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ABSTRACT

We study the performance of national education systems along two important dimensions: The degree to which they help individuals develop capabilities necessary for their successful social integration (educational quality) and the degree to which they confer equal opportunities for social advancement (educational equality). To investigate how educational quality and equality relate to each other as well as to selected institutional features of national education systems and macro-economic contexts, we draw on comparative data from the International Adult Literacy Survey for 19 OECD nations and caution against the limitations of international student assessment data in speaking to these questions. Our analyses reveal a positive relationship between educational quality and equality and show that education systems with a lower degree of institutional differentiation not only provide more educational equality but are also marked by higher levels of educational quality. While the latter association is partly driven by other institutional and macro-structural factors, we demonstrate that the higher levels of educational equality in less differentiated education systems do not entail an often-assumed trade-off for lower quality.

INTRODUCTION

The education system in modern society is supposed to fulfill two largely uncontested functions: First, equip individuals with knowledge that allows them to take part in social, economic, and political life (Durkheim 1922). Second, confer access to valuable credentials independent of individuals' socio-economic background, in other words, provide opportunities for social mobility (Coleman 1968; Labaree 1997). If we accept these two functions as fundamental elements of modern education systems, we should judge their performance according to the *quality* of knowledge they produce and the degree to which they provide *equality* of educational opportunities (in the remainder simply referred to as quality and equality). Both of these dimensions of educational outcomes are central and long-standing concerns of public policy and social science (Hallinan 1988; Blossfeld and Shavit 1993a).

This contribution asks whether countries can achieve both educational equality and educational quality *simultaneously* or whether certain institutional features of education systems may entail a trade-off between these two aims. In particular, we focus on the role of institutional differentiation – that is, the nature and timing of assigning students to different tracks or secondary schools (Hopper 1968; Allmendinger 1989) – as a potential joint determinant of equality and quality in education. For a fruitful sociological approach to these questions, we propose different conceptualizations and measures of educational outcomes than those used in a growing field of comparative research. Although many contributions in this field share the theoretical motivation laid out here, most of them revert to a specific type of readily available and increasingly popular data, namely international student assessments, often with very limited appreciation of the conceptual limitations and assumptions these data entail.

AN EQUALITY-QUALITY TRADEOFF IN EDUCATION?

A fundamental question in sociological research on education and a primary concern of educational policy-making is whether equality in educational opportunities can be achieved without lowering the quality of education (see Van de Werfhorst and Mijs 2010). We label this the potential equality-quality tradeoff in education but hasten to add a note on the linguistic imprecision of this term: Here and in the remainder of the article “equality” serves as a shorthand for “equality of opportunity”. It does not refer to the total variance in the aggregate distribution of educational outcomes¹. A low dispersion in educational outcomes does, of course, not necessarily

¹ The tradeoff assessed here is thus also conceptually different from the one famously proposed for economic outcomes by Okun (1975), according to which the distribution of economic well-being tends to be negatively associated with total economic production (see Kenworthy

imply low socio-economic inequalities in education. In fact, our own analyses of the data used here show that a nation's degree of variance in educational outcomes and its degree of equality in educational opportunities do not correlate (not reported, available from the authors). We choose to focus on equality in educational opportunities because fair access to education is a much more central sociological concern and more widely shared aim of educational policy than the reduction of variance in student outcomes.

