inputs by other industries. There will be increased supplies from industry j for industries which use product j in their production (supply side). The term 'forward linkage' is used to indicate the inter-connection of a particular industry to those to which it sells its output. Many definitions of linkage measures have been proposed and how to identify key industries in developing countries raised which are summarised in Rasmussen (1957), Hirschmann (1958), McGilvray (1977), Hewings (1982) and Miller and Blair (2009).

20.108 The Leontief quantity model will help to identify backward linkages while the Ghosh price model can be used to identify forward linkages. The column sum of the Leontief Inverse is the appropriate indicator for the magnitude of backward linkages. On the other hand, the row sum of the Ghosh Inverse is the corresponding indicator for the size of forward linkages.

20.109 In its simplest form, the strength of the backward linkage of an industry j is given by the column sum of the direct input coefficients. A more useful and comprehensive measure is provided by the column sum of the Leontief Inverse, which reflects the direct and indirect effects on other industries. In Table 20.14, the industry 'Manufacturing' has the most profound backward linkages ($b_j = 1.8704$) with other industries.

20.110 Backward linkages are use-oriented. The industry 'Construction' requires inputs from many other industries and therefore will have strong backward linkages.

20.111 Forward linkages are supply-oriented. The industry 'Electricity' supplies electricity to all other industries, and therefore, this industry is expected to have strong forward linkages (many clients) but weak backward linkages (few inputs). The row totals of the direct output coefficients and the Ghosh Inverse output coefficients are reflecting the intensity of forward linkages. In Table 20.15, the industry 'Business services' has the strongest forward linkages ($f_j = 2.0866$).

20.112 There is a discussion whether the on-diagonal elements of the input and output coefficients should be included or netted out of the summations. If all uses and supply effects are covered, then they are appropriately included. If, however, the focus is on the industry's backward dependence on other industries, and the forward dependence of an industry on the purchases by other industries of its products, then the on-diagonal elements should be excluded. Also various normalizations of those measures have been used in empirical studies.

Table 20.14 Backward linkages

		Agricul-ture (1)	Manufac-turing (2)	Construc-tion (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)
		INPUT COEFFICIENTS A					
Agriculture	(1)	0.0692	0.0139	0.0000	0.0004	0.0001	0.0008
Manufacturing	(2)	0.1686	0.2716	0.2048	0.0619	0.0110	0.0414
Construction	(3)	0.0219	0.0077	0.0749	0.0088	0.0278	0.0139
Trade, transport and comm.	(4)	0.0838	0.0956	0.0739	0.2000	0.0377	0.0552
Finance and business services	(5)	0.1443	0.0906	0.1284	0.1370	0.2584	0.0712
Other services	(6)	0.0095	0.0122	0.0138	0.0132	0.0166	0.0659
Total	(7)	0.4974	0.4916	0.4958	0.4214	0.3516	0.2483
		LEONTIEF INVERSE L = $(I-A)^{-1}$					
Agriculture	(8)	1.0786	0.0211	0.0050	0.0024	0.0008	0.0021
Manufacturing	(9)	0.2801	1.4040	0.3273	0.1207	0.0411	0.0776
Construction	(10)	0.0383	0.0207	1.0935	0.0214	0.0429	0.0217
Trade, transport and comm.	(11)	0.1650	0.1838	0.1548	1.2805	0.0757	0.0920
Finance and business services	(12)	0.2834	0.2155	0.2615	0.2578	1.3775	0.1339
Other services	(13)	0.0225	0.0252	0.0273	0.0246	0.0267	1.0756
Total	(14)	1.8679	1.8704	1.8695	1.7074	1.5648	1.4029
Backward linkages	(15)	1.8679	1.8704	1.8695	1.7074	1.5648	1.4029
Normalized BL	(16)	1.0899	1.0914	1.0908	0.9963	0.9130	0.8186

20.113 When linkages are being measured in order to compare the structure of production or technologies between countries, the matrix of input coefficients for intermediate consumption should be derived from total inter-industry transactions, disregarding whether the intermediate consumption is of domestic or foreign origin. On the other hand, if linkages are being used to identify key industries with high multipliers in a particular economy, then only domestic intermediate consumption should be used to assess the forward and backward linkages in the national context.

Table 20.15 Forward linkages

		Agricul-ture (1)	Manufac-turing (2)	Construc-tion (3)	Trade, trans.and comm. (4)	Finance and business service (5)	Other services (6)	Total (7)
		OUTPUT COEFFICIENTS B						
Agriculture	(1)	0.0692	0.4785	0.0000	0.0092	0.0026	0.0132	0.5727
Manufacturing	(2)	0.0049	0.2716	0.0331	0.0387	0.0077	0.0206	0.3765
Construction	(3)	0.0039	0.0475	0.0749	0.0341	0.1201	0.0426	0.3231
Trade, transport and comm.	(4)	0.0039	0.1531	0.0191	0.2000	0.0420	0.0439	0.4619
Finance and business services	(5)	0.0060	0.1301	0.0298	0.1230	0.2584	0.0508	0.5981
Other services	(6)	0.0006	0.0245	0.0045	0.0166	0.0232	0.0659	0.1353
		GOSH INVERSE G = $(I-B)^{-1}$						
Agriculture	(7)	1.0786	0.7263	0.0278	0.0524	0.0199	0.0360	1.9411
Manufacturing	(8)	0.0081	1.4040	0.0528	0.0754	0.0286	0.0385	1.6074
Construction	(9)	0.0069	0.1285	1.0935	0.0828	0.1852	0.0668	1.5637
Trade, transport and comm.	(10)	0.0077	0.2943	0.0400	1.2805	0.0844	0.0731	1.7799
Finance and business services	(11)	0.0118	0.3097	0.0606	0.2314	1.3775	0.0955	2.0866
Other services	(12)	0.0013	0.0508	0.0089	0.0310	0.0374	1.0756	1.2050

20.114 If l_{ij} is the $n \times n$ matrix of the Leontief inverse $(I-A)^{-1}$ then the backward linkage BL_j of the sector j is computed as:

$$BL_j = \sum_{i=1}^{n} l_{ij}$$

If however g_{ij} is the $n \times n$ matrix of the Ghosh inverse $(I - B)^{-1}$ then the forward linkage FL_i of the sector i is computed as:

$$FL_{\mathrm{i}} = \sum_{j=1}^{n} g_{\mathrm{ij}}$$

20.115 The results for forward and backward linkages are summarised in Table 20.16. Manufacturing has the highest backward linkages and business services the highest forward linkages. The lowest linkages are reported for other services.

Table 20.16 Forward and backward linkages

		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services
		(1)	(2)	(3)	(4)	(5)	(6)
Backward linkages	(1)	1.8679	1.8704	1.8695	1.7074	1.5648	1.4029
Forward linkages	(2)	1.9411	1.6074	1.5637	1.7799	2.0866	1.2050
Total	(3)	3.8091	3.4779	3.4332	3.4874	3.6514	2.6078

20.116 The normalised backward linkage NBL_j of the sector j is computed as:

$$NBL_{\mathrm{j}} = \sum_{i=1}^{n} l_{\mathrm{ij}} \Big/ \frac{1}{n} \sum_{{}^{2}i=1}^{n} \sum_{j=1}^{n} l_{\mathrm{ij}}$$

The normalised forward linkage NFL_i of the sector i is computed as:

$$NFL_{\mathrm{i}} = \sum_{j=1}^{n} g_{\mathrm{ij}} \Big/ \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{n} g_{\mathrm{ij}}$$

In both cases, the linkage of sectors j is divided by the average of all linkages.

Table 20.17 Normalised forward and backward linkages

		Agricul-ture	Manufac-turing	Construc-tion	Trade, trans.and comm.	Finance and business service	Other services
		1	2	3	4	5	6
Backward linkages	(1)	1.0899	1.0914	1.0908	0.9963	0.9130	0.8186
Forward linkages	(2)	1.1437	0.9471	0.9213	1.0487	1.2294	0.7099
Total	(3)	2.2336	2.0384	2.0121	2.0450	2.1424	1.5285

20.117 For a key sector we expect that $NBL > 1$ and $NFL > 1$. A sector with strong backward linkages is classified with $NBL > 1$ and $NFL < 1$. A sector with strong forward linkages reports $NBL < 1$ and $NFL > 1$. A non-key sector has values below unity for both $NBL < 1$ and $NFL < 1$.

20.118 Table 20.17 shows that agriculture is a key sector with $NBL = 1.0899$ and $NFL = 1.1437$. Manufacturing is a sector with strong backward linkages with $NBL = 1.0914$ and $NFL = 0.9471$. Business services is a sector with strong forward linkages with $NBL = 0.9130$ and $NFL = 1.2294$. Other services is a non-key sector with $NBL = 0.8186$ and $NFL = 0.7099$.

Chapter 21. Examples of compilation practices

A. Introduction

21.1 This Handbook provides guidelines towards best compilation practice for SUTs and IOTs, and, when not feasible or possible, recognises the use of possible alternatives. In general, while the guidelines provided in Part A and B of this Handbook should be the target, it is recognized that countries may have to use alternative approaches when establishing a SUTs and IOTs system in line with the recommendations presented in this Handbook. The alternatives may be less optimal but more achievable given, for example, a country's limited resources, lack of a business register, lack of data, etc. In some cases, the alternatives may be more suitable for smaller countries, for example, or countries at the early stages of statistical development with limited resource or statistical information.

21.2 Country practices and statistical circumstances vary greatly across the world. These are often driven by structural differences, which can in turn influence, or even limit, the direction and development of social and economic statistics. They include, for example:

- the legal framework (for example, different administrative/statistical laws, different ways businesses may be set up, managed and recorded, and the importance of the informal economy);
- the political environment (for example, different economic situations and resources for official statistics, and different uses/demands for statistics);
- the regional/administrative set up (for example, states, provinces, federal set-up's, etc.); and
- the taxation system (for example, different policies, different types of taxes, access to administrative data, etc.).

