Journal of Development Economics 90 (2009) 33–49

Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/econbase

Openness can be good for growth: The role of policy complementarities ☆

Roberto Chang [a,b], Linda Kaltani [c], Norman V. Loayza [d,*]

[a] Rutgers University, United States
[b] NBER, United States
[c] International Monetary Fund, United States
[d] The World Bank, United States

ARTICLE INFO

Article history:
Received 15 August 2006
Received in revised form 30 May 2008
Accepted 12 June 2008

JEL classification:
E61
F13
F43
O40

Keywords:
Openness
Growth
Economic reform
Policy complementarity

ABSTRACT

This paper studies how the effect of trade openness on economic growth may depend on complementary reforms that help a country take advantage of international competition. This issue is illustrated with a simple Harris–Todaro model where welfare gains after trade openness depend on the degree of labor market flexibility. The paper then presents cross-country, panel-data evidence on how the growth effect of openness may depend on a variety of structural characteristics. For this purpose, the empirical section uses a non-linear growth regression specification that interacts a proxy of trade openness with proxies of educational investment, financial depth, inflation stabilization, public infrastructure, governance, labor market flexibility, ease of firm entry, and ease of firm exit. The paper concludes that the growth effects of openness may be significantly improved if certain complementary reforms are undertaken.

1. Introduction

Ever since Ricardo's critique on the *Corn Laws* to the current debate on globalization, few topics in economics have been more hotly contested than the importance of openness to international trade for economic development and growth. The arguments in favor of openness are well known and date back at least to Adam Smith's analysis of market specialization: openness promotes the efficient allocation of resources through comparative advantage, allows the dissemination of knowledge and technological progress, and encourages competition in domestic and international markets; also, recent theoretical models indicate a long-run growth effect when the areas of specialization promoted by trade enjoy increasing returns to scale.[1] But opposing arguments are not too hard to build: if market or institutional imperfections exist, openness can lead to under-utilization of human and capital resources, concentration in extractive economic activities, or specialization away from technologically advanced, increasing-return sectors.[2]

The theoretical ambiguity on the effects of openness is reflected in the available empirical evidence. Some papers point to strongly positive growth effects of trade openness.[3] Others point to small positive effects.[4] But others, most notably Harrison (1996) and Rodríguez and

☆ We gratefully acknowledge the valuable support of the World Bank's Poverty Reduction and Economic Management Network. We are also grateful to César Calderón, Rómulo Chumacero, Marco Cipriani, Mieke Meurs, Lant Pritchett, Romain Ranciere, Klaus Schmidt-Hebbel, Luis Servén, Vicente Tuesta, Roberto Zhaga, two anonymous referees, and seminar participants at George Washington University, Villanova University, the World Bank, the Central Bank of Chile, the Central Bank of Peru, the Federal Reserve Bank of Philadelphia, and the Tenth Conference of Dynamics, Growth, and International Trade for valuable comments and suggestions. Finally, Chang thanks the hospitality and financial support of Princeton University. The views expressed in this paper are those of the authors, and do not necessarily reflect those of the World Bank, their Boards of Directors, or the countries they represent.

* Corresponding author.
E-mail address: nloayza@worldbank.org (N.V. Loayza).

0304-3878/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.jdeveco.2008.06.011

[1] This is illustrated in the endogenous growth models of Young (1991), Grossman and Helpman (1991), Lee (1993), and Eicher (1999).

[2] In Grossman and Helpman (1991) and Matsuyama (1992) a country may specialize in a non-dynamic sector as a result of openness, thus losing out on the long-run benefits of increasing returns. Key to these models is an imperfection in contracts or in financial markets that induce people to follow a myopic or limited notion of static comparative advantage. Sachs and Warner (1995, 1999) develop a model where specialization in extractive, natural-resource sectors diverts the economy from achieving technological progress, the key to growth in the long run. In this case, the underlying imperfection is an institutional weakness that encourages natural-resource depletion for quick gains appropriated by certain groups in society. Rodríguez and Rodrik (2001) review the theoretical arguments as to why openness can be detrimental to developing countries.

[3] See e.g. Dollar (1992), Sachs and Warner (1995), and Edwards (1998).

[4] See Lee et al. (2004).

Rodrik (2001) have cast doubt on the significance and robustness of the growth benefits of openness.[5]

Our paper starts with the observation that although trade openness appears to be beneficial to economic growth on average, its effect varies considerably across countries and depends on a variety of conditions related to the structure of the economy and its institutions.[6] A simple exercise may serve to convey this point. Fig. 1 plots changes in growth rates of per capita GDP between the 1990s and 1980s versus changes in the volume of trade (exports plus imports over GDP) between those two decades for a worldwide sample of 82 countries. Fig. 1 has four panels; in each of them we separate the country observations according to whether they belong to the top one-third (diamonds) or bottom two-thirds (squares) of a rank distribution given by each of the following criteria, in turn: a) secondary enrollment rates (a proxy for human capital investment); b) main telephone lines per capita (a proxy for public infrastructure); c) a subjective index of the quality of governance; and d) a *de facto* and *de jure* index of labor market flexibility. (Appendix B gives details on variable definitions and sources). Each criterion used for ranking country observations is measured over the 1980s, the beginning period.

Dividing the country observations into top and bottom groups allows us to compare the corresponding slopes for the relationship between changes in trade volume ratios and changes in economic growth rates. In all panels, the OLS line described by the bottom observations is basically flat, implying no relationship between changes in trade openness and growth improvement. However, for the top group, the slope of the OLS line is positive and steeper than that for the bottom group.[7] This clearly suggests that the empirical impact of trade openness on growth may depend on the existence and degree of distortions in non-trade areas. Of course, this is quite a simple exercise and it does not control for other growth determinants (such as initial per capita GDP), does not account for joint endogeneity, and does not use all information efficiently. But more careful econometric methods are used later in the paper and confirm that the growth response to trade openness is heterogeneous, and not in random ways but in relation to specific country conditions.

Accordingly, we study how the eventual success of openness in terms of growth performance depends on the economic and institutional characteristics that enable a country to adjust to the new conditions imposed by international openness. This idea is very general, but for concreteness we illustrate it with a simple theoretical example where the welfare and efficiency gains after trade openness depend on the degree of labor market flexibility. The example is a version of the well-known Harris–Todaro (1970) model, in which labor market distortions are represented by a minimum wage that applies to the formal sector of the economy. We include trade restrictions as a tariff that also applies to formal sector output. In the model, trade protection may serve to ameliorate the problem of underemployment (and underproduction) in the sector affected by labor market distortions. As a consequence, trade liberalization unambiguously increases per capita income only when labor market distortions are sufficiently small.[8]

While our model belongs to the literature on commercial policy in the presence of labor market distortions, we regard it, more generally, as an example in the tradition of the general theory of the second best (Lipsey and Lancaster, 1956). This perspective emphasizes that one can expect similar interactions between openness and complementary reforms in other areas, and this is reflected in our empirical work.

The empirical contribution of this paper lies in providing new cross-country empirical evidence on how the growth effect of openness depends on a variety of structural characteristics, including some that may be subject to reform. We build on the panel-data growth regressions presented in Dollar and Kraay (2004) and Loayza et al. (2005). As these papers do, we use a generalized method of moments (GMM) procedure that addresses endogeneity and controls for unobserved country-specific factors in order to estimate the growth effect of openness, as well as those of other policy and non-policy variables. We, however, depart from those studies in that we interact the openness measure with proxies of, respectively, educational investment, financial depth, inflation stabilization, public infrastructure, governance, labor market flexibility, and ease of firm entry and exit. Our objective for using this specification is to assess whether an increase in openness may have a growth effect that depends on country characteristics that, at least in principle, are subject to improvement through economic and institutional reforms.

We find that the growth effect of openness is significantly positive if certain complementary reforms are undertaken. The interaction effects are significant in both the statistical and economic sense, and robust to a number of changes, including the measure of openness. Our estimates indicate that openness can reduce or increase growth, depending on the status of the complementary reforms. However, since progress in implementing reforms has been considerable in recent decades, we find that the growth effect of openness is likely to have been positive in the most recent period of our sample (1996–2000).

The empirical growth literature offers some related examples of non-linear specifications considering interaction effects. On foreign direct investment, Borensztein et al. (1995) and Alfaro et al. (2006) find that the growth effect of FDI is significantly positive only when the host country has, respectively, sufficiently high human capital and financial depth. Specifically in the analysis of growth effects of trade openness, an important antecedent of our work is the empirical study by Bolaky and Freund (2004). Using cross-country regressions in levels and changes of per capita GDP and controlling for simultaneity via external instruments, they find that trade openness promotes an expansion of income only in countries that are not excessively regulated.[9] They argue that in highly regulated countries, growth does not accompany trade openness because resources are prevented from flowing to the most productive sectors and firms. Finally, Calderon et al. (2006) interact in their panel growth regressions a measure of openness (volume of trade/GDP) with linear and quadratic terms of GDP per capita, which they regard as a proxy for overall development. They find that the growth effect of trade openness is nearly zero for low levels of per capita GDP, increases at a decreasing rate as income rises, and reaches a maximum at high levels of income. Our strategy of

[5] These authors express concerns about the openness measures used in practice, as well as about econometric issues such as omitted-variable bias and joint endogeneity bias. Dollar and Kraay (2004) and Loayza et al. (2005) address these criticisms by using improved openness indicators and GMM methods, and conclude that openness to international trade results in significant growth improvements. Wacziarg and Welch (2003) use an event-study methodology and find that liberalizing countries tend to experience significantly higher trade ratios, investment rates, and, most importantly, growth rates. However, in an examination of 13 country-case studies, Wacziarg and Welch find noticeable heterogeneity in the growth response to trade liberalization.

[6] Edwards (1993) reviews the literature studying the conditions needed for successful trade reform. He cites Helleiner (1986), who argues that a minimum level of development is required before the benefits of exports promotion can be realized, and Kohli and Singh (1989), who find that countries' ability to benefit from export orientation depend on a 'minimum critical threshold' related to the trade structure itself, rather than to income per capita.

[7] For the top observations according to educational investment, public infrastructure, and governance, the slope of the OLS line is significantly positive at conventional levels. The top observations according to labor market flexibility also describe a positive slope that is larger than that of the bottom group, but it is not statistically significant. The more satisfactory methods used later in the paper, however, indicate that the impact of labor market reforms on the trade openness/growth relationship is in fact strongly significant.

[8] In the model the potential gains from openness are given in terms of the level of output per capita. There is no contradiction between this static treatment and our empirical emphasis on growth effects. This is so because the time horizons used in current econometric studies do not allow discriminating long-run growth effects from long-lasting transitional level effects. Moreover, the finding of conditional convergence suggests that growth impulses coming from improvements in growth determinants tend to decrease as per capita GDP increases.

[9] This paper differs from Bolaky and Freund's in including a theoretical model and using a rather different econometric methodology regarding regression specification, treatment of endogeneity, and mode of interaction between trade and complementary variables. The results are, nonetheless, broadly similar.