The tension between the aims of equality and quality frequently surfaces in debates on many different educational policies but it is nowhere more crystallized than in the controversy about the effects of institutional differentiation. The U.S. literature on institutional differentiation – here, in the form of tracking and ability grouping – serves as a case in point (Oakes 1985; Barr and Dreeben 1983; Hallinan 1994). Aided by formidable empirical evidence (for instance, Gamoran 1987; Gamoran and Mare 1989), critics of institutional differentiation point towards its negative effects on equality, that is, its causal role in increasing the influence of students' ascriptive characteristics on their educational success. In contrast, defendants of differentiation argue that it increases educational quality based on the following mechanism: The sorting of students into different groups is supposed to increase classroom homogeneity with respect to students' ability and learning potential. More homogeneous classrooms should allow more targeted instruction, which in turn is assumed to benefit students at all ability levels (Figlio and Page 2002; Duflo et al. 2011). In this view, the abolishment or reduction of differentiation is seen as jeopardizing overall educational quality. Another version of this perspective goes beyond a concern for overall quality and specifically cautions against the dangers of decreasing quality at the top by exposing the highest achieving students to classrooms or schools with low achieving students.

Institutional differentiation has long been understood as the most central feature of education systems (Hopper 1968). The great international variation in the nature and extent of differentiation makes this institutional characteristic a prime candidate for explaining cross-national differences in educational outcomes (Kerckhoff 1995; 2001). In the following section, we describe how an emerging field of comparative research has attempted to address the role of institutional differentiation for both educational equality and quality and discuss why we consider the evidence produced so far to be lacking. Next, we introduce the measures, methods, and data tailored to a more direct assessment of the relationship between educational quality and equality and their institutional contexts. The following section summarizes our hypotheses on the effects

of institutional differentiation on these two outcomes as well as the potentially biasing impact of other institutional features of national education systems and macro-economic characteristics. The presentation of our empirical results begins with a description of the correlation between educational equality and quality and then proceeds to the empirical assessment of institutional explanations of observed cross-national differences in educational equality and quality. Approaching this explanatory part with the caution appropriate for comparative analyses (Liebersohn 1991), we also discuss the bias arising from neglecting relevant macro-structural factors.

COMPARATIVE EVIDENCE: SHORTCOMINGS & ALTERNATIVES

For the longest time, reliable empirical estimates of international differences in educational outcomes and, more so, their explanation were largely elusive (Breen and Jonsson 2005). Large-scale, coordinated surveys that assess student outcomes in many countries, such as the International Mathematics and Science Study (TIMSS) or the Program for International Student Assessment (PISA), have set out to provide a wealth of new data to rectify this situation. At the very least, these studies can be credited with putting the issues of educational equality and quality back to the center of public discourse and reviving the comparative study of education systems. Here, we critically review the conclusions researchers have drawn from these data regarding the association between educational equality and quality and the role of institutional differentiation for both of these outcomes (for an excellent review of this literature see also Van de Werfhorst and Mijs 2010).

In response to the question of whether educational equality and quality can be achieved simultaneously, many educational policy makers like to refer to Scandinavian countries, in particular Finland and Sweden, which in most league tables of student achievement rank high on both dimensions. Comparative researchers typically take a more systematic approach and assess the association between the size of socio-economic gradients in student test scores (as an indicator of lacking equality) and the national average of these scores (as an indicator of quality) for a larger sample of nations. Based on the TIMSS data, researchers have found no association between educational equality and quality (Woessmann 2008; Schütz et al. 2008). Similarly, the Organization for Economic Cooperation and Development, which collects the PISA data, reports that these two dimensions of educational performance are not associated with each other (OECD 2007). The OECD's own analyses have been criticized on methodological grounds (see Hauser 2009) but even more careful analyses of these data could not find a strong and consistent

association between educational equality and quality (Hermann and Horn 2011). Overall, the research based on international student assessment data therefore suggests that there is no notable trade-off between educational equality and quality.

At the same time, researchers have investigated the effects of selected institutional characteristics of national education systems on both average student test scores and socio-economic gaps in these scores. By far the most frequently studied characteristic is that of institutional differentiation. Systems with more intense and early differentiation have repeatedly been shown to also have lower levels of educational equality (Ammermüller 2005; Marks 2005; Marks et al. 2006; Hanushek and Woessmann 2006; Brunello and Checchi 2007; Horn 2009; Schütz et al. 2008; Woessmann 2009). In contrast, the relationship between institutional differentiation and average test scores, although less frequently studied, is much weaker. Researchers have found either no association (Hanushek and Woessmann 2006; Robert 2010) or a small positive association that is sensitive to different model specifications (Horn 2009). In sum, these results suggest that institutional differentiation is detrimental for educational equality and largely inconsequential for educational quality – a conclusion that is also in line with the observation of a non-existent tradeoff between educational equality and quality.