21.3 Over the past 60 or so years, since the first BPM in 1948 and SNA in 1953, huge strides have been made to improve comparability and harmonization of economic statistics and National Accounts across countries. This has been achieved, firstly by developing international standards for the compilation of these accounts, and secondly by helping countries continually developing the coverage, accuracy, quality and timeliness of the national, industrial and regional statistics produced in line with the international standards.

21.4 Thus countries continuously improve their statistical infrastructure, registers, surveys, methodologies, etc. These improvements in turn also generate revisions to various key microeconomic and macroeconomic statistics. These revisions albeit sometimes inconvenient, for example to users, they should be welcomed and viewed as improvements to quality and comparability. The development of the SUTs framework to underpin GNI and GDP also provides a source of revision when confronting data from different sources and balanced through such a framework, and provide a coherent and consistent base.

21.5 This Chapter provides some guidance for countries with limited resources for statistics. Examples of the compilation practices from different regions in the world are provided. They illustrate a common theme of continual change and improvement of the National Accounts and SUTs and related statistics. They show how countries have addressed challenges and how they followed different paths of development to the present day situation. Section B provides some basic considerations on the compilation of National Accounts that are particularly important also for the compilation of SUTs. The importance of good quality basic economic statistics, the availability of business registers and measurements of the non-observed economy are some of the aspects that affect the quality of the National Accounts and SUTs. Examples of the development of the National Accounts vis a vis that of SUTs are presented for Malawi, the Czech Republic and Chile in Section D, E and F respectively.

B. Basic considerations for the compilation of National Accounts and SUTs

21.6 The 2008 SNA and BPM 6 are the latest statistical standards for the compilation of the National Accounts and Balance of Payments respectively. Since the compilation of SUTs forms an integral part of the compilation of National Accounts (it relies, for example, on the same data sources, conceptual framework, etc.) some general considerations on the compilation of National Accounts are presented below. In general, the implementation of 2008 SNA is a challenge to varying degrees reflecting the need for resources, methods, new systems and new or more detailed data.

21.7 The NSOs are usually responsible for the National Accounts but in some countries, the National Accounts compilation (and more so, the Balance of Payments) is the responsibility of the NCBs (even though, in some countries, this role has changed over the years whereby, for example, the Balance of Payments shifted from the NCBs to the NSO as it happened, for example, in Finland in 2014).

21.8 The quality of National Accounts and also SUTs depends greatly on the methodology used, data quality and coverage, timeliness of their compilation and their compliance with international standards. The following elements will have a significant impact on the level of available details:

- adoption of international industrial, product and functional classifications;
- availability and quality of current price source data;
- availability of prices for deflation;
- benchmarking using comprehensive sources (annual benchmarking as opposed to 5-yearly benchmarking or longer is preferred);
- staff resources, time schedules for production and publication; and
- system infrastructure.

21.9 Several countries with less developed statistical systems are using SUTs as an integral part of the compilation of the final or benchmarked annual National Accounts in current prices. Such countries might only be able to follow the production approach and the expenditure approach, while the income approach might be difficult. The income approach requires data for wages, salaries, taxes and subsidies on production and also consumption of fixed capital.

21.10 A number of countries used to complete the SUTs after the final National Accounts aggregates are published. However, this is now changing in many cases to a situation whereby compilation of SUTs is used to set some of the National Accounts aggregates.

21.11 The compilation of National Accounts requires good knowledge about the country's economy, special training in the National Accounts compilation, methodology, and also knowledge about the coverage and quality of the different economic statistics and administrative data.

21.12 The National Accounts estimates rely on a large number of economic statistics compiled by various stakeholders such as NSOs, the NCBs and by several different Ministries and Government Departments including the Finance Ministry.

21.13 It is important to have a solid base of economic statistics for the compilation of National Accounts so that differences in economic growth can be attributed to the actual changes in the economy rather than to poor and insufficient basic economic statistics which do not have a good coverage or are based on some broad assumptions. For example, the inclusion or exclusion of the non-observed economy and its measurement is a serious problem for the comparability between National Accounts and GDP across countries and across time.

21.14 Better measurement of the informal sector is a key issue for national accountants especially in countries with a large informal sector. Issues that affect the measurements of the informal sector include, for example, the imputation of the GVA of production of crops and livestock for own consumption, the estimation of the GVA of own construction of dwellings or farm buildings; or the imputation of rentals for owner-occupied dwellings. In the cases when these calculations are not done, the GDP may be under-estimated compared with countries that follow the 2008 SNA recommendations.

21.15 The adoption of the 2008 SNA provides countries with the opportunity to thoroughly review the sources and methods underlying the collection and compilation of their National Accounts. Efforts to improve coverage and quality have generated large revisions in the National Accounts of several countries. This is inevitable and should be welcomed and managed through an effective communication strategy.

21.16 The SNA require imputations for various types of non-monetary production, and these are particularly important in developing countries. These include both stricter adherence to SNA guidelines and, in particular, the adoption of a regular program of surveys of households, enterprises, and agriculture.

1. Statistical business register and administrative registers

21.17 The sample frame for the main statistical surveys should be determined by a census or a business register. A comprehensive high-quality statistical business register regularly updated and maintained in the NSO, alongside the statistical unit, should be one of the most important instruments of the statistical system.

21.18 The business register should in principle cover all formal producing units operating in the economy, listing names, addresses, ownership, links to other parts of the enterprise/enterprise group, and some key variables like employment and turnover. However, in many countries the business register may have insufficient coverage or may be out of date.

21.19 The business register might include enterprises that no longer exist and/or not include new enterprises; changes such as mergers or splits of enterprises may not be included; or the register may contain incorrect information about types of economic activity, enterprise size or address, etc. Enterprises may not be recorded or be missing from data sources due to statistical reasons. These situations will occur with high rates of enterprise turnover (for example, economic slowdowns and upturns) and/or many new industries (for example, reflecting new products). Industrial production is rising sharply in many developing countries will also lead to many new start-up businesses.

21.20 Regular updates of the statistical business register for conducting economic surveys should have high priority. Administrative registers (for example, tax and VAT registers) should be key sources used for updating the statistical business register. Resources are also required to plan and complete the moves onto any new or revised classifications, for example the introduction of ISIC Rev. 4 used in the business register and for the economic statistics.

2. Data sources for compilation of National Accounts and SUTs

21.21 Countries should develop a sustainable system for regular collection of economic data required for the compilation of National Accounts and SUTs. Administrative data should also be used as a key data source. Delays, statistical errors and incomplete statistical data, may require time consuming estimation of the National Accounts estimates. Several versions of preliminary and corrected data from statistical surveys will also require corrections of the input data for National Accounts and re-balancing of the National Accounts leading to revisions. These in turn need to be managed with suppliers and users. An established revision policy will provide transparency, help planning schedules and provide rationale for revisions and planning.

21.22 Specific ministries such as agriculture, health and education will often have statistical services and a range of detailed data covering their areas of policy. A formal service-level agreement or memorandum of understanding between the NSO, Government Departments, Central Bank and other non-NSO suppliers compiling statistics is sometimes necessary to align the interests and supply of data required.

21.23 Chapter 4 of this Handbook covers the need for National Accounts/SUTs compilers to analyse and develop the following types of data sources for the compilation of SUTs/IOTs:

- Statistical domains usually the responsibility of the NSO:
  - Agriculture census.
  - Crop surveys and livestock censuses.
  - Fisheries statistics.
  - Economic surveys for large enterprises or from a sample of enterprises.
  - Annual survey for non-profit institutions or for a sample of the non-profit institutions.
  - Energy statistics.
  - Labour force survey.
  - External trade statistics with value and quantity data for imports and exports of goods.
  - Integrated Household Surveys.
  - Consumer price indices.
  - Population Census and Housing Census.
- Administrative data often sourced from other departments:

- Agriculture, fishing, forestry statistics from different ministries.
- Banking statistics and statistics for other financial institutions from the NCB.
- Balance of payments data from the NCB.
- Insurance accounts from Insurance industry regulators.
- Government audited accounts and Budget Documents with expenditures split between individual consumption and collective consumption categories.
- VAT paid data, and if recorded, VAT turnover, by industry (and by product where differential rates exist) from tax collecting departments.

(a) Economic surveys for large enterprises or for a sample of enterprises

21.24 Economic enterprise surveys as required for the compilation of SUTs need to collect information on output by products, intermediate consumption by product, components of GVA and employment as well as explore the fixed and financial assets and liabilities and the categories of GFCF.

21.25 The collection of data at the establishment level could be challenging. The statistical data source therefore may have to be based on enterprises that publish their financial accounts or are covered in an enterprise survey. It is easier to collect reliable figures on output from financial accounts of the enterprises but in some cases the output is valued at producers' prices rather than at basic prices which is the valuation concept in SNA

21.26 The enterprise surveys is the major source for estimating the input cost structures of industries by products but enterprise surveys based on the fiscal data usually provide aggregated data for intermediate consumption with no detail breakdown of the cost structure. Special cost structure surveys for all industries should be compiled annually or, at least, for the base years. These surveys are an important source for compiling intermediate consumption by industry for the National Accounts underpinning the production approach. However, in general they can be very costly.

21.27 GFCF by enterprises should also be derived from the enterprise survey and provide information about buildings, transport equipment, machinery, software, etc. Many countries are already including as GFCF on computer software by producers, mineral exploration and government expenditure on military durable goods other than weapons.

21.28 The product classification used for economic statistics should follow the CPC, and the industry classification in accordance with the ISIC. The industry and product classifications used for National Accounts and SUTs should always be aligned with the latest version of each classification.