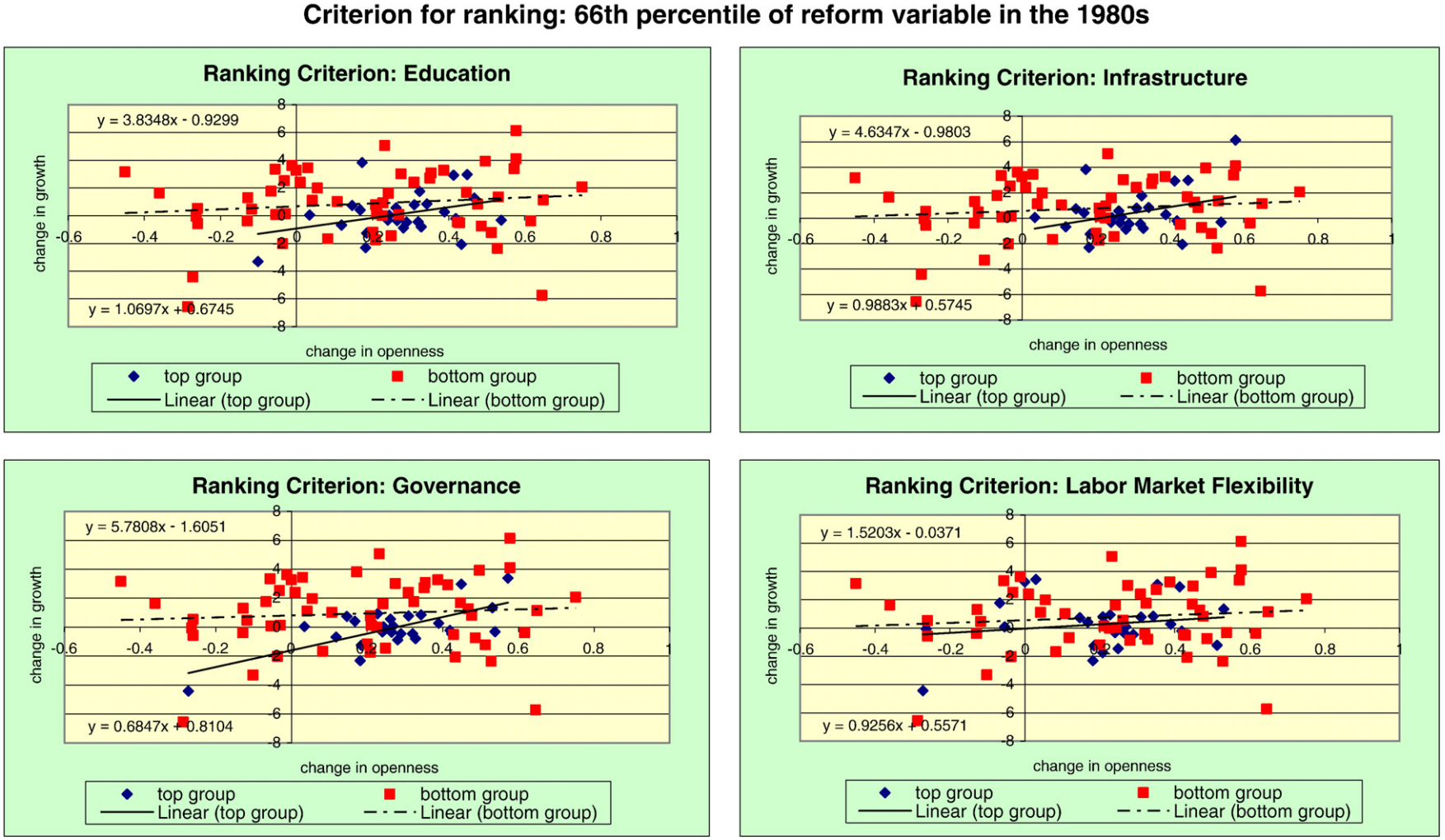


Fig. 1. Changes in growth rates of per capita GDP versus changes in openness between the 1990s and 1980s for top and bottom reformers in four areas.

interacting openness with specific country characteristics is, to some extent, an attempt to decipher what lies behind the dependence of the growth effect of openness on economic reform and development.

Section 2 discusses a theoretical model to illustrate the ambiguous effect of trade openness when labor market rigidities are present. Section 3 is devoted to the empirical analysis. We introduce the sample and methodology, present the main econometric results (illustrating them with simple simulations), and analyze their robustness to the inclusion of interactions with income and geographic variables, to different estimation methodologies, and to alternative openness measures. Section 4 offers some concluding remarks.

2. An illustrative model

Our basic premise is that economic reforms need to complement each other to be effective. This general principle can be derived from several models, and indeed one can see it as a straightforward implication of the theory of the second best. This section begins by illustrating the principle in a concrete situation, a simple open economy extension of Harris and Todaro (1970).

The justly celebrated Harris–Todaro model focused on endogenous migration and unemployment in the presence of labor market distortions. In our version below, distortions in the labor market interact with tariffs or other distortions in international trade.[10] We show how a tariff reform that reduces trade-related distortions may, at the same time, exacerbate the labor market distortions. The implication is that the sign of the impact of trade opening on productive efficiency and welfare depends on labor market conditions. This observation provides the basis for the empirical work in later sections.

Although we have chosen the context of the Harris-Todaro model for expositional purposes, the basic ideas, analysis, and results in this section can also be derived from the general theoretical literature on the role of trade policy in the presence of labor market distortions.[11] In fact, a wide spectrum of theories supports our central claim (that interactions between trade reforms and other complementary reforms may be crucial for the reforms' growth effects). To emphasize this point, the section ends with a brief discussion of how our analysis may extend to other related contexts.

2.1. Production and employment

Consider a static small open economy. There are two consumption goods, indexed by $i=1, 2$, with world prices given in terms of a fixed numeraire. Both goods are produced at home with a simple Cobb Douglas technology:

$$Y_i = A_i L_i^{\alpha_i},\ i = 1, 2. \tag{2.1}$$

Labor is the only variable input in production. Home firms are owned by identical entrepreneurs that behave competitively in product and factor markets. Profit maximization then implies that, in each productive sector $i=1, 2$, the value of the marginal product of labor equals the wage in that sector:

$$\alpha_i A_i P_i L_i^{\alpha_i - 1} = W_i \tag{2.2}$$

where $0<\alpha_i<1$, P_i is the home price of good i, and W_i is the wage prevailing in sector i.

The price of good i in domestic markets, P_i, may differ from its world price (hereon denoted by P_i^*) because of trade policy. In particular, if there is a tariff on imports of good i, $P_i>P_i^*$. A "trade reform" is a reduction in the difference between P_i and P_i^*.

As in the classic Harris–Todaro model, wages may be different in different sectors, and there is a minimum wage in sector 1, which is assumed to exceed the wage in sector 2:

$$W_1 = W_{\min} > W_2. \tag{2.3}$$

A "labor market reform" would involve eliminating the minimum wage in sector 1.

There are L workers in this economy. Each one chooses whether to work in sector 1 or 2. Once the location decision has been made, workers cannot move from one sector to the other. The critical aspect of the Harris–Todaro model is that, in equilibrium, the number of workers that choose to locate in sector 1 will be too large for all of them to be employed. Hence there will be a number, which we denote by U, of unemployed workers in sector 1. Assuming that jobs in sector 1 are distributed randomly among workers located in that sector, the probability that a worker in sector 1 is employed is $L_1/(L_1+U)$. As we shall see, optimal location decisions by workers imply that the expected wage in the two sectors must be the same:

$$W_2 = [L_1/(L_1+U)]W_{\min}. \tag{2.4}$$

Eqs. (2.1)–(2.4) and the definition $U=L-(L_1+L_2)$ suffice to describe the production side of the economy: given the minimum wage $W_{\min}$ and home prices P_1 and P_2, we can solve for Y_1, Y_2, L_1, L_2, U, and W_2.

To see the implications of a trade reform, assume that $P_1>P_1^*$ initially, while $P_2=P_2^*$ (i.e. only sector 1 is protected). A trade reform is a reduction in P_1 and, hence, must reduce employment in sector 1: since W_1 is fixed at $W_{\min}$, a fall in P_1 increases the product wage in that sector, inducing firms there to hire fewer workers. On the other hand, L_2 must increase.[12]

Decreasing marginal productivity of labor implies that W_2 must fall. But then Eq. (2.4) implies that $L_1/(L_1+U)$ must fall or, in other words, that the rate of unemployment in sector 1 must increase. The impact on U, the number of unemployed workers, is ambiguous.

It should be obvious that a lower P_1 increases distortions in the labor market: real wages in the two sectors move away from each other, and hence the initial gap between the marginal productivity of labor in the two sectors becomes larger. But a trade reform may, of course, have beneficial effects as well. To identify those in a concrete setting, we need to make some additional assumptions and complete the description of the economy.

2.2. Demand, efficiency, and welfare

The typical worker consumes a conventional linearly homogenous aggregate of goods 1 and 2. Letting P denote the associated price index and I the worker's final income, the worker's final consumption is then simply I/P. Assume that the worker maximizes expected consumption, and therefore expected income.

All workers receive a lump sum transfer from the government. In addition, each worker has one unit of time, and so his income will include his wage earned if he is employed. There is no disutility from labor.

These assumptions imply that the worker will choose a location to maximize the expected wage. But then an equilibrium with workers in both sectors requires the expected wage in both sectors to be the same (Eq. (2.4)).

The typical entrepreneur consumes the same aggregate of goods 1 and 2 as the typical worker. He is assumed to receive a lump sum transfer from the government, and all profits from production.

[10] One can see our model as a special case of Bhagwati and Srinivasan (1974), for example, so their results apply. Khan (1980) summarizes and synthesizes different versions of the Harris–Todaro model.

[11] Early classics are Magee (1973) and Brecher (1974). For a discussion of recent developments with emphasis on the role of trade opening on poverty, see Harrison (2006).

[12] Suppose L_2 falls. Then, by Eq. (2.2), the wage in sector 2 must increase. By Eq. (2.4), the probability of employment in sector 1 must then increase, so U must fall. But then L_1, L_2, and U would all fall, contradicting $L_1+L_2+U=L$.

Finally, assume that the government levies a tariff $P_1 - P_1^*$ on imports of good 1, and no tariff on imports of good 2, and rebates all tariff revenues to workers and entrepreneurs as lump sum transfers. Fiscal balance and the fact that aggregate expenditure in the two goods must equal aggregate income is then easily shown to yield the standard result that the value of domestic consumption must equal the value of production, both at world prices (that is, $P_1{}^*C_1^a + P_2{}^*C_2^a = P_1{}^*Y_1 + P_2{}^*Y_2$, where C_i^a denotes total domestic consumption of good i).

Now it is straightforward to see the effects of the tariff on efficiency and welfare. The tariff causes a distortion in consumption, since domestic agents face the after tariff relative price P_1/P_2 instead of the world price $P_1{}^*/P_2{}^*$ when making consumption decisions. This causes them to choose a consumption bundle such that the social indifference curve is not tangent to the national budget constraint line. A trade reform reduces this distortion.

The effect of trade reform on the value of national production at world prices, $Z = P_1{}^*Y_1 + P_2{}^*Y_2$ is, in contrast, ambiguous. As in the standard case, the tariff increases the relative domestic price of good 1, pushing up domestic production of good 1 beyond efficient levels. But the minimum wage in sector 1 pushes production of good 1 down; indeed, in the absence of the tariff, production and employment in sector 1 would be inefficiently low. A tariff in sector 1 offsets this distortion by increasing the price of good 1 and inducing firms to expand hiring in that sector.

More precisely, consider the effect of a small change in P_1 on Z, the value of home production at world prices. Using Eqs. (2.2), (2.3), and normalizing so that $P_2{}^* = 1$,

$$\frac{dZ}{dP_1} = P_1^*\alpha_1 A_1 L_1^{\alpha_1 - 1}\frac{dL_1}{dP_1} + A_2\alpha_2 L_2^{\alpha_2 - 1}\frac{dL_2}{dP_1} = \frac{P_1^*}{P_1}W_{\min}\frac{dL_1}{dP_1} + W_2\frac{dL_2}{dP_1}$$

which yields after some algebra:

$$\frac{dZ}{dP_1} = W_{\min}\frac{dL_1}{dP_1}\left[\frac{P_1^*}{P_1} - \{(1-\alpha_2)(L/L_2) + \alpha_2\}^{-1}\right]. \quad (2.5)$$

By Eqs. (2.2) and (2.3), $dL_1/dP_1 > 0$. Hence the impact of a marginal change in the tariff depends on the quantity in square brackets, which captures the opposing effects of trade distortions and labor market distortions. The term $\{(1-\alpha_2)(L/L_2)+\alpha_2\}^{-1}$ is less than one, so the term in brackets can be positive or negative. In other words, when distortions exist in both trade and labor markets, a marginal reduction in tariffs (keeping the labor market distortion fixed) can increase or reduce productive efficiency.

Eq. (2.5) has, in fact, a straightforward interpretation. The term $P_1{}^*/P_1$ is a measure of the tariff on good 1 imports: the larger the tariff, the smaller $P_1{}^*/P_1$. On the other hand, the distortionary impact of a minimum wage is given by L_2/L: the smaller this ratio, the larger the RHS of Eq. (2.5). Intuitively, the smaller the size of sector 2, the greater the discrepancy between the marginal product of labor in sectors 1 and 2, and the more likely it is that an increase in P_1 will increase efficiency, by inducing more hiring in sector 1, where the marginal product of labor is higher.