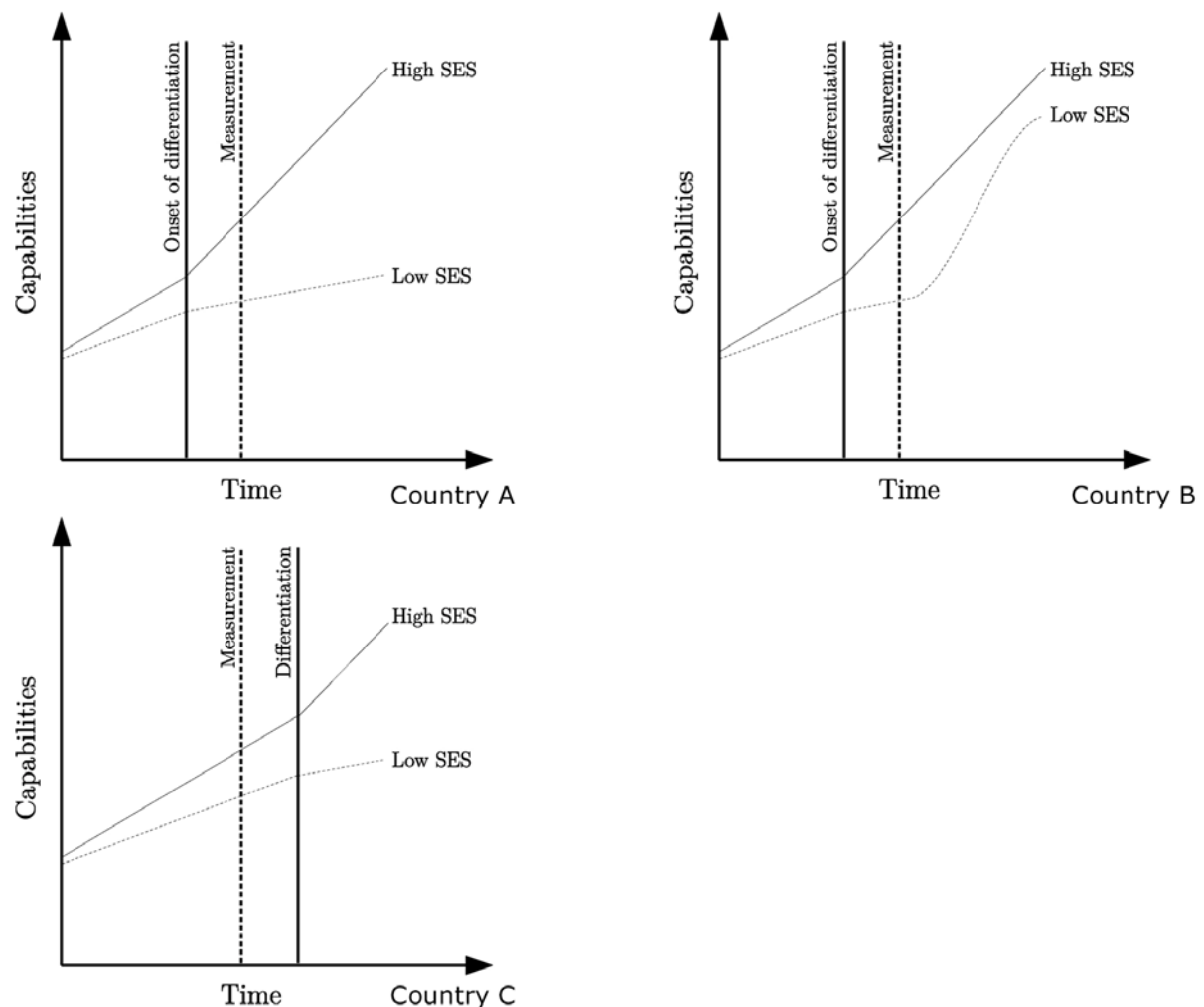
Limitations of international student assessment data