(b) External trade data

21.29 External trade statistics with detailed data for imports and exports of goods and services are of great importance for the compilation of SUTs and IOTs in all countries. Different data processing and database management systems are used for trade statistics and more information is provided in the compilers manual for international merchandise trade statistics (United Nations, 2016). Eurostat, for example, has developed the 'Eurotrace' software package which is used in many developing countries to manage data for external trade statistics for goods. The 'Eurotrace' software allows: (a) the import and management of the data necessary to the development of the external trade statistics (in particular the customs data); (b) the treatment of these data, in particular through carrying out quality controls and the application of standards; (c) the calculation of a certain number of aggregates, in particular indices of Foreign Trade; and (d) their export for dissemination and publication. For further details, see https://circabc.europa.eu/webdav/CircaBC/ESTAT/eurotracegroup/Information/en/index.html

21.30 In small economies data from imports with detailed specification of goods such as transport equipment and machinery, also forms a reliable data source for deciding large part of the GFCF data by product and by type. The balance of payments data should provide a data source for import and export of services.

3. The "non-observed" economy

21.31 The term "non-observed" economy is used to describe activities that, for one reason or another, are not captured in regular statistical questionnaires. The reason may be that the activity is informal and thus escapes the attention of surveys geared to formal activities; it may be that the producer is anxious to conceal a legal activity, or it may be that the activity is illegal. (2008 SNA paragraph 6.39).

21.32 The following activities should be recorded within the production boundary in the National Accounts: underground activities, informal activities, including production of households for their own final use, illegal and other activities omitted due to deficiencies in the basic data collection programme. Several small enterprises are often omitted due to deficiencies in the basic data collection program.

21.33 Although services produced for own consumption within households fall outside the boundary of production used in the SNA, it is nevertheless useful to give further guidance with respect to the treatment of certain kinds of household activities which may be particularly important in some developing countries. The SNA includes the production of all goods within the production boundary. The 2008 SNA, paragraph 6.32, provides a list of types of production by households that are included whether intended for own final consumption or not. The list covers, for example: the production of agricultural products and their subsequent storage; the gathering of berries or other uncultivated crops; forestry; wood-cutting and the collection of firewood; hunting and fishing; other kinds of processing such as weaving cloth; and dress making and tailoring; the production of footwear.

21.34 Data obtained through household budget/expenditure surveys on household consumption from own sources should be used to estimate production of agricultural commodities for own consumption and the use of firewood gathering from the use side.

21.35 Other activities that are within the production boundary of the SNA but often difficult to measure are: own-account production of housing services by owner-occupiers; own-account construction, including that by households; production of domestic and personal services by employing paid domestic staff; and illegal activities.

21.36 The value of housing services should be included in GDP regardless of whether these are explicitly purchased in the form of rentals paid to the owner or "paid" by homeowners to themselves. The SNA suggests that rentals should be imputed for owner-occupiers using rentals actually paid for similar dwellings. Dwellings in rural areas are often constructed by their owners using locally available materials and are almost never rented out. When no actual rentals are available, the NSO might ask the owners to estimate what they think they would have to pay to rent their dwelling or, alternatively, what they would charge in rent for someone else to live in it. When properly measured, total rentals for dwellings (both actual and imputed) account for significant amounts, for example, at least five per cent of GDP in low-income countries, while in richer countries the percentage is often twice that level. In regions where most people are owner-occupiers, the omission of imputed rentals means that GDP is likely to be under-estimated.

4. SUTs being populated using a simplified approach

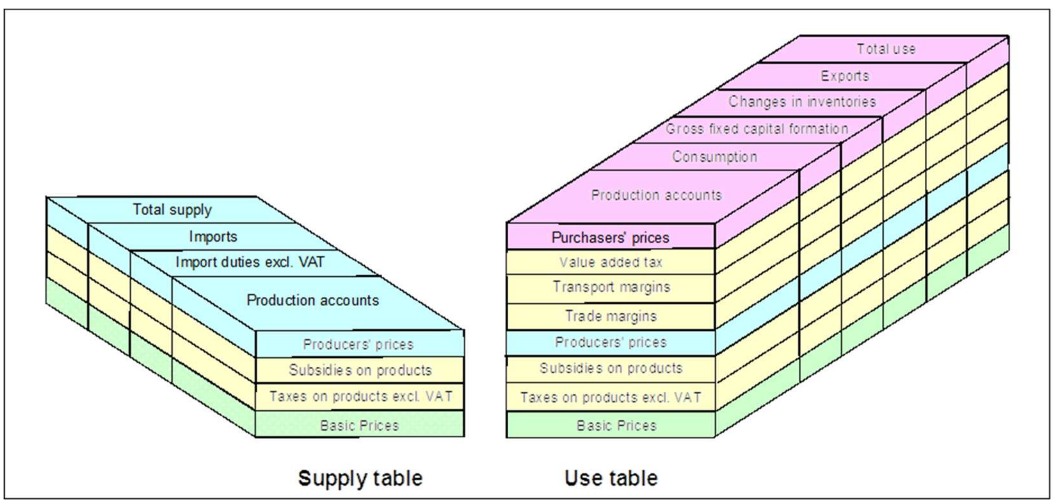
21.37 For the compilation of the National Accounts and SUTs, the industry and product classifications used should be consistent with the international standard classifications such as ISIC and CPC. Of course, the level of detailed shown in the tables should be chosen taking into accounts its relevance for the country's economy among other things.

21.38 In general, the classification of products should be more detailed than the classification of industries thus generating rectangular SUTs. Detailed specification of products is important to be able to allocate VAT, trade and transport margins and, for example, product taxes on petrol and product subsidies on seeds and fertiliser.

21.39 The compilation of SUTs in countries with limited statistical resources can follow a simplified sequence of five steps when the full suite of recommendations presented in this Handbook cannot be implemented in the short term. These steps are described below and provide a simplified temporary alternative until a proper system is put in place.

21.40 Table 21.1 provides an overview linking the Supply Table and the Use Table using the product (also known as commodity) flow approach.

Figure 21.1: Illustration of a data base for product-flow method used in smaller countries (note, role of producers' prices)



21.41 The recommended valuation(s) for balancing should be struck at either basic prices or purchasers' prices. However, although not ideal or recommended, some countries may have to apply the identities at producers' prices or at purchasers' prices exclusive of VAT with the estimates valued on a consistent basis in the Supply Table and Use Table. These identities still hold at producers' prices, for example:

Total supply at producers' prices *equals* Total use at producers' prices

21.42 **Step 1**. The Supply Table at basic prices classified by appropriate industry codes and products codes is first put together. In cases where the data are at producers' prices, an additional step is needed to move to basic prices for compiling SUTs in volume terms.

21.43 Other components by industry and product as appropriate should be shown for:

- Market producers.
- Production for own final use.
- Non-market producers - General government.
- Non-market producers – NPISHs.
- Imports of goods, CIF and custom duty.
- Import of services.

21.44 **Step 2**. The Use Table at purchasers' prices classified by appropriate industry codes and products codes is put together. The Use Table at purchasers' prices should specify:

- Intermediate Use of products (at purchasers' prices):
  - Market producers.
  - Production for own final use – no VAT, trade or transport margins.
  - Non-market producers - General government.
  - Non-market producers – NPISHs.
- Final consumption (at purchasers' prices):
  - Final consumption expenditure by households, using COICOP classification.
  - Final consumption expenditure of NPISHs, using COPNI classification.
  - Final consumption expenditure, individual consumption and collective consumption, using COFOG classification.
  - Capital formation by type of industry and product.
  - Exports of goods and services.

21.45 **Step 3**. The Use Table at purchasers' prices is corrected to basic prices (or if not feasible, then producers' prices, if relevant to link with the Supply Table) by re-allocating non-deductible VAT, trade and transport margins.

21.46 Non-deductible VAT could be relevant for intermediate consumption (although all non-observed/informal producers will have to pay non-deductible VAT on their intermediate consumption) for non-market producers and other exempted activities. Exports of goods are usually zero-rated for VAT purposes.

21.47 Trade margins have to be estimated for different types of goods and will vary depending on the receiver of the goods. Transport charges invoiced separately by the producer will vary depending on the receiver of the goods.

21.48 The first estimated values of non-refundable VAT, trade and transport margins have to be deducted from purchasers' prices to compile the Use Table at producers' prices and later at basic prices.

21.49 **Step 4**. Confrontation of data sources - balancing the Supply Table and Use Table at producers' prices (as opposed to the recommended valuation basic prices and/or purchasers' prices).

21.50 In many countries with a less developed statistical system, the compilation and balancing of the National Accounts implies that the National Accounts staff are controlling, correcting and balancing the data and, in some cases, even heavily involved in the collection of data. The SUTs framework enables an efficient and consistent confrontation of all the primary data sources. The identity between resources and uses of products requires product flows to be compiled or estimated.

21.51 The "**product flow**" method is an approach used in National Accounts in several countries, for example, where detailed information of the input structure of industries is missing or incomplete. It might be collected data from businesses on outputs but data on inputs for producing those outputs may be difficult to collect. Changes in inventories will be calculated by the "product flow" method as the difference between supply and use of each product at producers' prices, determined as a residual variable allocated to change in inventories. Using a manual procedure the residuals have to be corrected to an acceptable level. Based on judgement, the compilers should balance the accounts by adjusting selected components based on criteria like quality, coverage, etc. Change of inventories for services have to be corrected on the supply or the use side and eliminated.

21.52 **Step 5**. When the Supply Table and the Use Table have been corrected and balanced at producers' prices, the Use Table will be compiled at purchasers' prices by adding corrected trade and transport margins and non-refundable VAT. The first figures estimated for non-refundable VAT will be re-allocated according to the move of final consumption expenditure, gross capital formation and exports from producers' prices to purchasers' prices. Similarly, some part of the trade and transport margins may also have to be re-allocated. At this stage, the Use Table is valued at purchasers' prices.

21.53 When the first version of the SUTs is established, the following types of checks are important:

- the total figures for production, intermediate consumption, GVA and gross capital formation for the different industries; and
- the total figures for final consumption, product taxes, product subsidies, imports and exports.

21.54 The estimates for household final consumption expenditure at purchasers' prices must be evaluated in relation to the computed figures for trade and transport margins and change in inventories/residuals. Even with annual Household Budget Surveys, small samples and a high degree of non-response might make this important data source unreliable. The results from the Household Budget Surveys have to be evaluated and balanced with other data sources for supply of goods and services. Household surveys often understate final consumption expenditure, especially on services.