The obvious but significant corollary is that trade liberalization may increase or reduce productive efficiency and welfare, depending on the importance of the labor market distortion. This indicates the need to include a term for the interaction between trade policy and labor market distortions in our empirical assessment of the connection between trade openness and growth.

2.3. Discussion

While our Harris–Todaro example is attractive because of its clarity and simplicity, its specificity may invite criticism. For example, some readers may feel uneasy about the assumption of the existence of a minimum wage, on the basis that minimum wages do not appear to be a dominant distortion in many countries. We would argue, however, that what is crucial for our example is not a minimum wage *per se*, but some policy-induced labor market distortion that results in an inefficient allocation of labor. Examples of such distortions are not hard to find: restrictions on hiring and firing workers, mandatory benefits, and regulations on workweek length immediately come to mind and, in fact, are prominently represented in the data we use for our empirical work.

More generally, that trade reforms may need to be complemented by other reforms has been stressed by other studies in related contexts. Perhaps the closest literature in this regard is the one concerning the impact of trade openness on the informal sector. A key issue in that literature is whether a trade reform will increase the size of the informal sector: formal sector firms – subject to labor and other regulations – may respond to a decrease in protection by economizing in labor costs, hence shedding employment.[13] Indeed, Goldberg and Pavcnik (2003) show that a model with formal and informal workers in which employment of the former (but not the latter) is subject to regulation and efficiency wages does imply that trade liberalization increases informality. Such an effect is, in addition, greater when labor market regulation is more distorting. Hence, while Goldberg and Pavcnik's model differs from ours in the details, it delivers the same basic lesson about reform complementarities.[14] And the empirical significance of such complementarities was indeed confirmed by Goldberg and Pavcnik, as they found that trade liberalization in Colombia was associated with an increase in the size of the informal sector only before labor reforms were enacted there.[15]

Our arguments are also related to the recent empirical literature on trade reforms and labor reallocations. In our model, because of labor market distortions, trade reform may result in flows of workers in the "wrong" direction. This is consistent with evidence that trade reform often fails to be followed by the kind of labor flows that standard Hecksher–Ohlin theory would predict (for a discussion, see Harrison, 2006). Furthermore, and most significantly for our purposes, Wacziarg and Wallack (2004) find that the effect of trade liberalization on labor reallocations is stronger in countries where it was accompanied by other reforms.

Finally, while our model emphasizes the interaction between trade openness and labor market distortions, its central message applies to the interaction between openness and other reform areas. For instance, in the influential work of Acemoglu and Zilibotti (2001), openness (in the sense of unobstructed access to technological progress) does not lead to productivity improvements in developing countries that fail to improve their human capital (to adopt the new technologies) and to enforce intellectual property rights (to encourage the development of technologies best suited to their skill mix). Likewise, Banerjee and Newman (2004) have recently presented a model in which lack of financial development and sluggish factor mobility make poor countries lose from trade openness, as unproductive sectors are wiped out by foreign competition but the capital and labor attached to them fail to divert to more efficient uses. Other examples are not too hard to find. Hence, our empirical work investigates the complementarity between trade openness and several kinds of reforms, not only labor market ones.

3. Empirical analysis

Our empirical objective is to examine how the growth effect of openness may depend on a variety of country characteristics, including some that are subject to reform. For this purpose, we work with pooled cross-country and time-series data, focusing on comparative information from within-country changes. We start with a linear growth regression specification and then extend it to account for interaction terms between an openness measure and proxies for various country

[13] Currie and Harrison (1997) provide evidence for Morocco.

[14] In fact, one could easily reinterpret our model, calling our sector 1 "formal" and sector 2 "informal", to obtain conclusions very similar to Goldberg and Pavcnik's.

[15] Accordingly, Goldberg and Pavcnik (p. 466) conclude that "trade policy effects are dependent on … labor market institutions".

characteristics. These are educational investment, financial depth, macroeconomic price stability, public infrastructure, governance, labor market flexibility, ease of firm entry, and ease of firm exit. We build on the panel-data growth regression literature that uses a GMM procedure to address endogeneity and control for unobserved country-specific factors, as presented for example in Levine et al. (2000) and Dollar and Kraay (2004). Further details on the methodology are given below.

3.1. Sample and regression specification

Our sample consists of an unbalanced panel dataset that comprises 82 countries. For each of them, the dataset includes at most 8 observations, consisting of non-overlapping 5-year averages spanning the 1960–2000 period. The sample includes 22 developed countries and 60 developing ones. Among the latter, 18 are from Sub-Saharan Africa, 12 from Asia, 9 from the Middle East and North Africa, and 21 from Latin America and the Caribbean. Appendix A provides the full list of countries in the sample.

Our point of departure is a basic regression equation:

$$y_{i,t} - y_{i,t-1} = \beta_0 y_{i,t-1} + \boldsymbol{\beta_1'} \boldsymbol{CV}_{i,t} + \beta_2 \mathrm{OP}_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (3.1)$$

where the subscripts i and t represent country and time period, respectively; y is the log of GDP per capita, CV is a set of control variables, and OP represents trade openness; μ_t and η_i denote unobserved time- and country-specific effects, respectively; and ε is the error term.

As is standard in the literature, the dependent variable is the average rate of real per capita GDP growth (i.e., the log difference of GDP per capita normalized by the length of the period). The regression equation is dynamic in the sense that it includes the level of per capita GDP at the start of the corresponding period in the set of explanatory variables.

Our measure of trade openness is based on the volume of trade — the ratio of real exports and imports to real GDP, adjusted for structural country characteristics. The volume of trade is an outcome measure in principle related to trade policy, but not exclusively so. In order to strengthen this outcome-policy connection, we only work with the portion of the trade volume not due to structural country characteristics such as population, area, oil wealth, and access to the sea. Furthermore, as explained below, our econometric methodology uses the *changes*, rather than the levels, of all dependent and explanatory variables. The received literature indicates that *effective* changes in trade policy are followed by large changes in trade shares (see Wacziarg and Welch 2003, among others). Granted, there are other time-varying within-country effects that are only loosely connected to trade policy – such as the emergence of new export sectors, booms in production of existing sectors, changes in other countries' trade policies, or greater capital inflows – which can also cause significant changes in the trade share. With these caveats, we believe that, after controlling for country and time time-specific effects, this outcome measure is a sensible, albeit imperfect, proxy for trade policy. It is arguably better than legalistic (*de jure*) measures to the extent that the latter are difficult to summarize in a single indicator (there are multiple tariff rates, multiple non-tariff barriers, multiple trade agreements) and even more difficult to adjust for the strength with which they are enforced. At any rate, in the robustness section of the paper, we replace the outcome measure by one based on average tariff rates, finding broadly similar results.

We select the set of control variables considering both their importance as growth determinants *per se* and their potential for affecting the growth response of trade openness. The control set includes variables that vary both across countries and over time, as well as variables that vary only across countries (that is, assumed constant over time). Among the former, we have the initial rate of secondary school enrollment to account for human capital investment, the average ratio of private credit to GDP as a measure of financial depth, the average inflation rate to account for macroeconomic price stability, and the average number of main telephone lines per capita as a proxy for public infrastructure.[16] Among the variables that vary only across countries, we have a governance index from *International Country Risk Guide* (Political Risk Services), labor market and firm exit flexibility indices from *Doing Business* (the World Bank), and a firm entry flexibility index from both *Doing Business* (the World Bank) and the *Index of Economic Freedom* (the Heritage Foundation). Appendix B provides full definitions and sources of all variables used in the paper, and Appendix C presents basic descriptive statistics for the data used in the regressions.

We then extend the regression specification by allowing the growth effect of openness to vary with the country characteristics represented by the control set. We do this by interacting the openness measure with each of the control variables in turn. The regression equation with an interaction term is the following,

$$y_{i,t} - y_{i,t-1} = \beta_0 y_{i,t-1} + \boldsymbol{\beta_1'} \boldsymbol{CV}_{i,t} + \beta_2 \mathrm{OP}_{i,t} + \beta_3 \mathrm{cv}_{i,t} * \mathrm{OP}_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (3.2)$$

where cv represents one of the control variables in particular. We interact openness with the country characteristics one at a time in order both to simplify the interpretation of the results and not to overextend the parameter requirements on the data.[17] In an extension discussed at the end of the paper, we add the interaction of openness with GDP per capita to each of these regressions. Since GDP per capita can be regarded as a summary measure of overall development, controlling for its interaction with openness can help gauge the *additional* effect of each of the individual country characteristics on the openness-growth link.

3.2. Estimation methodology

The growth regression presented above poses some challenges for estimation. The first is the presence of unobserved period- and country-specific effects. While the inclusion of period-specific dummy variables can account for the time effects, the common methods of dealing with country-specific effects (that is, within-group or difference estimators) are inappropriate given the dynamic nature of the regression. The second challenge is that most explanatory variables are likely to be jointly endogenous with economic growth, so we need to control for the biases resulting from simultaneous or reverse causation. The following paragraphs outline the econometric methodology we use to control for country-specific effects and joint endogeneity in a dynamic model of panel data.

We use the generalized method of moments (GMM) estimators developed for dynamic models of panel data that were introduced by Holtz-Eakin et al. (1988), Arellano and Bond (1991), and Arellano and Bover (1995). These estimators are based, first, on differencing regressions or instruments to control for unobserved effects and, second, on using previous observations of explanatory and lagged-

[16] Regarding inflation, we take the absolute value of annual inflation minus 3%. We do this to take into account that very low or negative inflation rates are also signs of macroeconomic instability. The results are not affected by marginal changes to the 3% threshold.

[17] The interpretation of the coefficients on the time-varying variables and on their interaction term with openness is straightforward. However, the interpretation of coefficients related to the variables that are constant per country requires some explanation. In linear regression models (that is, with no interactions), time-invariant variables are well captured by the country-specific effect and, in general, would not be incorporated into the regression specification. In the presence of interactions, however, we need to include them in the regression in order to analyze their interaction with openness. The coefficients on the constant variables *themselves* cannot be identified unless we have additional information on their relationship with the country-specific effect (see the methodological section below). Nevertheless, in order to complete the information set, we include them in the regression as explanatory variables on their own whenever their respective interaction with openness is analyzed. In order to avoid confusion, we do not report the estimated coefficients on the constant variables themselves but only the coefficients on their corresponding interaction terms.

dependent variables as instruments (which are called internal instruments).

After accounting for time-specific effects, we can rewrite Eqs. (3.1) or (3.2) as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \boldsymbol{\beta}' \boldsymbol{X}_{i,t} + \eta_i + \varepsilon_{i,t}. \tag{3.3}$$

To eliminate the country-specific effect, we take first differences of Eq. (3.3):

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \boldsymbol{\beta}'\left(\boldsymbol{X}_{i,t} - \boldsymbol{X}_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right). \tag{3.4}$$

Note that by differencing we also eliminate the variables that are constant over time. However, their interaction with the trade openness proxy is not eliminated (given that this does vary over time).

The use of instruments is required to deal with the likely endogeneity of the explanatory variables and the problem that, by construction, the new error term, $\varepsilon_{i,t}-\varepsilon_{i,t-1}$, is correlated with the lagged lagged-dependent variable, $y_{i,t-1}-y_{i,t-2}$. The instruments take advantage of the panel nature of the dataset in that they consist of previous observations of the explanatory and lagged-dependent variables. Conceptually, this assumes that shocks to economic growth (that is, the regression error term) be unpredictable given past values of the explanatory variables. The method does allow, however, for current and future values of the explanatory variables to be affected by growth shocks. It is this type of endogeneity that the method is devised to handle.