Existing comparative studies thus yield a rather consistent picture. But do they provide proper empirical evidence that directly speaks to the fundamental sociological concerns about the performance of education systems? As we have proposed earlier, the most important sociological concerns refer to the extent to which education systems provide individuals with the means for successful social integration and the extent to which they provide opportunity irrespective of socio-economic origins. Achievement indicators of students measured at a given age or grade level have important drawbacks when used to address these specific concerns and, even more so, when used to assess the potential impact of educational differentiation.

Most international achievement tests, unlike many national student testing systems, have been designed for the explicit purpose of measuring broad student competencies rather than the mastery of specific curricular content (Hersh Salganik and Rychen 2003). For instance, PISA aims to measure students' ability to "interactively use language, symbols, and text [to] function well in society" (OECD 2005). Even though the reliability of the competency measures used in different international studies has been questioned (Brown et al. 2007), at first sight, the focus on assessing "competencies to function well in society" is exactly the kind of measure sociologist

should be most interested in (Kingston et al. 2003). However, measuring these competencies and their distribution at a selected – and ultimately arbitrary – age or grade is problematic. Naturally, a test taken at, say, age fifteen or in eighth grade, provides but a snapshot of a longer developmental trajectory of student competencies (Kerckhoff 1993). We may hope that these snapshot measures are predictive of later student outcomes (both in terms of competencies and credentials), although the cross-sectional design of these international student assessments cannot lend empirical support to this end (Raudenbush and Kim 2002). But even if early test scores were reliable predictors of later student outcomes, they do not allow us to estimate the contribution of the education system and its institutional design towards the creation and distribution of final student competencies and credentials. Figure 1 helps illustrate why. It depicts selected and stylized trajectories of growth in three different education systems.

Figure 1: Hypothetical learning curves



In country A, students from higher socio-economic (SES) backgrounds show a steeper learning curve than those from lower socio-economic backgrounds. The learning curves of these two groups further diverge and at a faster pace once differentiation has taken place. This pattern of cumulative advantage emerges if advantaged students are more likely to enter higher tracks where their learning is accelerated. Of course, any different measurement point would yield a much different estimate of both socio-economic inequalities in achievement and average achievement (see also Brunello and Checchi 2007: 825ff). Also, interpolating to later outcomes is not only impossible in the absence of a second measurement point but also wrong if the shape of learning curves differs across nations: In country B, disadvantaged students are able to eventually catch up to their higher SES peers. This pattern of “late blooming” may arise from better-targeted instruction in lower tracks, track mobility (moving up to the higher track), or continuing education after completion of a particular track or school (for example, in the U.S. case, upward transfers from community college to four-year schools). Here, conclusions about levels of equality and quality based on the early student assessment would significantly overestimate the socio-economic gap in student outcomes and underestimate average capabilities later on. Finally, to illustrate a further complication, country C shows learning curves that are very similar to those in country A, the only difference being a later onset of differentiation. In fact, differentiation occurs only after the measurement of student capabilities. It should be apparent that it is impossible to draw any conclusions about the impact of differentiation based on a one-point comparison of student capabilities in country A and country C. Unfortunately, in the sample of countries included in research based on international achievement studies, the order of and distance between measurement time and the onset of differentiation differs widely (Brunello and Checchi 2007).