21.55 For products where change in inventories cannot be accepted (for example, some service products), the production or use of these products must be changed. The compiler has to use judgement to reach a balance by adjusting the components as necessary. In cases where statistical information is missing, estimates can be made using the product flow approach and SUTs framework. This is a fundamental aspect about producing SUTs in this way, in that it allows the National Accounts to be compiled in a coherent manner even in situations when the source data are incomplete or weak in quality. The “product flow” method also provides a basis for logical substitution of a weak data source, either on the supply side or on the use side.

21.56 **Step 6.** The Supply Table at producers’ prices is transformed to basic prices. The re-allocation of certain taxes on products and subsidies on products allows for the transformation from producers’ prices to basic prices, and thus for the balancing of SUTs also at basic prices.

21.57 With rapidly changing and developing economies, impact of globalization, increasing rate of change of technology and its impact, new products and new industries, etc., it is recommended that the production of new SUTs should reflect an annual benchmarking process. If countries are unable to compile SUTs every year, it is recommended that National Accounts should be benchmarked through the compilation of SUTs, at least every five years.

5. SUTs in volume terms (the ‘double deflation’ approach)

21.58 To obtain GDP in volume terms, the SNA recommends the use of annual chain indices, which implies in effect updating the base year each year. The SUTs provides a framework for compilation and balancing in current prices and in volume terms as well as to provide an overview of transaction data, price indicators and volume indicators interrelated in a systematic way. Deflation using price indices is the preferred method for calculating GDP in volume terms.

21.59 Chapter 9 of this Handbook provides more details and recommended approaches to compile SUTs in previous years’ prices. The approaches presented in this Section do not form recommended approaches but are recognised as accepted temporary alternatives until a proper system is put in place.

21.60 If countries are unable to update SUTs every year and use chain indices, the 2008 SNA recommends that the base year is updated every five years. Many countries, for example, compile SUTs only for the base years.

(a) SUTs as the basis for volume measures of GDP

21.61 The SUTs for the current year should be established with the same format as SUTs for the previous year or an earlier base year. The SUTs in volume terms should be compiled by deflating current price values by price indices or using volume indictors but at the product level. The price indices should match the values being deflated as closely as possible. This results in integrated Paasche price indices and Laspeyres volume indices. Below are examples of deflations for specific categories in the SUTs.

21.62 Supply Table - Price indices for products from domestic output linked to domestic use, at basic prices.

- Price indices for products supplied to domestic users can be based on PPIs, CPIs, unit value price indices or input price calculations.
- Market producers. Where industrial products are important in the economy, the PPI compilation as monthly or quarterly indices for industrial products are required but can be expensive and difficult to organise. CPI should be used for service industries, supplying services to the households but might also be used for identical services to market producers. CPI has to be corrected for change in VAT rates from the base year. Unit value indices are acceptable price indices for homogeneous products as agricultural, forestry and fishing products and also mining products.

- Production for own final use. If agricultural, forestry and fishery products for own consumption are important, these products should have a products code different from the products sold to the market because no trade margins and VAT are charged on own final consumption. The CPI adjusted for change in the VAT rate can be used for products for own consumption.

- Non-market producers (general government and NPISHs). Production for general government and NPISHs in current prices is compiled by summing up intermediate consumption, compensation of employees, consumption of fixed capital and taxes less subsidies on production. The compilation in volume terms is conducted from the input side and applies to all components of the sum of costs. Input price indices should be calculated using the Paasche formula for each non-market producer, weighting the price indices for intermediate consumption and a wage index for compensation of employees. The wage index should be adjusted for changes in quality of the labour force (using type of job and educational background of the employees).

21.63 Supply Table - Price indices for products from imports (CIF value), at basic prices.

- Unit value price indices for similar groups of products from foreign trade customs declarations.

21.64 Use Table - Price indices for products to exports (FOB value), at purchasers' prices.

- Unit value price indices for similar group of products from foreign trade customs declaration. CPIs for domestic services as estimates of prices for export of domestic services.

21.65 Use Table - Volume estimates for products for domestic use at basic prices are covered in later in this Section.

(b) The compilation process - A simplified methodology

21.66 A simplified methodology for the compilation of SUTs in volume terms is presented below.

21.67 **First step**. Use Table - products for export at purchasers' prices are deflated with unit value price indices and consumer price indices for services.

21.68 **Second step**. Use Table - products for export at basic prices in volume terms are calculated by deducting VAT, trade and transport margins and taxes on products from exports at purchasers' prices and adding product subsidies (if relevant), all compiled in previous years' prices (or a base year price). VAT, trade and transport margins and product taxes, subsidies are estimated in volume terms at detailed product level by applying rates of the respective tax, trade and transport margins from the previous year (or the base year).

21.69 **Third step**. Supply Table - production for own final use and also other products will only go to the domestic market in all countries. For products supplied both to the domestic market and to exports, one combined price index should be used to deflate domestic supply of the products at basic price values. To form the price index for total domestic supply of one of these products, the price index should be compiled as a weighted average of the price index for export of the product, calculated at basic prices and the price index for domestic production of the same product supplied to domestic users, also at basic prices. The combined index for a product is used to deflate domestic supply of that product from the various industries.

21.70 If no price indices are accessible for some products to the domestic market, the export price index might be used if the major part of the product is exported, for example, coffee, tobacco, minerals or oil.

(c) Balancing between the Supply Table and the Use Table in volume terms

21.71 The balancing of the Supply Table and the Use Table in volume terms is first carried out at the detailed product level at basic prices. The balancing for different parts of the SUTs are described below.

21.72 Balancing of products for domestic use at basic prices:

- For each product, volume estimates for the total domestic use could be calculated as total domestic supply plus imports minus exports, all in volume terms.
- For each product, volume estimates for the various domestic uses of the product could be calculated by distributing total domestic use of the product in volume terms proportionally with the domestic uses in current prices.
- In volume terms, the supply and use of each product is balanced at basic prices.

21.73 Balancing of domestic use at purchasers' prices:

- For domestic use, taxes and subsidies on products, trade and transport margins and VAT in volume terms have to be calculated, specified by products and users, as a supplement to the basic prices in order to arrive at the purchasers' prices in volume terms. Tax rates and trade margins from the previous year (or base year) are used.

21.74 CPIs for household final consumption expenditure:

- Household final consumption expenditure is the only area, except for exports, where price indices could be used for deflating purchasers' prices directly. The deflated figures for goods and services supplied for Household final consumption expenditure could be adjusted to reflect the change in the CPI for the products in question.

21.75 Checking GVA in volume terms:

- GVA in volume terms is calculated as the difference between production at basic prices and intermediate consumption at purchasers' prices. Calculating GVA in volume terms for a given industry using "double deflation" might give negative figures if specification of intermediate consumption or price indices is poor and should be corrected. Relatively small errors may result in an obviously incorrect GVA in volume terms.

6. Documentation of sources and methods of estimation

21.76 When the SUTs are balanced, information in particular on the sources and methods of estimation for each single element of the SUTs would be useful to evaluate and analysing industry and product imbalances. A thorough documentation of the basic data and the methods used, the problems encountered, solutions applied and the results achieved is highly recommended.

21.77 The documentation helps to evaluate the data quality and outline the strategy and prioritization for balancing. In addition, some form of revisions analyses should be produced, and used to identify any underlying biases in the data and/or processes. Documentation of the various compilation steps should point to missing data issues and problems of basic data quality.

21.78 It is important that such findings are utilized as feedbacks to primary statistics as well as informing the development of future strategies and priorities to improve data and collecting data for the relatively weaker areas as well as seeking funding as appropriate.

C. The Effect on GDP of Integrating SUTs in the National Accounts for Malawi

21.79 National Accounts for Malawi (called Nyasaland from 1891 to 1964) was first calculated by Miss Phyllis Deane for the year 1938, and published in "The Measurement of Colonial National Income", Cambridge University Press, 1948.

21.80 During the Federal period, from 1954 to 1963 a set of National Accounts were prepared for Malawi by CSO, Salisbury. Phyllis Deane writes later:

> *"The difficulties in the way of measuring the national income in Africa spring from two main sources. First, the concepts and experience from which the national income estimator usually derives his definitions and methods have for the most part been developed in dealing with advanced industrial economies such as those of the United Kingdom or the United States. How far they are applicable to less advanced economies must be deduced from a series of practical tests. Second, data on which to base estimates are scarce".*

21.81 Following Independence in 1964, the task of preparing National Accounts for Malawi fell on the newly established National Statistical Office (NSO) in Zomba. The first National Accounts Publication for Malawi, covering the years 1964-1970 was released in November 1972, and was followed by five other National Accounts publications. The last of these publications "Malawi National Accounts Report 1990-1994" was published by NSO, Zomba with series starting from 1990, using 1994 as base year.

21.82 The National Accounts for the years up to 2006 were compiled in 1994 prices, with only GDP converted to current price by an aggregated price index composed of consumer price indices and price indices from external trade.

21.83 In June 2003, an Institutional Co-operation Project between Statistics Norway and the National Statistical Office of Malawi and the Ministry of Finance and Development Planning of Malawi was established and funded by the Government of the Kingdom of Norway. Statistics Norway provided technical advice and training to the National Statistical Office of Malawi on how to build a National Accounts system as a basis for economic and social policy planning.

21.84 In 2004, it was decided to start with the compilation of SUTs compliant with the 1993 SNA. The framework for the first benchmark SUTs was considered carefully. Two of the most important features supporting this framework included the establishment of an ISIC-based industry classification relevant to Malawi, specifying around 100 industries, and a CPC-based product classification, specifying around 350 products.

21.85 The aim was to utilize all economic statistics and relevant administrative data available in Malawi. Important food products in the Malawian economy were specified, also with a split between products sold to the market and products for own use. Products like food aid were also given special codes. The list of products was also relevant and manageable for compiling price indices or quantity indices. A link between the product classification and the HS used in the import and export statistics was established.