Under the assumptions that the error term, ε, is not serially correlated and that the explanatory variables are weakly exogenous (that is, the explanatory variables are assumed to be uncorrelated with future realizations of the error term), our application of the GMM dynamic panel estimator uses the following moment conditions:

$$E\left[y_{i,t-2} \cdot \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \tag{3.5}$$

$$E\left[\boldsymbol{X}_{i,t-2} \cdot \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \tag{3.6}$$

for $t = 3,\ldots, T$. Note that we use only a limited set of moment conditions. In theory the potential set of instruments spans all sufficiently lagged observations (and, thus, grows with the number of time periods, T). However, when the sample size in the cross-sectional dimension is limited, it is recommended to use a restricted set of moment conditions in order to avoid overfitting bias (see Arellano and Bond 1998; for a detailed discussion of overfitting bias in the context of panel-data GMM estimation, see Roodman, 2007). This is our case, and therefore we use as instruments only the *first appropriate lag* of each time-varying explanatory variable. Specifically, regarding the difference regression corresponding to the periods t and $t-1$, we use the following instruments: for the variables measured as period averages – trade openness, financial depth, inflation, and per capita phones – the instrument corresponds to the average of period $t-2$; for the variables measured as initial values – per capita GDP and secondary school enrollment – the instrument corresponds to the observation at the start of period $t-1$. Likewise, to further prevent overfitting, the multiplicative interaction terms are not used as instruments.

The GMM estimator based on the conditions in Eqs. (3.5) and (3.6) is known as the difference estimator. Notwithstanding its advantages with respect to simpler panel-data estimators, the difference estimator has important statistical shortcomings. Blundell and Bond (1998) and Alonso-Borrego and Arellano (1999) show that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. Instrument weakness influences the asymptotic and small-sample performance of the difference estimator toward inefficient and biased coefficient estimates, respectively.[18]

To reduce the potential biases and imprecision associated with the difference estimator, we use an estimator that combines the regression equation in differences and the regression equation in levels into one system (developed in Arellano and Bover, 1995, and Blundell and Bond, 1998). For the equation in differences, the instruments are those presented above. For the equation in levels (Eq. (3.3)), the instruments are given by the lagged differences of the explanatory variables. These are appropriate instruments under the assumption that the correlation between the explanatory variables and the country-specific effect is the same for all time periods. That is,

$$\begin{aligned} &E\left[y_{i,t+p} \cdot \eta_i\right] = E\left[y_{i,t+q} \cdot \eta_i\right] \text{ and} \\ &E\left[\boldsymbol{X}_{i,t+p} \cdot \eta_i\right] = E\left[\boldsymbol{X}_{i,t+q} \cdot \eta_i\right] \text{ for all } p \text{ and } q. \end{aligned} \tag{3.7}$$

Using this stationarity property and the assumption of exogeneity of future growth shocks, the moment conditions for the second part of the system (the regression in levels) are given by:

$$E\left[\left(y_{i,t-1} - y_{i,t-2}\right) \cdot \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \tag{3.8}$$

$$E\left[\left(\boldsymbol{X}_{i,t-1} - \boldsymbol{X}_{i,t-2}\right) \cdot \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0. \tag{3.9}$$

As with the difference equation, the instruments are based only on the time-varying explanatory variables.[19] Note that in the levels equation, the variables that are constant over time are still present in the regression specification and are included in the estimation process; however, as mentioned above, their corresponding coefficients cannot be identified. This is because there are no available instruments for time-invariant variables based on either their own lagged changes (since they are constant) or the lagged changes of the time-varying variables (because if these changes are uncorrelated with the unobserved country-specific effect, they are also likely to be uncorrelated with the observed constant variables).

We thus use the moment conditions presented in Eqs. (3.5), (3.6), (3.8), and (3.9) and employ a GMM procedure to generate consistent and efficient estimates of the parameters of interest and their asymptotic variance–covariance (Arellano and Bond, 1991; Arellano and Bover, 1995). These are given by the following formulas:

$$\hat{\boldsymbol{\theta}} = (\bar{\mathbf{X}}'\mathbf{Z}\,\hat{\Omega}^{-1}\mathbf{Z}'\bar{\mathbf{X}})^{-1}\bar{\mathbf{X}}'\mathbf{Z}\,\hat{\Omega}^{-1}\mathbf{Z}'\bar{\mathbf{y}} \tag{3.10}$$

$$\text{AVAR}\left(\hat{\boldsymbol{\theta}}\right) = \left(\bar{\mathbf{X}}'\mathbf{Z}\,\hat{\Omega}^{-1}\mathbf{Z}'\bar{\mathbf{X}}\right)^{-1} \tag{3.11}$$

where $\boldsymbol{\theta}$ is the vector of parameters of interest (α, β); $\bar{\mathbf{y}}$ is the dependent variable stacked first in differences and then in levels; $\bar{\mathbf{X}}$ is the explanatory-variable matrix including the lagged-dependent variable $(y_{t-1}, \mathbf{X})$ stacked first in differences and then in levels; $\mathbf{Z}$ is the matrix of instruments derived from the moment conditions; and Ω is a consistent estimate of the variance–covariance matrix of the moment conditions.[20]

[18] An additional problem with the simple difference estimator involves measurement error: differencing may exacerbate the bias stemming from errors in variables by decreasing the signal-to-noise ratio (see Griliches and Hausman, 1986).

[19] The timing of the instruments is analogous to that used for the difference regression: for the variables measured as period averages, the instruments correspond to the difference between $t-1$ and $t-2$; and for the variables measured at the start of the period, the instruments correspond to the difference between t and $t-1$.

[20] Arellano and Bond (1991) suggest the following two-step procedure to obtain consistent and efficient GMM estimates. First, assume that the residuals, $\varepsilon_{i,t}$, are independent and homoskedastic both across countries and over time; this assumption corresponds to a specific weighting matrix that is used to produce first-step coefficient estimates. Second, construct a consistent estimate of the variance–covariance matrix of the moment conditions with the residuals obtained in the first step, and then use this matrix to re-estimate the parameters of interest (that is, second-step estimates).

Table 1
Economic growth and the interaction between openness and other economic reforms.

	Interaction of openness with				
	[1] Benchmark: no interactions	[2] Human capital investment	[3] Financial depth	[4] Inflation	[5] Public infrastructure
Control variables					
Initial GDP per capita (in logs)	−2.9072**	−3.1448**	−3.0687**	−2.9852**	−3.2507**
	0.20	0.25	0.21	0.22	0.23
Initial human capital investment	0.5700**	−1.4065**	0.6477**	0.6561**	0.5836**
(secondary enrollment, in logs)	0.08	0.40	0.10	0.09	0.09
Financial depth (private domestic	1.4455**	1.2810**	−0.0181	1.4393**	1.2239**
credit/GDP, in logs)	0.12	0.11	0.29	0.12	0.12
Inflation (deviation of inflation rate	−0.3318**	−0.2858**	−0.3558**	0.0223	−0.2865**
from 3%, in logs)	0.09	0.08	0.09	0.22	0.08
Public infrastructure (main telephone	1.4412**	1.6421**	1.5460**	1.4240**	0.7407**
lines per capita, in logs)	0.12	0.16	0.13	0.13	0.16
Openness					
Trade openness (TO) (structure-adjusted	0.6830**	−2.1669**	−1.1351**	0.9805**	2.7098**
trade volume/GDP, in logs)	0.16	0.56	0.34	0.26	0.41
Interactions					
TO*initial human capital investment		0.9312**			
		0.17			
TO*financial depth			0.6155**		
			0.11		
TO*inflation				−0.1843*	
				0.11	
TO*public infrastructure					0.4664**
					0.09
Period shifts					
Intercept	25.7164**	35.1080**	31.5844**	25.4520**	26.1121**
– 66–70 period shift	−0.3884**	−0.3499**	−0.2904**	−0.3805**	−0.3025**
– 71–75 period shift	−0.7112**	−0.7357**	−0.6384**	−0.7391**	−0.7413**
– 76–80 period shift	−1.4873**	−1.5319**	−1.4169**	−1.5309**	−1.5371**
– 81–85 period shift	−3.6674**	−3.6962**	−3.5926**	−3.7050**	−3.6809**
– 86–90 period shift	−3.1514**	−3.3320**	−3.1925**	−3.2184**	−3.3622**
– 91–95 period shift	−3.6727**	−4.0375**	−3.8051**	−3.7046**	−4.1141**
– 96–00 period shift	−4.0603**	−4.4793**	−4.2140**	−4.0693**	−4.5525**
Countries/observations	82/626	82/626	82/626	82/626	82/626
Specification tests (*p*-values)					
– Full Hansen test	0.45	0.51	0.45	0.44	0.55
– Incremental Hansen test	0.28	0.32	0.31	0.31	0.38
– 2nd order serial correlation test	0.19	0.17	0.21	0.21	0.19

Cross-country panel data consisting of non-overlapping 5-year averages spanning 1960–2000.
Estimation method: GMM system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).
Dependent variable: Growth rate of real GDP per capita.
Numbers below coefficients are the corresponding robust standard errors. * (**) denotes statistical significance at the 10 (5) percent level.
Source: Authors' calculations.

The consistency of the GMM estimators depends on whether lagged values of the explanatory variables are valid instruments in the growth regression. We address this issue by considering three specification tests. The first two are Hansen tests of overidentifying restrictions and test the validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The first one tests the validity of the full set of instruments, and the second one focuses on the additional instruments that are introduced in the levels equations (thereby testing the stationarity assumption on which they are based). They are called the Full Hansen test and the Incremental Hansen test, respectively. In both cases, failure to reject the null hypothesis gives support to the model.

The third test examines whether the original error term (that is, $\varepsilon_{i,t}$ in Eq. (3.2))is serially correlated. The model is, therefore, supported when the null hypothesis is not rejected. In the system specification, we test in fact whether the first-differenced error term (that is, the residual of the equation in differences) is second-order serially correlated. First-order serial correlation of the differenced error term is expected even if the original error term (in levels) is uncorrelated, unless the latter follows a random walk. Second-order serial correlation of the differenced residual indicates that the original error term is serially correlated and follows a moving average process of at least order one. This would reject the appropriateness of the proposed instruments (and would call for higher-order lags to be used as instruments).

3.3. Results

Regression results are presented in Tables 1 and 2. Table 1 shows the results of the basic regression with no interaction terms (column 1) and the results of the regressions where openness is interacted with time-varying variables (columns 2–5). These variables represent areas where economic reform has been especially active; they are human capital investment, financial depth, macroeconomic price instability, and public infrastructure, respectively. Table 2 shows the regression results where openness is interacted with time-invariant variables. They represent institutional and regulatory areas where reform – often called of second generation – has been most sluggish. They are indices of governance, labor market flexibility, firm entry flexibility, and firm exit flexibility. We treat them as constant per country because their underlying institutional characteristics vary little over time and, partly reflecting this, there is quite limited data on their time dimension.[21]

[21] The ICRG governance index is available since the mid 1980s and shows some time variation. Given that we are forced to assume that its value was the same in the 1960s and 1970s as in the mid 1980s, we consider that its growth effect cannot be estimated separately from that of the unobserved fixed effect, as is the case with the other institutional variables that are completely constant over time.

Table 2
Economic growth and the interaction between openness and institutional/regulatory reforms.