In sum, when it comes to their ability to provide sociologically relevant measures of educational equality and quality, international student assessments may not only be subject to measurement error – as noisy predictors of later outcomes – but also suffer severe conceptual problems that should lead us to re-assess the conclusions drawn from existing research. Of course, we again stress that international student assessments have provided great new possibilities and advances for comparative research (Porter and Gamoran 2002). But for a sociological assessment of the success of education systems in ensuring the educational quality and equality and, particularly, for the assessment of the influence of institutional differentiation we propose a different approach.

An alternative approach

Our suggestion for an alternative approach is simple: The success of education systems can most adequately be judged based on the final educational status of its adult population. More specifically, we claim that a sociological analysis of educational quality and equality should rely on measures of relevant *final* competencies and credentials attained.

For educational *quality*, we propose to draw on post-schooling measures of those capabilities that serve as the functional prerequisite for social integration. As we will discuss below, measures of literacy that capture adults' ability to interpret written texts or execute basic numerical tasks are one fitting option. The main point, however, is that measures taken after the completion of formal schooling circumvent all conceptual problems pointed out above: They reflect the final outcome of different learning trajectories and different routes through the education system. Of course, post-schooling capability measures also entail their own conceptual challenges. In particular, they may appear sensitive to influences from outside of the education system, such as on-the-job learning opportunities or more general societal conditions. Do they therefore provide a less direct indicator for the performance of education systems? First, we remind the reader that literacy and other capabilities are indeed also accumulated outside of formal schooling – but not only by adults but also by students enrolled in schools. For instance, we know that even the learning of curricular content occurs when schools are not in progress, such as the summer break, and that this out-of-school learning is tremendously consequential for students' learning trajectories (Heyns 1978; Downey et al. 2004). In this sense, measures of student capabilities may be no less sensitive to societal influence outside of formal schooling than measures of adult literacy. For both, then, it is crucial to take into account a range of macrosocial factors outside of formal schooling, which – as we will show – may bias our conclusions about cross-national differences in educational quality and the impact of the education system. Second, the assessment of school-produced capabilities would, in principle, be aided by measuring capabilities directly after the completion of formal schooling. Vast individual differences in the length of educational participation (and, in particular, the possibility of later returns to formal education) make it exceedingly difficult to collect these measures in cross-sectional, large-scale comparative surveys. Instead, as an empirical approximation, researchers may select a representative sample of adults for whom we expect that formal schooling has been completed². We note that existing international surveys that sought to provide “end-of-schooling” student assessments, such as a TIMSS wave administered at the end of secondary schooling, do not provide an adequate solution since they fail to capture both those who dropped out of formal

2 In our own analyses, we draw on the full adult population to capture those who return to formal schooling at later points in their lives. Sensitivity analyses restricted to respondents aged 25-35, however, yield the same substantive conclusion (available from the authors).

schooling before the selected measurement point as well as the learning growth of those participating in continuing and higher education (see also Porter and Gamoran 2002: p.10).

A meaningful assessment of educational *equality*, understood as the distribution of life chances offered through education, is also aided by measures of final educational attainment instead of early student test scores. Final educational degrees best capture the second function of education systems, that is, the (fair) distribution of valuable credentials that enable social mobility. While student assessments at a certain grade or age level may be predictive of ultimate educational attainment – the degree to which they are has, however, not been established – they certainly provide a less direct and more error-prone measure of mobility-relevant educational outcomes. A large literature has investigated socio-economic inequalities in the distribution of educational degrees (for reviews see, e.g., Haveman and Wolfe 1995; Buchmann 2002; Haveman et al. 2004). The measures of educational equality commonly used in this literature report the degree to which educational attainment is independent of individuals' family background, measured by parental educational status, occupational status, family income, or wealth – or any combination of these (for instance, Treiman and Yip 1989; Müller and Karle 1993; Blossfeld and Shavit 1993a; Shavit et al. 2007; Pfeffer 2008; Breen et al. 2009). Advances in the availability of cross-nationally harmonized data on educational attainment and socio-economic backgrounds have made possible important comparative projects (Hoffmeyer-Zlotnik 2003), for instance those debating changes in educational equality over cohorts for a range of industrialized nations (Blossfeld and Shavit 1993a; Pfeffer 2008; Breen et al. 2009) or the cross-national comparison of social inequalities in higher education (Shavit et al. 2007). In this contribution, we draw on a measure of educational equality that extends across all levels of education. We rely on internationally comparable measures of educational degrees but acknowledge that the further development and improvement of these measures is ongoing (Schneider 2008) and discuss their potential shortcomings later.