21.86 The SUTs for the year 2002 (and since 2002) mainly relied on Malawi's crop estimates, annual economic surveys covering 300 large enterprises, government accounts and integrated household surveys. For external trade data, the Eurotrace software providing details on imports and exports of goods was used. These details were not used in compiling the SUTs before 2002. The BoP figures covered import and export of services. In addition, as part of the Project, training was provided on how to utilize all available economic statistics in Malawi.

21.87 Excel worksheets are currently used for data input and the final tabulations of the SUTs estimates. A software application, SNA-NT, provided by Statistics Norway allowed to balancing the SUTs in current prices, calculating the SUTs in previous years' prices, and also deriving Industry by Industry IOTs. Balancing the different data sources in a systematic and well documented framework has provided important quality checks, and has also produced improved estimates for the informal economy in the National Accounts for Malawi.

21.88 In March 2007, Malawi released revised National Accounts estimates for the years 2002-2004 and preliminary aggregate figures for the years 2005 and 2006. Comparisons between the old and new estimates showed GDP in current prices had been revised upwardly by 38.0 per cent in 2004 and by 37.4 and 37.7 per cent in the two subsequent years. The main reasons for this revision were the introduction of better quality estimates for small and medium-sized businesses, and new data on NPISHs.

21.89 The Malawi National Accounts Report 2002-2005 (http://www.nso.malawi.net/) gives details on the concepts, sources, and methods used.

21.90 During 2009-2013, a further revision of the National Accounts for Malawi for previous years 2002-2010 started. The classification system was being updated so to conform to ISIC Revision 4 and CPC Revision 2. Some core aspects of the 2008 SNA were also being introduced. Relevant new data sources were analysed and used:

- Revised previous Annual Economic Surveys and improved Annual Economic Surveys from 2008;
- New survey for small and medium-sized enterprises and for NPISHs;
- National Census of Agriculture and Livestock for 2007;
- Third Integrated Household Survey for the year 2010;
- 2008 Population and Housing Census;
- Better estimate for the contribution of forestry by capturing the extensive use of wood for fuel.

21.91 The annual SUTs for the years 2002-2007 are revised at an aggregated level to establish comparable time series for the whole period 2002-2010. The annual SUTs at basic prices for the years 2002-2010 is converted to Industry by Industry IOTs. The methodology for transformation to IOTs is based on the main assumption that each of the detailed products has its own specific sales structure, 'the fixed product sales structure'.

Frequency of compilation of SUTs

21.92 Compiling detailed annual SUTs every year is in a general a challenging task which require careful planning and appropriate resources. Even though the benefits of compiling SUTs as a regular component of the annual National Accounts was recognized, after careful considerations it was decided that, given the limited resources in the NSO and users' needs in the country, the compilation of annual SUTs was not a technically, financially, or sustainable approach for the NSO in the country. It was decided that, for the time being, SUTs would be compiled instead only for benchmark years which are around every five years.

21.93 Main users of the National Accounts data, like the Reserve Bank are more interested in preliminary estimates of national accounts and quarterly data rather than the final annual estimates which are published with a lag of more than two years.

A twinning project between Malawian institutions: the Ministry of Development, Planning and Cooperation and the National Statistical Office

21.94 The SUTs offers a flexible approach to compile Industry by Industry IOTs in current prices and in volume terms. The twinning project aimed at building a macroeconomic model to assist the Government in macroeconomic planning and management. The close link between the two projects made the transition from a simple aggregated model to a more complex and disaggregated model easier. Apart from providing new insight into the economy, it also created a close link between the model builders and users and the producers of the statistical inputs to the model. This, in effect, acts as a quality assurance system bringing along important feedbacks to further improve the statistics. Once the disaggregated model was implemented it became apparent that the new methodology was a huge improvement.

21.95 Choosing the type of model to build clearly depends upon for what it is going to be used. Malawi has a long history of undergoing IMF programs, one of the design criteria to make it useful was to be able to analyse such programs. Another criterion was for the model to be useful in formulating the national budgets, an area in which it has already proved helpful, for example, estimating the fiscal position and any related financing needs, and to keep track of the revenue effects from tax policies.

21.96 The debate whether to go for large scale models or to keep them small and simple is a recurrent theme. When the model project was on the drawing-board, a 'large' model was adopted due to the fact that there was a need for IOTs to form the core of the model.

21.97 The IOTs derived from the SUTs were used to create the core of the macroeconomic model. Furthermore, the IOTs for 2002-2010 made up the bulk of the data for the model. For each year, the IOTs in current and previous years' prices were used to create constant price value time series by chain-linking. The I-O coefficients used in the model were estimated from the latest version of the IOTs which also defined the base year of the model's dataset.

21.98 The data in the SUTs was aggregated into 26 domestic industries, of which, 15 industries import goods and services. Also defined were the prices of intermediate inputs and all the 35 final use components. One particular useful design was the separation of household's production for own use and what was sold to the market.

D. Development of the application of the I-O framework in the Czech Republic

21.99 The Czech Republic became an independent state in 1993 following the dissolution of Czechoslovakia. Economic statistics including I-O accounts had a long tradition starting in the 1950s linked with economic planning, and controlling the fulfilment of the plan to providing statistical information to the public.

21.100 From 1969, the Czechoslovakian Statistics were organised by three main agencies: the Federal Statistical Office which represented the most important part aimed at coordination and creation of methodology for data surveys; the Slovak Statistical Office and the Czech Statistical Office which served as subsidiaries, mainly aimed at data collection.

21.101 In addition, there were research institutes closely cooperating or working with statistical offices. Czechoslovakia implemented the Soviet Model for macroeconomic statistics that consisted of sets of balances (Balances of National Economy). The most important were Balances of National Income, Balances of Non-productive Sphere and Balances of Capital. These balances were very close to the System of National Accounts in principle although there were different sets of tables (like accounts). The key part of the system devoted to the creation of product was called the Material Product System and it covered production by productive sphere. This very narrow concept of production covered only tangible products (goods) and selected services. The MPS also covered IOTs.

21.102 In line with Marx theories, socialist measurement of economy was based on the division of economy into productive and non-productive activities and this was applied on both national income measurement and IOTs. This implied IOTs compiled in socialist countries were not comparable with the practice in the Western countries. Box 21.1 provides details on the evolution of the MPS and the Phare Projects in all the new EU countries through to the development of SUTs.

21.103 The first IOTs were compiled for Czechoslovakia for 1962 (using 96 products) and a lot of research work preceded the compilation of these tables. Since then the IOTs were produced roughly five-yearly (1967, 1973, 1977, 1982 and 1987). The first tables for the Czech Republic were compiled for 1973 (using 89 products) and subsequently in 1977, 1982 and 1987.

Box 21.1 Material Product System and Phare Projects

After the Russian Revolution, the official National Accounts for the USSR from the 1920s were based on the Marxist's production concept, later known as the Material Product System (MPS). From the 1950s, other centrally planned countries also followed by using the MPS for their National Accounts.

The MPS 1969 version was published in Russian in 1970, and became the official statistical standard for measurement of economic performance for the centrally planned countries.

From 1971, the UN accepted that these countries used the MPS 1969 for their reporting to UN, while much of the remaining world tended to use the UN System of National Accounts (1968 SNA).

The major conceptual difference between the MPS 1969 and the 1968 SNA covered the production boundary, which was confined to only 'material' production in the MPS 1969. For example, the services of owner-occupied dwellings and government health care, education and defence were not regarded as production. However, the MPS 1969 already included concepts such as actual consumption (total consumption of the population), first included in SNA from 1993 SNA. Some of these countries compiled IOTs between 1960 and 1989 following the methodological principles of MPS - the basic indicator in this system was 'Net Material Product'. Some countries used both MPS and 1968 SNA in parallel.

In 1989, the European Commission started so-called Phare Projects, with the aim of improving official statistics in Phare Candidate Countries (at that time, comprising Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). A number of Phare Projects have been undertaken for the implementation of ESA 1995 (Eurostat, 1996) (consistent with the 1993 SNA) in these countries. The majority of the new EU 12 countries had experience with compiling IOTs following the methodological principles of MPS. Difficulties for many countries during their transition period were to introduce new concepts in surveys, establishing new data sources, especially for the service sector activities and change the classifications used, for example to ISIC, then later to NACE. However, some countries such as Slovenia, had already experiences with compilation of IOTs according to 1968 SNA (IOTs for Slovenia according to 1968 SNA were compiled for years 1990, 1992 and 1993).

In accordance with ESA 1995, later ESA 2010, all EEA/EU countries are obliged to prepare SUTs and IOTs. The first SUTs/IOTs for some of the countries in transition were published in the second half of the 1990s. Major challenges relating to the compilation of SUTs for many of the new EU 12 countries have included:

- New price and volume measures as price statistics had not been part of their statistical practice.
- Calculation of consumption of fixed capital for all industries using the Perpetual Inventory Model (PIM) approach.
- FISIM allocation by the consuming industries and final uses.

Several of these countries are now compiling the SUTs as an integral part of the compilation of final or benchmarked Annual National Accounts in current prices, and as the framework for balancing National Accounts and compiling National Accounts aggregates. In 2006, the Norwegian Statistical Office signed contracts with three Eastern European countries to allow them to use their software. One of the institutions, the Czech Republic Statistical Office (CZSO) used the Norwegian software to implement commodity flow for balancing SUTs combined with their own Excel based routines, and continue to develop their systems and processes. In 2009, Statistics Norway also provided Slovakia the right to use software.

All the EU countries are now compiling SUTs in current prices. However, only around half the EU countries are compiling annual SUTs in previous years' prices, these include some of the former Phare Candidate Countries such as the Czech Republic, Slovakia, Hungary and Slovenia. Countries such as the Czech Republic, Hungary and Slovenia are now also compiling IOTs in current prices (five-yearly), and the Czech Republic is also among the few EU countries producing IOTs in previous years' prices. For some countries, the present day position has also reflected the change to the compilation process of producing SUTs before IOTs as opposed to IOTs only.