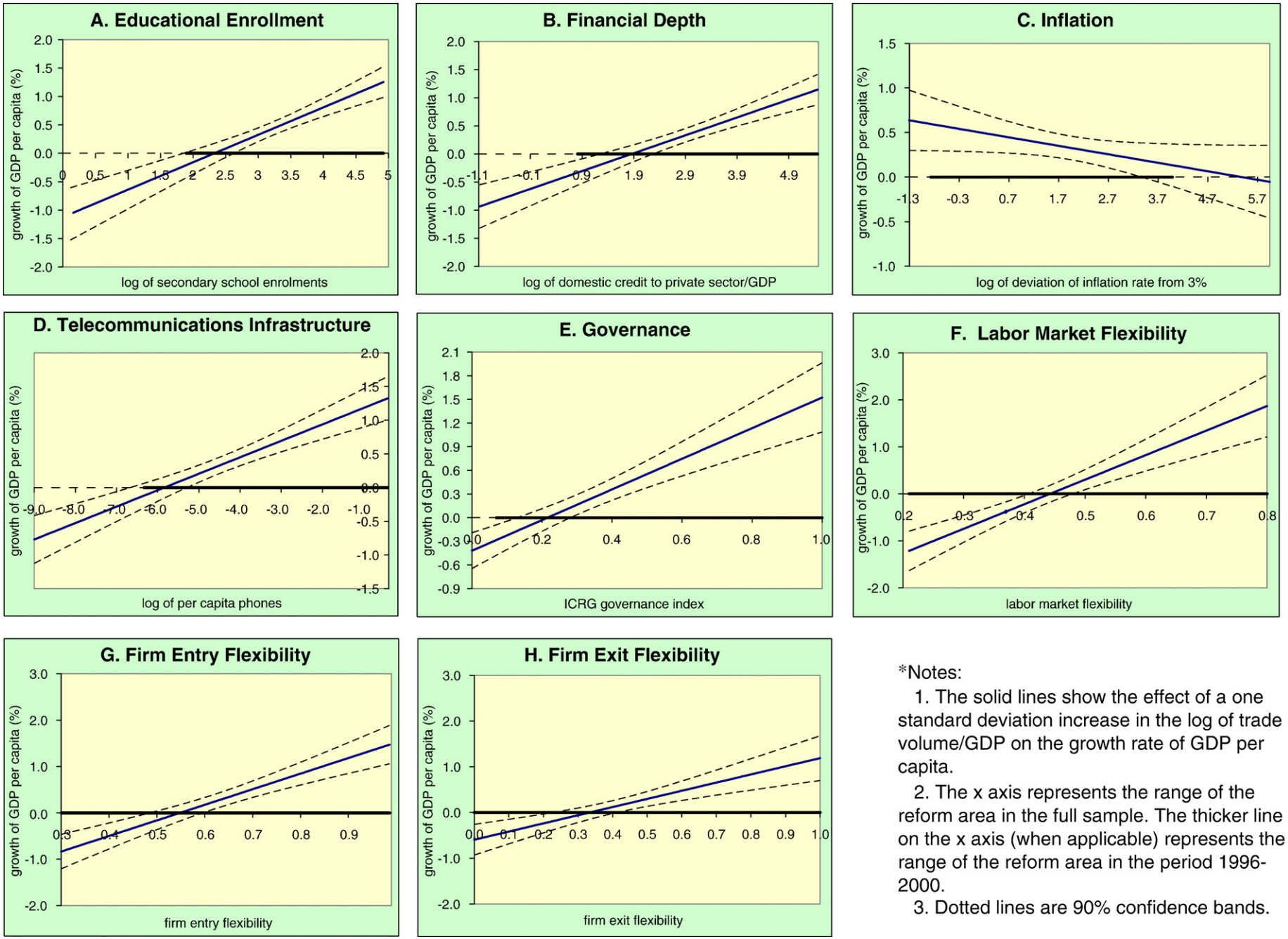
	Interaction of openness with			
	[1] Governance	[2] Labor market flexibility	[3] Firm entry flexibility	[4] Firm exit flexibility
Control variables				
Initial GDP per capita (in logs)	−3.4667**	−3.7634**	−2.8265**	−3.9013**
	0.31	0.28	0.22	0.19
Initial human capital investment (secondary	0.7927**	0.9473**	0.8826**	0.4966**
enrollment, in logs)	0.14	0.13	0.12	0.14
Financial depth (private domestic credit/GDP, in logs)	1.0704**	1.4202**	1.2714**	1.8623**
	0.16	0.14	0.14	0.17
Inflation (deviation of inflation rate from 3%, in logs)	−0.3409**	−0.3955**	−0.3495**	−0.1667*
	0.11	0.10	0.10	0.10
Public infrastructure (main telephone lines	1.5955**	1.7080**	1.4617**	1.5484**
per capita, in logs)	0.14	0.15	0.13	0.14
Openness				
Trade openness (TO) (structure-adjusted trade	−0.8087**	−4.4559**	−3.6171**	−1.1481**
volume/GDP, in logs)	0.27	0.90	0.66	0.40
Interactions				
TO*governance (governance: index from	3.7494**			
ICRG, 0–1)	0.71			
TO*labor market flexibility (labor: index		10.0766**		
from DB, 0.21–0.80)		2.02		
TO*firm entry flexibility (entry: index from			7.0049**	
DB, 0.25–0.94)			1.10	
TO*firm exit flexibility (exit: index from DB, 0–1)				3.4428**
				0.91
Period shifts				
Intercept	33.5171**	42.3240**	35.2881**	34.7012**
– 66–70 period shift	−0.4124**	−0.1939	−0.4853**	−0.1828
– 71–75 period shift	−0.8035**	−0.7224**	−0.9301**	−0.8019**
– 76–80 period shift	−1.5396**	−1.7457**	−1.7918**	−1.6353**
– 81–85 period shift	−3.7326**	−3.9127**	−4.0290**	−3.7447**
– 86–90 period shift	−3.3710**	−3.4950**	−3.6753**	−3.2017**
– 91–95 period shift	−4.2223**	−3.9812**	−4.3543**	−3.7662**
– 96–00 period shift	−4.6577**	−4.4113**	−4.6863**	−4.1019**
Countries/observations	82/626	79/602	81/621	78/596
Specification tests (*p*-values)				
– Full Hansen test	0.56	0.59	0.61	0.35
– Incremental Hansen test	0.39	0.55	0.23	0.18
– 2nd. order serial correlation test	0.17	0.36	0.18	0.26

Cross-country panel data consisting of non-overlapping 5-year averages spanning 1960–2000.
Estimation method: GMM system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).
Dependent variable: Growth rate of real GDP per capita.
Numbers below coefficients are the corresponding robust standard errors. * (**) denotes statistical significance at the 10 (5) percent level.
Our measures of institutional and regulatory reform do not vary, or vary little, over time. Their direct impact on growth cannot be separated from that of the country-specific effect; however, we include them in the levels equations.
Source: Authors' calculations.

The basic regression (Table 1, Col. 1) shows results consistent with the previous empirical literature. Initial GDP per capita carries a significantly negative coefficient, commonly interpreted as evidence of conditional convergence. The proxies of human capital investment, financial depth, and public infrastructure have positive and significant coefficients, denoting their beneficial impact on economic growth. Inflation, on the other hand, carries a negative coefficient, indicating the harmful consequence of macroeconomic price instability. Trade openness is also a significant explanatory variable; as in other studies that rely on the cross-country variation of within-country changes, trade openness is found to have a positive impact on economic growth. Since in this basic specification only linear effects are allowed, the estimated openness impact on growth is an average effect; below we attempt to uncover what is behind this average.

The period shifts indicate that the international trend in economic growth experienced a declining trend over 1960–2000, resulting in less favorable external conditions in the 1980s and 1990s than in the previous decades. Finally, regarding the specification tests, the Hansen and serial correlation tests indicate that the null hypothesis of correct specification cannot be rejected, lending support to our estimation results. This is also the case for the remaining exercises presented below, and we only mention it here in order to avoid redundancy.

Table 1 also shows the regression results that consider interaction effects between openness and the time-varying variables (Cols. 2–5). An interesting pattern of reform complementarity emerges: the coefficients on the interaction between the trade volume ratio and each of the country characteristics are statistically significant and with the correct sign, that is positive for the variables whose increase indicates progress and negative for the variable (inflation) whose decline denotes improvement. This indicates that the growth effect of an increase in openness depends positively on the progress made in each of these areas. That is, more openness results in a larger increase in economic growth when the investment in human capital is stronger, financial markets are deeper, price inflation is lower, and public infrastructure is more readily available. One possible explanation for these results is related to the competitiveness of domestic firms in international markets: when domestic firms find a better educated labor force, a stable macroeconomic environment, and less costly credit and communications, they are able to compete with foreign firms and expand their markets effectively.



*Notes:

1. The solid lines show the effect of a one standard deviation increase in the log of trade volume/GDP on the growth rate of GDP per capita.
2. The x axis represents the range of the reform area in the full sample. The thicker line on the x axis (when applicable) represents the range of the reform area in the period 1996-2000.
3. Dotted lines are 90% confidence bands.

Fig. 2. Growth effect of trade openness as a function of complementary reforms.

Table 3
Economic growth and the interaction between openness, reforms, and income.

	Interaction of openness with				
	[1] Benchmark	[2] Human capital investment	[3] Financial depth	[4] Inflation	[5] Public infrastructure
TO*initial GDP per capita	0.8147**	0.4251*	0.3637	0.7090**	−1.1547**
	0.19	0.25	0.28	0.20	0.49
TO*initial human capital investment		0.4660*			
		0.25			
TO*financial depth			0.3694**		
			0.16		
TO*inflation				−0.0559	
				0.12	
TO*public infrastructure					0.9759**
					0.22
Countries/observations	82/626	82/626	82/626	82/626	82/626
Specification tests (*p*-values)					
– Full Hansen test	0.62	0.49	0.48	0.48	0.56
– Incremental Hansen test	0.49	0.28	0.35	0.36	0.41
– 2nd. order serial correlation test	0.18	0.19	0.21	0.20	0.17

	Interaction of openness with			
	[6] Governance	[7] Labor market flexibility	[8] Firm entry flexibility	[9] Firm exit flexibility
TO*initial GDP per capita	0.4183	0.3303*	0.2009	0.9491**
	0.28	0.20	0.31	0.36
TO*governance (governance: index from ICRG, 0 – 1)	2.1224**			
	0.93			
TO*labor market flexibility (labor: index from DB, 0.21–0.80)		9.7984**		
		1.68		
TO*firm entry flexibility (entry: index from DB, 0.25–0.94)			5.2071**	
			2.02	
TO*firm exit flexibility (exit: index from DB, 0–1)				−1.9150
				1.22
Countries/observations	82/626	79/602	81/621	78/596
Specification tests (*p*-values)				
– Full Hansen test	0.52	0.41	0.61	0.58
– Incremental Hansen test	0.36	0.35	0.24	0.33
– 2nd. order serial correlation test	0.18	0.34	0.18	0.33

Cross-country panel data consisting of non-overlapping 5-year averages spanning 1960–2000.
Estimation method: GMM system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).
Dependent variable: Growth rate of real GDP per capita capita.
Numbers below coefficients are the corresponding robust standard errors. * (**) denotes statistical significance at the 10 (5) percent level.
Each column in the table is part of a larger regression which includes the same control variables as Tables 1 and 2 but that we do not present here for the sake of succinctness.
Source: Authors' calculations.

Table 2 shows the growth regression results when openness is interacted with the proxies of institutional and regulatory reform. Interestingly, as in the results related to time-varying variables, we observe a pattern of complementarity between openness and other reforms: the estimated coefficients on the interaction between the trade volume ratio and, in turn, the proxies for governance, labor market flexibility, and firm entry and firm exit flexibility are positive and statistically significant. The beneficial impact of an increase in trade openness on economic growth is larger when society has a more efficient, accountable, and honest government and where the rule of law is more respected. Likewise, the positive growth effect of trade opening is stronger when flexible labor markets make it easier for domestic firms to transform and adjust to changing environments, particularly those in highly competitive foreign markets. Our results also point out the importance of unrestricted firm renewal in order for trade opening to have a positive growth impact, regarding both the entry and exit margins.

The preceding discussion focuses on the interaction terms; however, in order to ascertain whether the *total* impact of a change in openness leads to higher or lower growth, we need to consider the coefficients on both the interaction term and the openness variable itself (taking as given the initial level of income and the remaining explanatory variables). Since the total impact depends on the values of the variables with which openness is interacted, it is not really informative to provide a single summary measure of the effect. Instead, it may be best to show how the growth effect of a change in openness varies for different levels of the other country characteristics. We do so in Fig. 2. Specifically, this figure presents the total effect on economic growth of a one-standard-deviation change in the openness measure for each value that a given complementary reform can take in the sample.[22] Since only simple interaction effects are considered (see Eq. (3.2)), the growth effect of openness can be expressed as a linear function of each complementary reform. In addition to the growth effects based on the coefficient point estimates, the figure shows the corresponding 90% confidence bands (constructed from the estimated variance–covariance matrix of the corresponding parameters).[23] Fig. 2 has eight panels, each corresponding to a country

[22] The standard deviation in the openness measure is calculated over the largest regression sample, which corresponds to 626 panel observations (in 82 countries).