INSTITUTIONAL & MACROSTRUCTURAL EFFECTS ON EQUALITY & QUALITY

In the preceding section, we have outlined how empirical research may describe the performance of national education systems in a way that speaks most directly to fundamental sociological concerns about education. We now turn to the theoretical motivation of our explanatory aim, namely, the assessment of the relationship between selected institutional characteristics of national education systems and cross-national differences in educational quality and equality. We begin with a presentation of hypotheses on the effects of institutional differentiation, which is the institutional characteristic that is most central to debates in sociology

and educational policy. We then introduce hypotheses on the effects of other attributes of national education systems as well as non-school, macro-social factors that may impact both educational quality and equality and, more importantly, account for bias in their association with institutional differentiation.

Institutional differentiation

In comparative research institutional differentiation is typically defined as the way in which educational opportunities are differentiated between and within educational levels through formal tracking or streaming as well as the timing and rigidity of student selection on the secondary level (Allmendinger 1989; Müller and Shavit 1998; Buchmann and Dalton 2002; Buchmann and Park 2009). Given the breadth of research on tracking in the United States, it may be important to remind the reader that the degree of formal differentiation of the U.S. education system is considerably lower than that of many other, particularly European nations (Rubinson 1986). We expect a negative relationship between the degree of institutional differentiation and educational equality: Highly differentiated education systems, that is, systems with strong, stable, or early student selection into separate educational pathways increase the information requirements for students to successfully navigate their educational careers. Guidance and management skills of high status parents become more consequential in this environment and confer children from high status backgrounds additional advantage in selecting the right educational track (see also Baker and Stevenson 1986; Pfeffer 2008). Once on this track, this advantage accumulates further in the form of steeper learning curves thanks to the exposure to more advanced curricular content (see DiPrete and Eirich 2006: p. 286).

In contrast, the relationship between institutional differentiation and educational quality is more difficult to ascertain a priori. Defendants of institutional differentiation certainly have a clear line of reasoning why this relationship should be positive: Higher average quality in highly stratified systems, so the argument, may be mainly due to the maximized achievement of high ability students whose learning progress is not hampered by the integration of lower ability students. In addition, lower ability students may profit from instruction that can be geared to their needs in more ability-homogeneous classrooms. Of course, this argument assumes that the allocation of students to different classrooms is indeed based on ability – and its strength is thus limited by the extent to which factors other than ability impact the assignment process (Brunello et al. 2007), such as the socio-economic factors assessed here and in the research cited earlier. In addition, it may be at least as convincing to suggest that the achievement of lower ability students may decrease when they are grouped with low ability students as opposed to higher ability

students: A high degree of institutional differentiation has been shown to be associated with a “cooling out” of educational expectations among low achieving students (Buchmann and Dalton 2002; Buchmann and Park 2009). It is difficult to tell a priori whether these presumed learning losses at the bottom of the ability distribution fully counterbalance or even exceed the presumed gains at the top. In fact, a long line of research in economics continues to debate the effects of being grouped with individuals of different ability levels (Sacerdote 2011). While potential heterogeneity in peer effects has been acknowledged from the beginning of this literature (Summers and Wolfe 1977) – in particular, the possibility that the impact of peers differs by individuals’ own ability – it often remains unclear how heterogeneous peer effects at different distributional points sum up into average achievement differences (Brunello et al. 2012). Some findings, however, point to stronger peer effects at the bottom of the achievement distribution and thus the possibility that lower institutional differentiation may boost achievement at the bottom far enough to increase average achievement (Summers and Wolfe 1977; Argys et al. 1996; Zimmer and Toma 2000). The assessment of the effects of differentiation – and, for that matter, any other institutional characteristic – on educational quality will thus profit from an analysis that goes beyond average estimates to look at the full achievement distribution.