21.104 National Accounts were introduced in Czechoslovakia with the transformation of the country after 1990. Originally proposed ideas on the combination of the Balances of National Economy and the System of National Accounts were abandoned. During the preparation for transformation of macroeconomic statistics, Czechoslovakia was divided into the Czech Republic and the Slovak Republic. The first National Accounts were compiled for the Czech Republic for 1992 in 1995. The division of the country also meant the closure of the Federal Statistical Office. Some skilled experts moved to the CZSO but many left to join private companies.

21.105 The first Czech Republic National Accounts contained both institutional sector accounts and SUTs at purchasers' prices based on 1993 SNA/ESA 1995 concepts. The 1968 SNA was never implemented in Czechoslovakia except GDP estimates compiled within the international comparison programme organised by the UN. The progress in the compilation of National Accounts during the 1990s were driven by the most demanded aspects like improvements in institutional sector accounts, construction of financial accounts, and subsequently, construction of balances of non-financial assets. SUTs were not often compiled - finished for 1995 and 1997.

21.106 Before entry into the EU in 2004, a major revision of the Czech Republic National Accounts was undertaken. This revision included time series of both institutional sector accounts and SUTs for 1995-2003 and ensured the full consistency between institutional sector accounts and SUTs. Since then SUTs have become a standard tool for balancing and deflation in the annual National Accounts and IOTs compiled every five years.

21.107 Currently, the Czech Republic National Accounts have two parts:

- Institutional sector accounts describing the creation, distribution and redistribution of values (including balance sheets); and
- SUTs and IOTs describing technical links and the process of production.

21.108 The SUTs are now compiled annually with three vintages: t+9 months (preliminary), t+15 months (semi-definitive) and t+27 months (definitive). These tables serve the statistical office as well as other users - their main purpose is to find equality between resources and uses on both product level and on aggregates. These tables are automatically deflated into previous years' prices and resulting GDP deflators and volumes derived. Up to now, quarterly SUTs are not compiled but the structures from annual SUTs (industrial weights) are used to produce quarterly GDP estimates.

21.109 The SUTs provide the main tool for the analysis of compiled figures and the balancing adjustments are also taken into the institutional sector accounts, balances of fixed assets and inventories. Balancing equality is found between two completely independent approaches to measuring GDP - production and expenditure. Balancing is organised as a team of seven staff with clear roles and responsibilities for specific products and industries. All members of the balancing team record balancing adjustments following balancing protocols. This implies the CZSO is transparent in its processes and able to describe how consistency is achieved.

21.110 The core of the Czech Republic I-O system is represented by annual SUTs compiled at the 2-digit level of CPA and NACE, consistent with CPC and ISIC respectively.

21.111 Appropriate IT systems were evaluated for SUTs and IOTs before it was decided to construct an internal bespoke system using spreadsheets. In 2006, the CZSO implemented the Norwegian database system, SNA-NT. In both systems (Norwegian and Czech Republic), all valuation sets are simultaneously balanced -

purchasers' prices, VAT, trade margins, transport margins, subsidies on products, taxes on products and basic prices. The Use Table at basic prices is further split between domestically produced products and imported products. All sets of data are important for deflation purposes.

21.112 While the spreadsheet based Czech Republic system had about 89 products, the SNA-NT for Czech implementation has more than 1,500 products. The spreadsheet system is still used for preliminary version of SUTs and for major revisions. Balancing of SUTs with a skilled team using the spreadsheet system takes about two weeks. More developed and detailed SNA-NT takes around one and half months.

21.113 The CZSO is also very active in international cooperation. Between 2007 and 2014, the CZSO provided technical assistance to Macedonia for developing National Accounts including the I-O system. The Czech Republic system for SUTs was also introduced in Azerbaijan (2010-2012) and Slovakia (2012-2013). The first aim of the approach is consistency. Even though some minor aspects can be omitted, it is crucial that full consistency between institutional sector accounts (both non-financial and financial accounts) and SUTs. Experience has shown that it seems to be easier and more successful to start with a simplified but complex system rather than to build up fragments or unrelated tables from the SNA framework.

21.114 In September 2011, new series of SUTs and IOTs were published using the new classifications CPA 2008 and NACE Revision 2. The revision of the Czech Republic National Accounts covered all years 1990-2010. The SUTs are compiled for all years and IOTs (both Product by Product and Industry by Industry versions) for years with 0 or 5 in the end.

21.115 Experts from the University of Economics in Prague estimated goods and services for 1970-1989 based on 1993 SNA/ESA 1995 methodology. These estimates were based on MPS figures and the original IOTs for 1973 and 1987. In 2012, the users were provided with long run comparable series of sources and uses of GDP (goods and services) starting in 1970 (in 1971 at previous years' prices). Revisions to the CPA (linked to CPC) and NACE (linked to ISIC) classifications have caused various complications for compilation and for users.

21.116 However, the most difficult situation is connected with the implementation of 2008 SNA/ESA 2010. These new standards are very demanding for both compilers and users, and the beginning of their implementation has been difficult. Nonetheless, the 2008 SNA/ESA 2010 based accounts should be fully implemented in the Czech Republic by September 2014. This revision should cover the whole time series starting in 1990, and later this will be taken back to 1970.

21.117 The 2008 SNA/ESA 2010 approach to foreign trade covering merchanting is to record the goods on the export side (even with negative values) and adoption of the principle of change of ownership affecting processing will cause problems to users. Users of IOTs from research institutes and universities were used to some interpretation of production process, production function and resulting I-O coefficients. The new concept introduced in 2008 SNA/ESA 2010 will be changing these assumptions and issues like factory-less production are getting an increased role. The link between production (output) and intermediate consumption is not so straightforward and it means that the concept of financial flows is preferred to physical production. The difference between the institutional sector accounts' concept of generation of income (who has a profit) is getting closer to production side of national accounts represented by SUTs and IOTs.

E. Continual change, development and improvement in Chile

Background and institutional framework

21.118 The production of IOTs in Chile has historically been linked to the benchmarking of the National Accounts which constitute the most comprehensive estimation for macroeconomic aggregates for the Chilean economy in a given year. The production of IOTs began in the 1960s when the National Accounts were compiled at the Office for National Planning (ODEPLAN). During this period, two IOTs were produced, for the years 1962 and 1977. In 1982, the compilation of National Accounts was transferred to the Central Bank of Chile, where four further benchmarking exercises were carried out along with the corresponding IOTs for the years 1986, 1996, 2003 and 2008. Table 21.1 provides a summary of the historical benchmarks.

Table 21.1 Historical benchmark exercises

	Benchmark year					
	1962	1977	1986	1996	2003	2008
Benchmark SNA	1953	1968	1968/1993	1993	1993	1993/2008*
Breakdown industry/product	54 x 54	68 x 68	75 x 75	73 x 73	73 x 73	111 x 76
Price basis	constant	constant	constant	constant	constant	chain-linking
Compatibilisation basis	SIOT	SIOT	SUT	SUT	SUT	SUT
Valuation (prices)	purchaser	purchaser	purchaser producer basic	purchaser producer basic	purchaser producer basic	purchaser producer basic
Integrated economic accounts	-	-	-	yes	yes	yes

* Recommendation of 2008 started to be implemented.

21.119 Currently, the Chilean Statistical System comprises with two main institutions responsible for the compilation of economic information:

- National Statistical Institute (INE) responsible for producing a wide range of production, sales, consumption, employment and price statistics; and
- Central Bank of Chile (CBC) responsible for the compilation of the National Accounts, Balance of Payments and Monetary statistics.

21.120 The basis of the Chilean National Accounts is moving towards the implementation of 2008 SNA. The estimation of macroeconomic aggregates is organised in separate compilation cycles. Each cycle starts with the definition of a benchmark year which sets the methods and statistical infrastructure for the follow up estimates of the reference year. The cycle ends with the setting of a new benchmark year, at the same time begins with a new cycle on a rolling basis.

21.121 As mentioned above, the benchmarking exercise forms the most detailed estimation of National Accounts. The main objectives are to:

- Revise previous estimates obtained from non-benchmark years (follow up exercises);
- Introduce considerable improvements to the methods and new classifications of industries and products; and

- Gather data for the preparation of IOTs.

21.122 Throughout the compilation cycles, the SUTs have become a key element in the compilation of the Chilean National Accounts and significant efforts have been made to improve the compilation and quality of these tables. These improvements have been undertaken in each of the benchmarking exercises, in particular the most recent exercise, for the year 2008.

The Benchmarking Exercise for 2008

21.123 The benchmarking exercise for 2008 represented a significant improvement for the compilation of Chilean National Accounts. The results were published in December 2011 and included SUTs (176 products and 111 industries) along with IOTs (111 products and 111 industries). The project considered extended information collection and a comprehensive use of the regular sources available for any follow-up year.

21.124 Several innovations were introduced following international recommendations as set in 2008 SNA. The main innovations in terms of sources of information were:

- Redesigned forms for structural economic surveys;
- Inclusion of new relevant sources not available for follow up compilation, such as household budget surveys and agricultural census, among others;
- Execution of specific studies, including agriculture/livestock and forestry, trade margins, and passenger transport; and
- Revised and updated business register.

21.125 Regarding improvements to the methods, a more detailed breakdown of products and industries was used in the SUTs. The benchmarking exercises for 1996 and 2003 were compiled using square SUTs (73 products and 73 industries) whereas the exercise for 2008 applied rectangular SUTs (176 products and 111 industries). In addition, a new method of estimation and allocation of FISIM was implemented and the "user cost" method was introduced for the estimation of dwelling services. Finally, information of software and mining prospection was recorded as GFCF.

21.126 Traditionally, benchmark exercises also provided the fixed base period for estimates in volume terms or constant prices. In line with international recommended practice, volume based estimates using the 2008 benchmark are now compiled using previous years' prices and chain-linking methods for obtaining a consistent time series. Since this method allows keeping up-to-date weights for volume based data, it also represented a significant improvement for the estimates thereafter.