[23] From our regression model, the growth effect of openness, given initial per capita GDP, is given by,

$$\Delta\text{Growth} = (\beta_{\text{OPEN}} + B_{\text{INT}}\text{REF})\Delta\text{Openness}$$

where β_{OPEN} and β_{INT} are, respectively, the estimated regression coefficients on openness and on the interaction between openness and a given complementary reform variable (REF). Note that ΔOpenness is an arbitrary constant (set to equal one sample standard deviation of the openness measure) and REF follows a fixed set of values (and can thus be treated as a constant at any given point along its sample range). Then, the confidence intervals can be constructed from the following expression for the variance of the growth effect,

$$Var[\Delta\text{Growth}] = \left\{Var(\beta_{\text{OPEN}}) + \text{REF}^2 Var(\beta_{\text{INT}}) + 2\text{REFCov}(\beta_{\text{OPEN}}, \beta_{\text{INT}})\right\}\{\Delta\text{Openness}\}^2$$

where the variances and covariances of the estimated coefficients are obtained from our panel estimation method.

Table 4
Robustness to estimation method.

	[1] OLS pooled	[2] GMM one-step	[3] GMM restricted var–covariance	[4] GMM Windmeijer correction
Control variables				
Initial GDP per capita (in logs)	−2.2792**	−3.8707**	−3.2445**	−3.7634**
	0.33	0.82	1.66	0.77
Initial human capital investment (secondary enrollment, in logs)	0.8816**	0.9713*	0.8464	0.9473*
	0.21	0.56	0.84	0.53
Financial depth (private domestic credit/GDP, in logs)	0.6321**	1.5515**	0.4894	1.4202**
	0.18	0.41	0.98	0.42
Inflation (deviation of inflation rate from 3%, in logs)	−0.6685**	−0.3699	−1.2471	−0.3955
	0.12	0.27	0.80	0.31
Public infrastructure (main telephone lines per capita, in logs)	0.9149**	1.6815**	1.6109*	1.7080**
	0.19	0.39	0.92	0.41
Openness				
Trade openness (TO) (structure-adjusted trade volume/GDP, in logs)	−2.3728**	−5.2888**	−17.4607**	−4.4559*
	0.68	2.04	8.55	2.51
Interactions				
TO*labor market flexibility (labor: index from DB, 0.21–0.80)	4.8620**	12.0391**	36.2421**	10.0766*
	1.26	4.70	17.15	5.59
Period shifts				
Intercept	26.3823**	43.8661**	70.1772**	42.3240**
– 66–70 period shift	−0.2341	−0.3325	−0.4250	−0.1939
– 71–75 period shift	−0.1267	−0.7023	0.1669	−0.7224
– 76–80 period shift	−0.9067**	−1.7602**	−0.7495	−1.7457**
– 81–85 period shift	−3.0197**	−3.9954**	−3.0965**	−3.9127**
– 86–90 period shift	−2.2709**	−3.4652**	−2.6596**	−3.4950**
– 91–95 period shift	−2.7084**	−4.0465**	−3.2622**	−3.9812**
– 96–00 period shift	−3.1063**	−4.6677**	−4.2517**	−4.4113**
Countries/observations	79/602	79/602	79/602	79/602
Specification tests (*p*-values)				
– Full Hansen test	n.a.	0.59	0.40	0.59
– Incremental Hansen test	n.a.	0.55	0.79	0.55
– 2nd. order serial correlation test	n.a.	0.35	0.51	0.36

Cross-country panel data consisting of non-overlapping 5-year averages spanning 1960–2000.
Estimation method: Various.
Dependent variable: Growth rate of real GDP per capita.
Numbers below coefficients are the corresponding robust standard errors. * (**) denotes statistical significance at the 10 (5) percent level.
Source: Authors' calculations.

characteristic (or complementary reform variable) with which openness is interacted. For time-varying variables, the range of values corresponding to the latest period (1996–2000) is found towards the higher values of the full range; since for current policy analysis the latest values are the most relevant, we highlight their range in the corresponding panel.[24]

For all reform variables, the total growth impact of openness is positive on average but it changes from negative to positive as progress occurs in complementary areas of reform. In principle, an increase in openness could bring a reduction in economic growth if a given complementary area is not sufficiently advanced. For educational enrollment, financial development, macroeconomic stability, public infrastructure, and governance, our results indicate that only the very backward countries may experience a decline in growth after trade openness. However, focusing on labor market flexibility and firm entry/exit flexibility, there may be countries that would not benefit from opening their markets to international trade. It can then be argued that, in order to make trade openness good for growth, the most *urgent* reforms are related to labor markets and firm renewal. This is not to say, however, that countries would not benefit more from trade openness if they also improved their educational attainment, financial depth, macroeconomic stability, public infrastructure, and overall governance.

So far we have considered only linear interactions between openness and other variables one at a time. A richer specification would allow for both non-linear interactions and interactions with multiple variables at the same time. The problem with richer specifications, however, is that the possibilities are almost endless. Our limited sample, demanding econometric methodology, and the multicollinearity among growth determinants prevent us from exploring a full set of interactions. However, we can make some progress in this regard by expanding our specification to include the interaction between openness and initial income in each of the regressions studied above. This exercise links our results to the literature discussed in the introduction, which finds that the growth effect of openness depends on the countries' level of income. That literature argues that income is a good proxy for overall development and is thus strongly related to the social and economic conditions that improve the beneficial impact of openness.[25] Therefore, in this expanded regression specification, the coefficient on the interaction between openness and each complementary reform would reveal its *additional* (or marginal) effect with respect to that of overall development.

Table 3 presents the main results of the expanded regression specification. In the benchmark (column 1), only the openness–initial income interaction is considered; it carries a significantly positive coefficient, as expected and predicted by previous literature. However, once we add the interactions between openness and specific complementary reforms, the openness–initial income interaction remains significantly positive in only half of the cases. This indicates that part of the initial income effect is captured by specific reforms, most notably public infrastructure and governance. More importantly for our purposes, six out of the eight interactions between openness and

[24] In the latest period, 1996–2000, the point estimate of the marginal effect of reform on growth is negative for 2.5% of the countries when the complementary reform is human capital investment, 5% when financial depth, 0% when inflation stabilization, 2.5% when public infrastructure, 9% when governance, 39% when labor market flexibility, 16% when firm entry flexibility, and 21% when firm exit flexibility.

[25] We find confirmation for this claim in the fact that, in our sample, initial per capita GDP has a correlation of 0.9 with the first principal component of our complementary reforms, meaning that income represents well what is common among these development variables.

Table 5
Robustness to openness measures and geographic controls.

	[1] Add latitude	[2] Add distance	[3] Add landlocked	[4] Trade openness at beginning of period	[5] Import duties
Control variables					
Initial GDP per capita (in logs)	−4.0004**	−3.7495**	−3.7359**	−3.2761**	−4.8733**
	0.28	0.26	0.33	0.22	0.25
Initial human capital investment (secondary enrollment, in logs)	0.9825**	0.8002**	1.0313**	1.4112**	0.7870**
	0.13	0.12	0.16	0.13	0.28
Financial depth (private domestic credit/GDP, in logs)	1.5547**	1.4735**	1.5764**	1.5999**	1.2735**
	0.16	0.15	0.15	0.12	0.16
Inflation (deviation of inflation rate from 3%, in logs)	−0.4221**	−0.4137**	−0.3510**	−0.4198**	−0.4790**
	0.13	0.14	0.12	0.10	0.13
Public infrastructure (main telephone lines per capita, in logs)	1.7514**	1.7763**	1.6056**	1.1257**	2.3259**
	0.16	0.15	0.16	0.11	0.15
Openness					
Trade openness (TO) (structure-adjusted trade volume/GDP, in logs)	−5.5413**	−7.1321**	−4.4903**	−5.0412**	
	0.86	1.04	1.02	0.65	
Import duties (proportional variation with respect to country mean)					1.3777**
					0.42
Interactions					
TO*labor market flexibility (labor: index from DB, 0.21–0.80)	11.1730**	10.6967**	10.5738**	10.2286**	
	2.13	1.70	2.14	1.39	
TO*geographic variable	0.0194	0.2531**	0.1512		
	0.01	0.08	0.52		
Import duties*labor market flexibility					−2.6611**
					0.66
Period shifts					
Intercept	46.4549**	47.3085**	41.2545**	24.9103**	40.0399**
– 66–70 period shift	−0.3007**	−0.2738**	−0.3142**	−0.1825	3.5385**
– 71–75 period shift	−0.7482**	−0.6182**	−0.8583**	−0.6067**	2.9476**
– 76–80 period shift	−1.8205**	−1.5442**	−1.9402**	−1.7223**	2.5086**
– 81–85 period shift	−3.9854**	−3.8206**	−4.0975**	−3.8200**	0.5757**
– 86–90 period shift	−3.6970**	−3.3634**	−3.6891**	−3.3037**	0.9129**
– 91–95 period shift	−4.1286**	−3.8215**	−4.1394**	−3.5638**	0.5025**
– 96–00 period shift	−4.6413**	−4.4415**	−4.6000**	−4.1153**	n.a.
Countries/observations	79/602	79/602	79/602	79/600	78/387
Specification tests (*p*-values)					
– Full Hansen test	0.57	0.61	0.56	0.44	0.54
– Incremental Hansen test	0.57	0.58	0.50	0.30	0.42
– 2nd. order serial correlation test	0.31	0.37	0.34	0.30	0.50

Cross-country panel data consisting of non-overlapping 5-year averages spanning 1960–2000.
Estimation method: GMM system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).
Dependent variable: Growth rate of real GDP per capita.
Numbers below coefficients are the corresponding robust standard errors. * (**) denotes statistical significance at the 10 (5) percent level.
Source: Authors' calculations.

complementary reforms carry significantly positive coefficients.[26] Therefore, these variables have the effect of increasing the growth response to openness by either incorporating (e.g., financial development) or complementing (e.g., education) the effect of per capita income as a summary measure of economic development. In the latter group, we also find labor market flexibility. Since it does not necessarily improve with per capita income, labor market flexibility retains its strong marginal impact on the openness-growth link. In fact, its interaction coefficient has basically the same magnitude whether or not the income interaction is included in the same regression.

The exercise just presented examines the robustness of the reform interaction effects to the inclusion of an income interaction. In what follows, we continue the robustness analysis as it relates to other estimation methods, alternative openness measures, and additional controls. For this purpose, we concentrate on the regression specification that features the interaction between openness and labor market flexibility. Conducting the robustness analysis on all regression specifications would lead to an unmanageably large set of results. Moreover, we focus on labor market flexibility because it is considered explicitly in our theoretical model and because it presents some policy-relevant features according to our empirical results: it is one of the most urgent areas of complementary reform for countries undergoing trade liberalization and is not necessarily included in the general process of economic development.

Table 4 presents robustness exercises related to the estimation method. The first column shows the results obtained using OLS with pooled (time-series, cross-country) observations. This is the most basic estimator as it ignores both the presence of unobserved country-specific effects and the possibility of endogenous regressors. On the other hand, it has the advantages of simplicity and non-reliance on possibly questionable identification assumptions (see Hauk and Wacziarg, 2005). Despite these differences, the pattern of signs and significance regarding trade openness itself and its interaction with labor market flexibility is the same as in our benchmark regression.

Columns 2–4 present estimates obtained using variations of the GMM method. As explained above, our benchmark results are obtained using the standard GMM system estimator, which through a two-step procedure obtains consistent and efficient estimates under the conditions of large enough samples (in the cross-sectional dimension) and appropriate instruments. When these conditions are not fully met, however, the two-step procedure may produce biased estimates; in particular, it may lead to underestimation of standard errors (see Arellano and Bond, 1998, and Windmeijer, 2005).

[26] The exceptions, inflation and firm-entry flexibility, do not carry statistically significant coefficients.