Other institutional characteristics of education systems

Of course, national education systems differ in many more ways than merely their degree of institutional differentiation. Here, we briefly motivate additional institutional features that have been proposed as important determinants of either educational quality or equality:

First, the openness or size of the post-secondary education sector as a measure of the advance of educational expansion. Clearly, we expect higher educational quality in a country in which a larger share of the population participates in higher education. Regarding educational equality, it has been proposed that the size of the post-secondary sector positively correlates with educational equality (Hout 2007) since in countries with higher post-secondary participation rates the access to secondary education is more likely to be saturated, in which case inequalities at that level can be expected to decrease (Raftery and Hout 1993). We already note that the size of the post-secondary sector is not independent of the degree of institutional differentiation: Highly differentiated systems often limit access of higher education by tying it to the successful completion of a particular secondary track or school type. In the discussion of the results, we will explain why the size of the post-secondary sector in some instances serves as a partial explanation of the effects of institutional differentiation rather than a source of bias.

Second, the degree to which education meets the same standards nationwide, typically referred to as the degree of standardization (Allmendinger 1989). Certainly, many of today's educational policy debates revolve around the benefits and perils of setting achievement benchmarks to which schools are held accountable. However, institutional standardization encompasses not only the distribution of educational outputs measured through national benchmarks or testing systems but also that of educational inputs, such as schools' economic resources or curricular contents. These different dimensions of standardization, in our view, defy a prediction of the relationship between standardization and educational quality. In contrast, we expect standardization to positively impact educational equality since, by definition, standardized systems show fewer local disparities in terms of content and quality of education (see Stevenson and Baker 1991) and may therefore reduce the potential impact of economic characteristics and information advantages of high status parents on the selection of higher quality schools.

Third, the degree of privatization of the education systems. We have no a-priori hypothesis on whether private or public providers of education may be more successful in ensuring high educational quality, unlike, for instance, proponents of school choice who assume that privatization improves overall quality through increased pressures from market competition. We contend ourselves to stating that the latter perspective follows a simplistic model of the workings of markets that appears particularly problematic when applied to the education sector, which is marked by great levels of imperfect information among its "consumers" (especially among socio-economically disadvantaged families) and significant transaction costs for "suppliers" (for instance, the market exit of low-performing schools is a drawn-out process during which many students continue to attend these schools). Regarding the relationship between privatization and educational equality, we refer to what Arum et al. (2007) have proposed as the dual character of private educational institutions: As "client-seekers", private schools aim at increasing enrollment and - driven by economic interest - exert efforts to include and support students that otherwise might encounter fewer opportunities in the public sector. However, as "status-seekers" they also compete for prestige with other private and public institutions and therefore may seek to exclude otherwise able students through forms of student selection that are open to socio-economic discrimination. These countervailing effects of status- and prestige-seeking of private institutions leave the relationship between privatization and educational equality to be established empirically.

Finally, we consider the possibility that cross-national differences in adult training and professional development may play an important role in increasing adult literacy and counterbalance shortcomings of the formal education system.

Macro-structural contexts

Educational processes do not occur in isolation from the broader structure of society. In other words, education systems are not the only factor shaping literacy outcomes and educational opportunities. The question to be addressed in this section is whether other cross-national differences of economic and social kind may account for the observed association between institutional differentiation and educational performance (see also Marks 2005). Here, we outline arguments that have been brought forward in favor of the influence of two central macrostructural features, namely economic development and social inequality, on both educational quality and equality.