21.127 Since this exercise, the follow up estimates present SUTs in current prices with the same breakdown of industries and products as well as valuation at basic prices, producers' prices and purchasers' prices. Similarly, IOTs will be elaborated and published annually for 111 products and 111 industries. This represents a significant improvement compared with the previous compilation cycle where IOTs were only available for the benchmark years.

Data sources

21.128 The Chilean National Accounts have a wide range of data sources at its disposal in order to compile SUTs.

21.129 The most important sources are annual business surveys and administrative records. The annual business surveys are collected for almost all industries and are conducted mostly by INE. These surveys present mainly information on sales, purchases, employment, compensation of employees, capital expenditures and taxes. In addition to this information, several surveys gather data on products. For example, the manufacturing survey presents two sets of forms to obtain information on purchased and sold products. This information is very useful for the compilation of the detail in the domestic supply part of the Supply Table and the intermediate use part of the Use Table. The annual business surveys used in the Chilean National Accounts are shown in Table 21.2, as well as the institution in charge for the collection and the number of units collected every year.

Table 21.2 Annual business surveys

Industry	Units collected (approximated)	Source
Mining	60	Central Bank of Chile
Fishing	100	Central Bank of Chile
Manufacturing	4,000	National Statistic Institute
Energy	190	Central Bank of Chile
Trade	3,000	National Statistic Institute
Restaurants and hotels	550	National Statistic Institute
Cargo road transportation	500	National Statistic Institute
Other transports	400	Central Bank of Chile
Comunications	90	Central Bank of Chile
Private education	200	Central Bank of Chile
Private health	80	Central Bank of Chile
Business services	2,000	National Statistic Institute
Other services	500	National Statistic Institute

21.130 Administrative records are also used intensively in the compilation of the Chilean National Accounts and they provide a high coverage of statistical units, especially regarding formal activities. A substantial part of the administrative records are derived from the Tax Revenue Service (SII), namely information on VAT, income and wage statements.

21.131 Foreign trade data are mainly obtained from customs records and the Foreign Exchange Regulation Manual from the National Customs Service and the Central Bank of Chile, respectively.

21.132 Table 21.3 shows the main administrative records used in Chilean National Accounts.

Table 21.3 Administrative records

Information	Source
Value Added Tax Income Statements Wages Statements	Internal revenue (SII)
Custom Records	Chilean Custom Services
Fiscal Income Records	National Treasury
Foreign Exchange Regulation Manual	Central Bank of Chile
Budget Statements	National Controller's Office

21.133 INE collects a wide range of monthly surveys and indices that are used less intensively in the compilation of SUTs. These surveys cover mainly mining, manufacturing and utilities covering output and sales, as well as retail trade sales. The surveys of employment and compensation of employees are also used.

21.134 Other regular sources used include the CPI, PPI, companies' balance sheets, financial statements, annual reports and statistical yearbooks of various institutions and industries.

21.135 Information sources that are not available on a monthly or yearly basis are incorporated into National Accounts estimates for every benchmark exercise. These include mainly information from the Household Budget Survey (EPF) collected currently every five years as well as data collected in some specific censuses, such as Agricultural-Livestock-Forestry Census and Fishery and Aquaculture Census.

21.136 For benchmark years, special studies are conducted by the CBC in order to collect specific information of industries not covered appropriately with surveys or administrative records. This is the case of agriculture/livestock, forestry, construction, capture fishery and aquaculture, trade, and passenger road transport. These studies gather information on prices of products, inputs and trade margins.

1. Compilation of SUTs

(a) Industry Production Accounts

21.137 Production accounts are compiled using three methods - censused industry, sampled industry and product method. The choice of the method depends on the available information for each industry. Hence, for industries where complete coverage of units is available, the censused method is chosen. Conversely, if data covers only a sample of the industry, the sample methods is applied. Finally, the product method is considered for industries with no information on companies or establishments but with data on their respective main products and prices.

21.138 The censused industry method consists in estimating the total output, intermediate consumption and GVA by industry (the SUTs column total) at a population level, using data directly from surveys and/or financial statements for all companies. The output, intermediate consumption product breakdown and the components of GVA is obtained mainly from the surveys.

21.139 The sampled industry method estimates total output, intermediate consumption and GVA by industry (the SUTs column total) extrapolating to the population information obtained from a sample of companies or establishments. The population level is obtained mainly from tax records provided by SII. Additionally, economic surveys provide information on the sample of production unit, detailing output product breakdown as well as costs structures, including intermediate consumption and GVA.

21.140 The product method consists in estimating the total supply by product (the SUTs row total) at the population level. It is based on the measurement of value through price and quantity (commodity flow) by using data on supply of products. Once output levels had been obtained, the cost structures are derived based on estimated production functions or economic surveys.

21.141 A special feature of the production accounts compilation is that output is also allocated in an expenditure variable. This estimation is called “supply hypothesis” and it is based on information obtained from the same surveys that are used to produce the industries’ production accounts or, in some cases, derived directly according to the nature of the products. This means that all the supply is classified in accordance with its hypothetical use, either intermediate use or final use. The supply hypothesis will be more robust as the product breakdown in the SUTs increases, this will create easier identification to whether the product is used for household final consumption, capital investment or intermediate consumption.

(b) Imports

21.142 Imports are estimated mainly using data from customs records at the 8-digit level of the harmonised system and are valued at CIF prices along with the import duties. The estimations of imports identifies when they were carried out directly by the user of the good (direct purchases) or by a trade business. In the latter case, trade margins are estimated for imported goods.

21.143 Similar to domestic supply, imports are classified by type of use, namely final consumption, capital investment or intermediate consumption products. This produces the "supply hypothesis" for imported goods and services. This hypothesis is built based on the nature of the good or service. This allocation process carried out at the 8-digit level of the Harmonised System and recognises goods with dual use, for example, destination of imports of vehicle fuel could go to Household final consumption expenditure and/or to the intermediate consumption of the transport industry, among others.

(c) Expenditure variables

21.144 The expenditure variables are estimated using a diverse suite of methods. The variables compiled are household final consumption expenditure, GFCF, changes in inventories and foreign trade.

21.145 The estimation of household final consumption expenditure is based on data obtained in EPF. This survey is collected currently every five years and presents monthly expenditure for a sample of more than 10,000 households of Greater Santiago and the regional capitals. The sample is expanded to the population universe, separately between Greater Santiago and the rest of the country based on an expansion factor constructed for each area from INE's population data. The household consumption vector thus obtained is incorporated for the benchmark compilation. For non-benchmark years, household consumption is estimated using the monthly surveys of retail trade as well as information from the production accounts from industries.

21.146 Information on final consumption expenditure of government and NPISH is derived from industries production accounts. The former is estimated using sum of costs, and the latter is obtained from tax statement from non-profits institutions.

21.147 GFCF is estimated by product and demanding industry using mainly data from the compilation of production accounts of the construction industry, the imports of capital goods, tax records and economic surveys. In the 2008 benchmark exercise, a service component was incorporated as intangible fixed assets, related to software and mining prospecting, in line with the recommendations of the SNA.

21.148 The estimation of inventories employs varied sources of information, including income tax records, economic surveys and financial statements. In order to ensure comparability with the rest of the expenditure aggregates in the SUTs, the method used to obtain the value of the inventory change considered valuing stocks at the average price of the period being estimated. To this end, inventory turnover rate (period of product permanence in stock), and inventory entry and exit prices were estimated in order to elaborate an appropriate deflator.

21.149 Exports are estimated using data mainly from customs records at the 8-digit level of the harmonised system and are valued at FOB prices.