In order to consider this possibility, we use three alternative GMM system estimators. In column 2, we present the results obtained under the one-step procedure. This uses as weight matrix for the GMM a variance–covariance consistent with a homoskedastic error term in the levels regression (see footnote 7). For the results in column 3, we use a GMM procedure that restricts the variance–covariance of moment conditions not to vary across periods. This results from substituting the assumption that the average (across periods) of moment conditions for a particular instrument be equal to zero for the assumption, conventional but more restrictive, that each of the individual moment conditions be equal to zero.[27] At the cost of the reduced efficiency, this procedure uses fewer instruments thus accommodating cases when the unrestricted variance–covariance is too large for estimation and inversion given both a large number of explanatory variables and the presence of several time-series periods. In column 4, we present the results that apply the correction proposed in Windmeijer (2005) for the standard errors of the estimated coefficients. This procedure is rather new and not fully sanctioned in the literature; moreover, as recognized in the paper itself, it may produce abnormally large standard errors under certain conditions. Indeed, the Windmeijer standard errors are considerably larger than those of our benchmark. Nevertheless, the coefficients on all regressors, except inflation, remain statistically significant (albeit with higher *p*-values). Considering the results obtained with the alternative GMM methods, we conclude that all three of them coincide fully with the benchmark regarding the sign and statistical significance of the coefficients on trade openness and its interaction with labor market flexibility.

Table 5 considers robustness checks with respect to geographic controls and alternative openness measures. The paper emphasizes the importance of complementary policies and institutions for the effect that trade openness can have on growth. There are, however, other country characteristics that have been shown to influence the level of trade openness and which could also have an effect on its link with growth. Such is the case of geographic variables, and here we consider three of them: the country's latitude, its average distance to major markets (France, Japan, and the U.S.), and whether it is landlocked or not. We add their interaction with openness to the benchmark specification, and the results are presented in columns 1–3, respectively. The first point to notice is that the basic coefficients are remarkably robust to the inclusion of geographic variables (part of their level effect may have already been captured by the country-specific effect). In particular, the coefficient on the interaction between openness and labor market flexibility remains of the same sign, same statistical significance, and virtually same magnitude. The second point is that only the interaction with distance to major markets carries a statistically significant coefficient: the farther away the country, the more it benefits from an increase in openness.

Table 5 also considers robustness to alternative openness measures. Column 4 uses the adjusted trade ratio measured not as a period average as in the benchmark but at the start of the period. Although this reduces the information content involved in contemporaneous values, initial trade openness may be subject to less endogeneity concerns. The results are basically the same as under the benchmark. Finally, column 5 uses a policy measure of openness rather than an outcome measure based on the trade ratio. Specifically, we use the import duty data of DeJong and Ripoll (2006); in order to isolate the within-country variation of the data, we compute the policy measure for each period as the proportional deviation from the corresponding country mean. The results are qualitatively similar to those of the benchmark. Since higher import duties correspond to lower openness, the respective coefficients are expected to reverse signs. This is exactly the case: import duty by itself carries a positive coefficient and its interaction with labor market flexibility a negative one, statistically significant in both cases. As in the benchmark, the level of labor market flexibility at which the growth effect of lower import duties turns positive is in the middle of the range.

[27] This uses the "collapse" option of xtabond2 for STATA.2.

4. Concluding remarks

As discussed in the Introduction, previous empirical evidence on the impact of trade openness on economic growth has failed to reveal undisputed beneficial effects. Second-best theory, however, indicates that such a failure should not have come as a surprise. In fact, we present a theoretical example in which the removal of barriers to trade needs to be accompanied by complementary reforms in non-trade areas if it is to improve productive efficiency and growth.

Our empirical work finds that trade openness is associated with faster growth generally but, more importantly, that this positive effect can be significantly enhanced if some complementary reforms are undertaken. We find these interactions to be economically and statistically significant, and robust to changes in specification, econometric method, and openness measure.

Our estimates indicate that, while trade openness may potentially reduce growth, it is likely to have boosted growth for most countries in recent periods because of their progress in complementary reforms. Thus our results not only provide support for freer trade but also for the benefits of comprehensive reforms. In particular, our findings indicate that "second generation" reforms not only have direct benefits but may also have indirect ones, by allowing a country to take fuller advantage of trade openness. This is a significant argument in the ongoing debate about the gains from furthering reform in developing countries.

Appendix A. Sample of countries

I. Industrial economies (22 countries)		
Australia	Germany	Norway
Austria	Greece	Portugal
Belgium	Iceland	Spain
Canada	Ireland	Sweden
Denmark	Italy	Switzerland
Finland	Japan	United Kingdom
France	Netherlands	United States
	New Zealand	
II. Latin America and the Caribbean (21 countries)		
Argentina	Ecuador	Nicaragua
Bolivia	El Salvador	Panama
Brazil	Guatemala	Paraguay
Chile	Haiti	Peru
Colombia	Honduras	Trinidad and Tobago
Costa Rica	Jamaica	Uruguay
Dominican Republic	Mexico	Venezuela, RB
III. Asia (12 countries)		
Bangladesh	Korea, Rep.	Philippines
China	Malaysia	Singapore
India	Pakistan	Sri Lanka
Indonesia	Papua New Guinea	Thailand
IV. Middle East and North Africa (9 countries)		
Algeria	Israel	Syria, Arab Rep.
Egypt, Arab Rep.	Jordan	Tunisia
Iran, Islamic Rep.	Morocco	Turkey
V. Sub-Saharan Africa (18 countries)		
Burkina Faso	Ghana	Senegal
Botswana	Kenya	Sierra Leone
Cote d'Ivoire	Madagascar	South Africa
Congo, Rep.	Malawi	Togo
Congo, Democratic Rep.	Niger	Zambia
Gambia, The	Nigeria	Zimbabwe

Appendix B. Definitions and sources of variables used in regression analysis

Variable	Definition and construction	Source
GDP per capita growth	Log difference of real GDP per capita	Authors' construction using Summers and Heston (1991) and The World Bank (2003a,b).
Initial GDP per capita	Initial value of ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US$.	Authors' construction using Summers and Heston (1991) and The World Bank (2003a,b).
Education	Ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to that level of education. The observations correspond to the year prior to the start of each 5-year period.	Easterly and Sewadeh (2002) and The World Bank (2003a,b).
Public infrastructure	Telephone mainlines are telephone lines connecting a customer's equipment to the public switched telephone network. Data are presented in per capita terms.	Canning (1998), International Telecommunications Union.
Governance	First principal component of four indicators (prevalence of law and order, quality of bureaucracy, absence of corruption, and accountability of public officials).	International Country Risk Guide (ICRG), Political Risk Services (2003). www.icrgonline.com
Financial depth	Ratio of domestic credit claims on private sector to GDP	Author's calculations using data from IFS, the publications of the Central Bank and PWD. The method of calculations is based on Beck et al. (2000).
Trade openness	Residual of a regression of the log of the ratio of exports and imports (in 1995 US$) to GDP (in 1995 US$), on the logs of area and population, and dummies for oil exporting and for landlocked countries.	Easterly and Sewadeh (2002) and The World Bank (2003a,b).
Inflation rate	Absolute value of annual inflation minus 3%	Author's calculations with data from IFS.
Labor market flexibility	Weighted average of three indicators: flexibility of hiring, conditions of employment and flexibility of firing. The original index from Botero et al. has been rescaled to range between 0 and 1 and higher values indicate more flexible labor markets.	Doing Business, The World Bank Group. See Botero, Djankov, La Porta, Lopez-de-Silanes and Shleifer, "The Regulation of Labor", Quarterly Journal of Economics, 119, 1339–1382, Nov. 2004.
	The difficulty of hiring component measures i) whether term contracts can only be used for temporary tasks; ii) the maximum duration of term contracts; and iii) the ratio of the mandated minimum wage to the average value-added per working population.	http://rru.worldbank.org/doingbusiness/exploretopics/hiringfiringwork
	The rigidity of hours component measures i) whether night work is restricted; ii) whether weekend work is allowed; iii) whether the workweek consists of five-and-a-half days or more; iv) whether the workday can extend to 12 h or more; v) whether the annual paid vacation days are 21 days or less.	
	The difficulty of firing component measures i) whether redundancy is not grounds for dismissal; ii) whether the employer needs to notify the labor union or the labor ministry for firing one redundant worker; iii) whether the employer needs to notify the labor union or labor ministry for group dismissals iv) whether the employer needs approval from the labor union or labor ministry for firing one redundant worker v) whether the employer needs approval from the labor union or the labor ministry for group dismissals; vi) whether the law mandates training or replacement prior to dismissal vii) whether priority rules apply for dismissals; viii) whether priority rules apply for re-employment.	
Firm entry flexibility	Composed of four indicators:	
	1) Entry procedures: The number of different procedures that a start-up has to comply with in order to obtain a legal status, i.e. to start operating as a legal entity. The data cover (i) procedures that are always required; (ii) procedures that are generally required but that can be avoided in exceptional cases or for exceptional types of businesses.	Doing Business, The World Bank Group. See Djankov, La Porta, Lopez-de-Silanes and Shleifer, "The Regulation of Entry", Quarterly Journal of Economics, 117, 1–37, Feb. 2002. http://rru.worldbank.org/doingbusiness
	2) Entry days: The average duration estimated necessary to complete a procedure. The fastest procedure (independent of cost) is chosen. It is assumed that the entrepreneur completes the procedure in the most efficient way, ignoring the time that the entrepreneur spends in information gathering.	
	3) Entry costs: Costs associated with starting-up a business, based on the texts of the Company Law, the Commercial Code, or specific regulations. If there are conflicting sources and the laws are not completely clear, the most authoritative source is used. If the sources have the same rank the source indicating the most costly procedure is used. In the absence of express legal fee schedules, a governmental officer's estimate is taken as an official source. If several sources have different estimates, the median reported value is used. In the absence of government officer's estimates, estimates of incorporation lawyers are used instead. If these differ, the median reported value is computed. In all cases, the cost estimate excludes bribes.	
	4) Entry regulations: i) Very Low: existing regulations straightforward and applied uniformly to all businesses; regulations not much of a burden for business; corruption nearly nonexistent. ii) Low: simple licensing procedures; existing regulations relatively straightforward and applied uniformly most of the time, but burdensome in some instances; corruption possible but rare iii) Moderate: complicated licensing procedure; regulations impose substantialburden on business; existing regulations may be applied	The Index of Economic Freedom, Heritage Foundation. Based on: Economist Intelligence Unit, Country Commerce and Country Report, 2001 and 2002, U.S. Department of State, Country Commercial Guide 24 and Country Reports on Economic Policy and Trade Practices. See O'Driscoll et al. (2003).

Appendix B (*continued*)

Variable	Definition and construction	Source
	haphazardly and in some instances are not even published by the government; corruption may be present and poses minor burden on businesses iv) High: government-set production quotas and some state planning; major barriers to opening a business; complicated licensing process; very high fees; bribes sometimes necessary; corruption present and burdensome; regulations impose a great burden on business v) Very High: Government impedes the creation of new businesses; corruption rampant; regulations applied randomly	
Firm exit flexibility	Composed of three indicators: 1) A measure that documents the success in reaching the three goals of insolvency, as stated in Hart (1999). It is calculated as the simple average of the cost of insolvency (rescaled from 0 to 100, where higher scores indicate less cost), time of insolvency (rescaled from 0 to 100, where higher scores indicate less time), the observance of absolute priority of claims, and the efficient outcome achieved. A score of 100 on the index means perfect efficiency. 2) The cost of the entire bankruptcy process, including court costs, insolvency practitioners' costs, the cost of independent assessors, lawyers, accountants, etc. In all cases, the cost estimate excludes bribes. The cost figures are averages of the estimates in a multiple-choice question, where the respondents choose among the following options: 0–2%, 3–5%, 6–10%, 11–25%, 26–50%, and more than 50% of the insolvency estate value. 3) The degree to which the court drives insolvency proceedings. It is an average of three indicators: whether the court appoints and replaces the insolvency administrator with no restrictions imposed by law, whether the reports of the administrator are accessible only to the court and not creditors, and whether the court decides on the adoption of the rehabilitation plan. The index is scaled from 0 to 100, where higher values indicate more court involvement in the insolvency process.	Doing Business, The World Bank. See Djankov, Simeon, Oliver Hart, Tatiana Nenova, and Andrei Shleifer, "Efficiency in Bankruptcy", working paper, Department of Economics, Harvard University, July 2003.
Latitude	Absolute value of a country's location north or south of the equator.	CEPII. http://www.cepii.fr/anglaisgraph/bdd /distances.htm and Easterly and Sewadeh (2002) for the Democratic Republic of Congo.
Distance	Average of three bilateral distances between each country in the sample and France, Japan and USA.	CEPII. http://www.cepii.fr/anglaisgraph/bdd /distances.htm
Landlocked	Dummy variable taking the value of 1 for landlocked countries and 0 otherwise.	CEPII. http://www.cepii.fr/anglaisgraph/bdd distances.htm
Trade openness at the beginning of period	Initial value of the trade openness variable.	Authors' calculations
Import duties	Proportional variation of tariff rates (in percent) with respect to country means.	Authors' calculation using data from DeJong and Ripoll (2006)
Period-specific shifts	Time dummy variables.	Authors' construction.