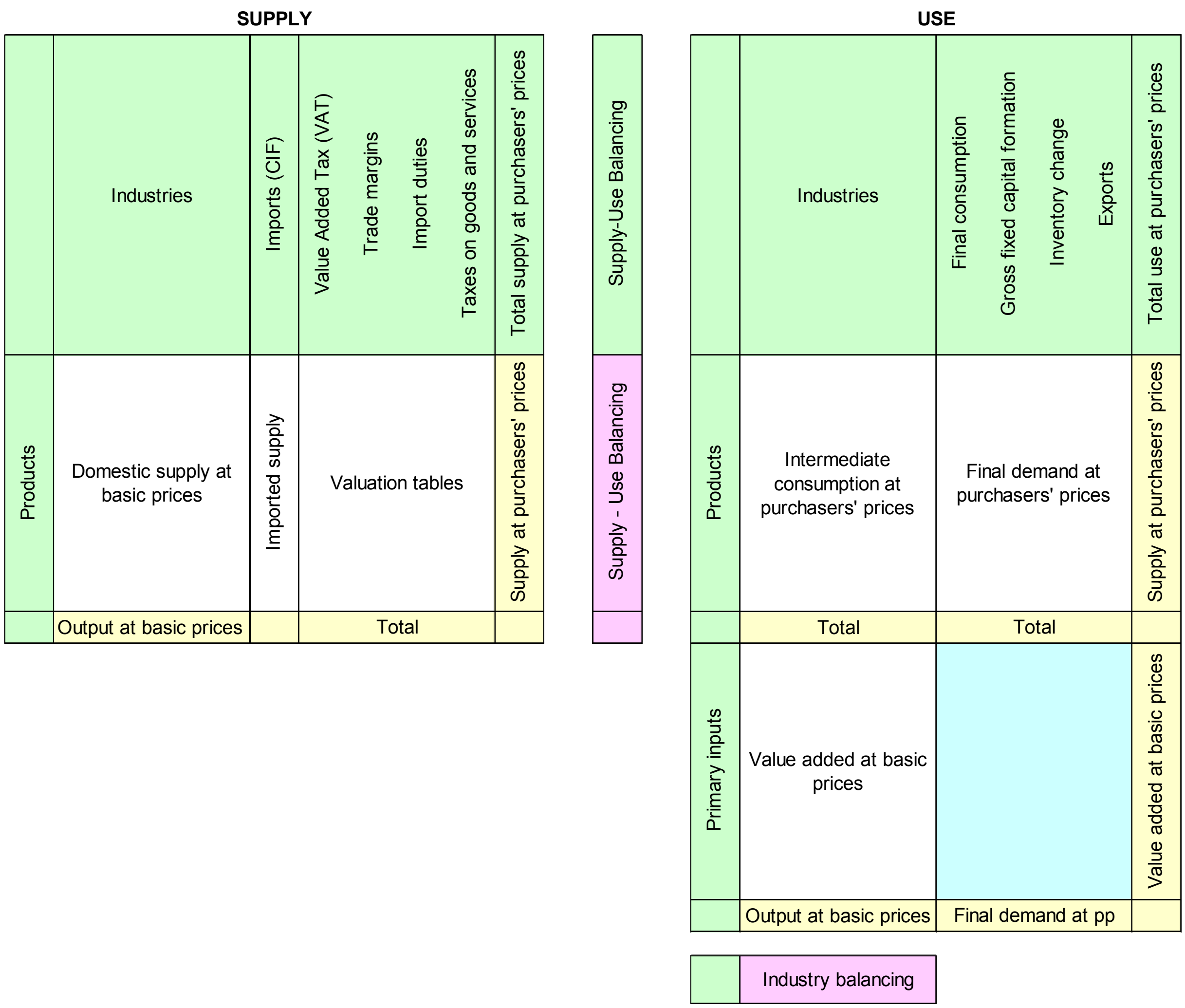
(d) SUTs compilation

21.150 The SUTs are composed by transaction and valuation tables as shown in Figure 21.2. Transaction tables are supply, use, and GVA, while the valuation tables cover non-deductible VAT, trade margins, import duties, and taxes on goods and services.

21.151 Domestic supply and value added tables at basic prices as well as the intermediate consumption table at purchasers' prices are obtained directly from the industries production accounts. These accounts contain information for each ones of the industries in the SUTs as well as the breakdown of products.

21.152 Imported supply at basic prices is derived straightforward from the imports estimates at CIF prices.

Figure 21.2 Supply and Use Table



21.153 Regarding valuation tables, wholesale and retail trade margins are estimated from a special study developed to collect such data. For domestic margins, the margin rates obtained in the study are applied to the basic price valuation. The imported product margins are obtained directly from the imports study.

21.154 The non-deductible VAT table is prepared using the actual amount collected by the government which is distributed using a theoretical VAT rate for each product. The latter is applied to intermediate consumption and GFCF for exempted industries as well as household final consumption expenditure.

21.155 The import duties table is constructed using records from the national customs service, in which, each transaction includes an amount of duties paid. These amounts are reconciled and corrected according to amounts actually received by government.

21.156 Taxes on domestic goods table is derived directly with information from government, and products subject to excise taxes are fuels and tobacco.

21.157 Final Use Tables are obtained accordingly to the expenditure side variable estimation.

(e) SUTs balancing

21.158 In general terms, balancing the SUTs is an iterative process, which involves arbitrating differences by analysing the economic consistency of the results and the reliability and quality of each data sources used. The process consists in detecting any inconsistencies that may arise and making any necessary ad-hoc adjustments. Corrected data are included back into the balancing process, which ends when no more discrepancies are found; in this way, consistency of the SUTs is attained.

21.159 In the Chilean context, most of the figures from the production table, imports, exports, import duties, taxes on production and non-deductible VAT are set as predetermined values. On the other hand, variables that are more prone to changes during the balancing process are intermediate consumption, trade margins and some components of final consumption.

21.160 As explained above, domestic and imported supply present an allocation in expenditure variables, called the "the supply hypothesis". During the balancing process, this hypothesis is compared with the actual estimation of intermediate consumption and expenditure side variables, with the exception of exports that given the robustness of the data are unique. In this way, we observe two sets of estimations for each of the use table variables, one from the "supply hypothesis", and the second from the "use hypothesis".

21.161 For example, in Table 21.4 unbalanced SUTs for tobacco products is presented. The first row shows the "use hypothesis" and the second row shows the "supply hypothesis". Given that there is a unique estimation for exports, the main difference is observed in final consumption. In this case, the "supply hypothesis" is considered more robust because it is obtained directly from business's information and, particularly, tobacco production is concentrated in one company. On the other hand, "use hypothesis" is obtained from household surveys and it is known that these surveys tend to underestimates consumption in this type of products. Therefore, in this particular case, the supply hypothesis prevails.

Table 21.4 SUTs for tobacco products, year 2008, current prices

	Domestic supply	Imported supply	Total supply	Intermediate consumption	Final consumption	GFCF	Changes in inventories	Exports	Total use
1. Use hypothesis				30	500		-20	250	760
2. Supply hypothesis	1000	12	1012	30	766		-34	250	1012

21.162 A different situation is observed in Table 21.5 where the unbalanced SUT is presented for cleaning and toiletry products. In this case, it is more difficult to identify whether this type of products are used for final or intermediate consumption. The "use hypothesis" based on the household survey should deliver a better estimate for final consumption and, therefore, this hypothesis will dominate through the balancing process.

Table 21.5 SUT for cleaning and toiletry products, year 2008, current prices

	Domestic supply	Imported supply	Total supply	Intermediate consumption	Final consumption	GFCF	Changes in inventories	Exports	Total use
1. Use hypothesis				170	1111	0	2	38	1321
2. Supply hypothesis	789	444	1233	143	1015	0	36	38	1232

2. Compilation of IOTs

21.163 Once the SUTs at purchasers' prices are balanced, data are prepared for the transformation into IOTs. This involves obtaining SUTs at basic prices as well as identifying domestic output separate from imports. The procedure can be summarised as follows:

- Converting the total use at purchasers' prices into domestic use at purchasers' prices. Imports of goods and services are removed from both the Supply Table and Use Table. Since this alters the industry equilibrium (column), a row vector of total imports by industry and type of final use is added to ensure no change to column totals.
- Converting the Domestic Use Table at purchasers' prices into Domestic Use Table at producers' prices. Trade margins are re-distributed from each cell of the use of goods to the trade row. Row and column equilibriums remain.
- Converting the Domestic Use Table at producers' prices into Domestic Use Table at basic prices. Net taxes and subsidies on products are removed from both the Supply Table and Use Table. Since this alters the industry equilibrium (column), a row vector of net taxes and subsidies on products by industry and type of final use is added.
- Converting the Domestic Use Table at basic prices into an IOT at basic prices. The IOT may be either Product by Product or Industry by Industry. In the Chilean case, the industry technology is preferred in order to ensure that no negative values arise in the IOTs (this forms an example of the Product by Product IOTs being compiled using the product technology).

21.164 Table 21.6 shows IOTs for Chilean economy for the year 2008.

Table 21.6 IOTs for domestic output at basic prices, 2008

			PRODUCTS							FINAL USE								Total at basic prices
			Agricul-ture	Manufac-turing	Construc-tion	Trade, transport and communication	Finance and business services	Other services	Total	Final consumption expenditure			Gross fixed capital formation	Changes in inventories	Exports	Total		
										Households	NPISH	General government						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		(15)
PRODUCTS	Agriculture	(1)	1 151	5 048	4	99	15	29	6 346	892		53	255	- 97	1 175	2 278		8 624
	Manufacturing	(2)	1 948	17 914	3 720	3 554	918	1 341	29 394	10 733		83	887	795	29 780	42 278		71 672
	Construction	(3)	16	161	10	263	123	1 259	1 833				12 900			12 900		14 734
	Trade, transport and communication	(4)	712	4 649	1 234	7 271	1 315	1 011	16 192	14 960		167	1 433	4	5 465	22 029		38 221
	Finance and business services	(5)	641	4 547	1 337	5 524	4 619	1 773	18 440	5 036		123	914	0	660	6 733		25 173
	Other services	(6)	32	300	29	349	179	652	1 542	12 779	717	10 069	10	0	37	23 612		25 153
	Total	(7)	4 500	32 620	6 334	17 060	7 169	6 065	73 747	44 400	717	10 495	16 399	702	37 117	109 831		183 578
	Imports	(8)	984	13 659	1 482	5 111	1 175	640	23 052	6 147			6 014	466	922	13 550		36 602
	Total	(9)	5 484	46 279	7 816	22 171	8 344	6 706	96 799	50 547	717	10 495	22 414	1 168	38 039	123 380		220 179
	Taxes less subsidies on products	(10)	23	174	27	564	518	536	1 842	6 229		58	765	15	3	7 069		8 911
	Direct purchases abroad by residents	(11)								501						501		501
	Purchases on the domestic territory by non-residents	(12)								- 911					911			
	Total at purchasers' prices	(13)	5 507	46 454	7 842	22 735	8 861	7 241	98 641	56 365	717	10 553	23 179	1 184	38 953	130 950		229 591
VALUE ADDED	Compensation of employees	(14)	1 358	5 465	3 265	7 268	6 370	10 406	34 133									
	Other taxes less subsidies on production	(15)	83	162	106	281	206	606	1 445									
	Gross operating surplus/Gross mixed income	(16)	1 676	19 592	3 520	7 936	9 735	6 900	49 359									
	GVA	(17)	3 117	25 219	6 891	15 486	16 312	17 912	84 937									
	Output at basic prices	(18)	8 624	71 672	14 734	38 221	25 173	25 153	183 578									

Chile 2008

3. Future developments

21.165 The last benchmark process started with the planning of the project during 2012 and benchmark data for 2013 published in December 2016. The CBC has already initiated the work related to a new benchmark exercise for the year 2021.

21.166 The focus of this benchmarking exercise will reflect the update of the statistical infrastructure, namely ISIC Revision 4 and CPC Revision 2 as well as continuing with the implementation of 2008 SNA. In addition, the project will incorporate information of production accounts and expenditure variables not available for non-benchmark years such as Agriculture and Construction industries as well as trade margins and household consumption.

21.167 Finally, improving the balancing process is a key task in which CBC is currently working on to implement. In this context, CBC is exploring the use of statistical techniques to obtain balanced and reconciled SUTs. Automated balancing process would provide significant progress in National Accounts compilation such as systematising estimation processes, extending the detail of products and industries in the SUTs and improving the reliability of results.

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