Appendix C. Descriptive statistics for primary growth regressions

(a) Univariate

Variable	Mean	S.D.	Minimum	Maximum
Growth rate of GDP per capita	1.820	2.795	−10.924	13.019
Initial GDP per capita (in logs)	8.339	0.997	6.134	10.240
Secondary enrollment (in logs)	3.510	0.931	0.113	4.923
Private domestic credit/GDP (in logs)	3.311	0.888	−1.084	5.435
Inflation (in log |inf. rate − 3%|)	1.717	1.183	−1.346	5.883
Main telephone lines per capita	−3.471	1.918	−8.996	−0.327
Trade openness	2.033	0.518	0.051	3.593
Governance	0.534	0.282	0.000	1.000
Labor market flexibility	0.488	0.145	0.210	0.800
Firm entry flexibility	0.652	0.148	0.250	0.936
Firm exit flexibility	0.528	0.212	0.000	1.000

(b) Bivariate correlations between growth and determinants

Variable	Growth rate of GDP per capita	Initial GDP per capita (in logs)	Secondary enrollment (in logs)	Private domestic credit/GDP (in logs)	Inflation (in logs |inf. rate − 3%|)	Main telephone lines per capita	Trade openness	Governance	Labor market flexibility	Firm entry flexibility	Firm exit flexibility
Growth rate of GDP per capita	1.00										
Initial GDP per capita (in logs)	0.17	1.00									
Secondary 2enrollment (in logs)	0.15	0.79	1.00								
Private domestic credit/GDP (in logs)	0.26	0.73	0.59	1.00							
Inflation (in log |inf. rate − 3%|)	−0.34	−0.28	−0.09	−0.47	1.00						

Appendix C (*continued*)

(b) Bivariate correlations between growth and determinants

Variable	Growth rate of GDP per capita	Initial GDP per capita (in logs)	Secondary enrollment (in logs)	Private domestic credit/GDP (in logs)	Inflation (in logs |inf. rate − 3%|)	Main telephone lines per capita	Trade openness	Governance	Labor market flexibility	Firm entry flexibility	Firm exit flexibility
Main telephone lines per capita	0.20	0.94	0.85	0.72	−0.25	1.00					
Trade openness	0.02	−0.18	−0.12	0.05	−0.26	−0.15	1.00				
Governance	0.26	0.77	0.58	0.65	−0.38	0.76	−0.08	1.00			
Labor market flexibility	0.12	0.25	0.23	0.25	−0.25	0.25	0.22	0.43	1.00		
Firm entry flexibility	0.25	0.66	0.55	0.57	−0.37	0.64	0.06	0.67	0.52	1.00	
Firm exit flexibility	0.25	0.58	0.48	0.46	−0.27	0.61	−0.04	0.63	0.39	0.61	1.00

Data in 5-year period averages, 82 countries, 626 observations (The labor market flexibility variable has 602 observations; firm entry flexibility has 621 observations, and firm exit flexibility has 596 observations.).

References

Acemoglu, D., Zilibotti, F., 2001. Productivity differences. The Quarterly Journal of Economics 116 (2), 563–606.

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., Sayek, S., 2006. How does foreign direct investment promote economic growth? Exploring the Effects of Financial Markets on Linkages. NBER Working Paper 12522, Cambridge, MA.

Alonso-Borrego, C., Arellano, M., 1999. Symmetrically normalized instrumental-variable estimation using panel data. Journal of Business and Economic Statistics 17 (1), 36–49.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Montecarlo evidence and an application to employment equations. Review of Economic Studies 58 (2), 277–297.

Arellano, M., Bover, O., 1995. Another look at the instrumental-variable estimation of error-components models. Journal of Econometrics 68 (1), 29–52.

Arellano, M., Bond, S., 1998. "Dynamic Panel Data Estimation Using DPD98 for Gauss: a Guide for Users." Mimeo. CEMFI. ftp://ftp.cemfi.es/pdf/papers/ma/dpd98.pdf.

Banerjee, A., Newman, A., 2004. "Notes for Credit, Growth, and Trade Policy." Mimeo. MIT.

Beck, T., Demirguc-Kunt, A., Levine, R., 2000. A new database on financial development and structure. The World Bank Economic Review 14 (3), 597–605.

Bhagwati, Jagdish, Srinivasan, T.N., 1974. On reanalyzing the Harris–Todaro Model: policy rankings in the case of sector specific wages. American Economic Review 64 (3), 502–508.

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87 (1), 115–143.

Bolaky, B., Freund, C., 2004. Trade, Regulations, and Growth. World Bank Policy Research. Paper Series 3255.

Borensztein, E., De Gregorio, J., Lee, J.W., 1995. How does foreign direct investment affect economic growth? Journal of International Economics 45 (1), 115–135.

Botero, J., Djankov, S., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2004. The regulation of labor. The Quarterly Journal of Economics 119 (4), 1339–1382.

Brecher, R., 1974. Optimal commercial policy for a minimum-wage economy. Journal of International Economics 4 (2), 139–149.

Calderon, C., Loayza, N., Schmidt-Hebbel, K., 2006. External conditions and growth performance. In: Caballero, R., Calderon, C., Cespedes, L.F. (Eds.), External Vulnerability and Preventive Policies. Central Bank of Chile.

Canning, D., 1998. A database of world stocks of infrastructure, 1950–95. The World Bank Economic Review 12 (3), 529–547.

Currie, Janet, Harrison, Ann, 1997. Sharing the costs: the impact of trade reform on capital and labor in Morocco. Journal of Labor Economics 15 (3), S44–S71.

DeJong, D., Ripoll, M., 2006. Tariffs and growth: an empirical exploration of contingent relationships. The Review of Economics and Statistics 88 (4), 625–640.

Djankov, S., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2002. The Regulation of Entry. The Quarterly Journal of Economics 117 (1), 1–37.

Djankov, S., Hart, O., Nenova, T., Shleifer, A., 2003. Efficiency in Bankruptcy. Department of Economics, Harvard University. Working Paper.

Dollar, D., 1992. Outward-oriented developing economies really D grow more rapidly: evidence from 95 LDCs, 1976–85. Economic Development and Cultural Change 40 (3), 523–544.

Dollar, D., Kraay, A., 2004. Trade, growth, and poverty. Economic Journal 114 (493), F22–F49.

Easterly, W., Sewadeh, M., 2002. Global Development Network Growth Database. The World Bank, Washington, DC.

Edwards, S., 1993. Openness, trade liberalization, and growth in developing countries. Journal of Economic Literature 31 (3), 1358–1393.

Edwards, S., 1998. Openness, productivity, and growth: what do we really know? Economic Journal 108 (447), 383–398.

Eicher, T., 1999. Trade, development and converging growth rates: dynamic gains from trade reconsidered. Journal of International Economics 48 (1), 179–198.

Goldberg, Pinelopi, Pavcnik, Nina, 2003. The response of the informal sector to trade liberalization. Journal of Development Economics 72, 463–496.

Griliches, Z., Hausman, J., 1986. Errors in variables in panel data. Journal of Econometrics 31 (1), 93–118.

Grossman, G., Helpman, E., 1991. Innovation and Growth in the Global Economy. MIT Press, Cambridge, MA.

Harris, J., Todaro, M., 1970. Migration, unemployment, and development: a two-sector analysis. American Economic Review 60 (1), 126–142 (March).

Harrison, A., 1996. Openness and growth: a time-series, cross-country analysis for developing countries. Journal of Development Economics 48 (2), 419–447.

Harrison, Ann (2006). "Globalization and Poverty: An Introduction." In: Globalization and Poverty, Ann Harrison editor. NBER: U. of Chicago Press.

Hart, Oliver, 1999. Different approaches to Bankruptcy. In: Governance, Equity and Global Markets. Proceedings of the Annual Bank Conference on Development Economics in Europe, The World Bank, Oxford University Press.

Hauk, William R., Wacziarg, Romain, 2004. A Monte Carlo Study of Growth Regressions. NBER Technical Working Paper No. 296.

Helleiner, G., 1986. Outward orientation, import instability and african economic growth: an empirical investigation. In: Lall, Sanjaya, Stewart, Frances (Eds.), Theory and Reality in Development: Essays in Honor of Paul Streeten. Macmillan, London, pp. 139–153.

Holtz-Eakin, D., Newey, W., Rosen, H.S., 1988. Estimating vector autoregressions with panel data. Econometrica 56 (6), 1371–1395.

Khan, M. Ali, 1980. The Harris–Todaro hypothesis and the Hecksher–Ohlin–Samuelson trade model: a synthesis. Journal of International Economics 10, 527–547.

Kohli, I., Singh, N., 1989. Exports and growth: critical minimum effort and diminishing returns. Journal of Development Economics 30 (2), 391–400.

Lee, J., 1993. International trade, distortions, and long-run economic growth. International Monetary Fund Staff Papers 40 (2), 299–328.

Lee, H., Ricci, L., Rigobon, R., 2004. Once again, is openness good for growth? Journal of Development Economics 75 (2), 451–472.

Levine, R., Loayza, N., Beck, T., 2000. Financial intermediation and growth: causality and causes. Journal of Monetary Economics 46 (1), 31–77.

Lipsey, R., Lancaster, K., 1956. General theory of second best. Review of Economic Studies 24 (1), 11–32.

Loayza, N., Fajnzylber, P., Calderon, C., 2005. Economic Growth in Latin America and the Caribbean: Stylized Facts, Explanations, and Forecasts. The World Bank, Washington, DC.

Magee, Stephen P., 1973. Factor market distortions and trade: a survey. Oxford Economic Papers 25, 1–43 (March).

Matsuyama, K., 1992. Agricultural productivity, comparative advantage, and economic growth. Journal of Economic Theory 58 (2), 317–334.

O'Driscoll, G., Feulner, E., O'Grady, M.A., 2003. 2003 Index of Economic Freedom. The Heritage Foundation and the Wall Street Journal, Washington, DC.

Political Risk Services, 2003. International Country Risk Guide. Political Risk Services, East Syracuse, NY.

Rodríguez, F., Rodrik, D., 2001. Trade policy and economic growth: a skeptics guide to the cross-national evidence. In: Bernanke, B., Rogoff, K. (Eds.), NBER Macroeconomics Annual 2000, Vol. 15. MIT Press, Cambridge, MA, pp. 261–325.

Roodman, David, 2007. A Short Note on the Theme of Too Many Instruments. Mimeo. http://ssrn.com/abstract=1101731.

Sachs, J.D., Warner, A., 1995. Economic reform and the process of global integration. Brooking Papers on Economic Activity 1995 (1), 1–118.

Sachs, J.D., Warner, A., 1999. The big push, natural resource booms and growth. Journal of Development Economics 59 (1), 43–76.

Summers, R., Heston, A., 1991. The Penn World Table (Mark 5): an expanded set of international comparisons, 1950–1988. The Quarterly Journal of Economics 106 (2), 327–368.

Wacziarg, R., Welch, K.H., 2003. Trade Liberalization and Growth: New Evidence. NBER. Working Paper 10152.

Wacziarg, Romain, Wallack, Jessica Seddon, 2004. Trade liberalization and intersectoral labor movements. Journal of International Economics 64, 411–439.

Windmeijer, Frank, 2005. A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics 126 (1), 25–51.

World Bank, 2003a. Doing Business. The World Bank, Washington, DC.

World Bank, 2003b. World Development Indicators. The World Bank, Washington, DC.

Young, A., 1991. Learning by doing and the dynamic effects of international trade. The Quarterly Journal of Economics 106 (2), 369–405.