Economists have produced extensive evidence on the relationship between education and economic development, showing that educational investments are a central determinant of sustained economic growth (Schultz 1961; Psacharopoulos 1992; Barro 1998; Hanushek and Woessmann 2008; but also see Ramirez et al. 2006). That is, highly developed countries attained their current wealth partly based on the successful production of educational quality. Of course, part of the positive relationship between educational quality and economic development may also arise from influences that flow the other way: Wealthy countries may provide living conditions that are conducive to human flourishing in general, and the further development of individuals' skills in particular. Conversely, less advantageous conditions in poorer countries, say for instance those producing worse health outcomes, may impede the attainment and expansion of important capabilities. Hence, while we do not seek to establish the causal direction of this relationship, we include it in our empirical analysis to investigate whether our main hypothesis on the influence of institutional differentiation is biased by the varying level of economic development among the countries included in this analysis. The same applies to the relationship between economic development and educational equality. Forceful theoretical arguments in favor of the causal positive effect of economic development on educational equality have famously been made in the industrialism hypothesis and received a fair share of attention in sociological research on the intergenerational transmission of advantage (e.g., Erikson and Goldthorpe 1992). The industrialism hypothesis states that "the more industrialized a society, the smaller the influence of parental status on educational attainment." (Treiman 1970: p. 221). Although it has been rejected in most empirical research (Hout and DiPrete 2006; Müller and Karle 1993), it is fair to say that the industrialism hypothesis continues its existence as a widely held intuition and thus merits repeated empirical assessment.

For the degree of a society's economic inequality, we hypothesize a negative relationship to educational quality. Among industrialized countries, the labor markets of countries with higher levels of inequality tend to have a larger low-skill sector (Scharpf and Schmidt 2000). As the name implies, this segment of the labor market requires less skills to begin with; but, as we would argue, it also confers less skills to workers than other sectors of the economy. Following a famous hypothesis by Braverman (1974), one might even go as far as ascribing this sector of the labor market an independent role in destroying skills. But even those who dismiss the latter claim should easily agree that, on the other hand, high-skill white-collar occupations better serve to maintain or possibly even expand the literacy of workers by confronting them with a variety of texts, documents, and quantitative information on a daily basis. As a result, countries with a more extensive low-skill sector, that is, more unequal countries should show lower levels of adult literacy. The relationship between a society's level of social inequality and educational equality has been discussed by many scholars, such as Jencks et al. (1972) or Bowles and Gintis (1976). They argue that a significant reduction in social inequality in education can only be achieved by redistributing economic resources: equality of economic conditions as a 'sine qua non' of equality of opportunities. A somewhat weaker version of this claim states that "long-term commitments to socioeconomic equality may lead to an equalization of educational opportunities" (Blossfeld and Shavit 1993b: p. 19). Recent evidence for the United States has documented how increasing levels of inequality have coincided with sharp decreases in educational equality (Reardon 2011). Based on this perspective, we would expect a negative association between overall social inequality and educational equality.

In addition to the consideration of cross-national differences in economic development and social inequality, we follow other comparative research on mobility processes, which controls for former socialist countries (e.g., Beller and Hout 2006; Hout 2007).

DATA, MEASURES, AND METHODS

Data and sample

We draw on data from the International Adult Literacy Survey (IALS), an international comparative study assessing literacy in twenty industrialized nations. Although still much less frequently used than the international student assessment data reference above, these data have begun to support more comparative research over recent years (Brunello and Checchi 2007; Pfeffer 2008; Van de Werfhorst 2011; Barone and van de Werfhorst 2011; Park and Kyei 2011;

Gesthuizen et al. 2011)³. All countries participating in the IALS applied a common set of survey questions to a large, nationally representative sample of its adult population ranging in size between 1,500 and 6,000 individuals. For this analysis, we include the following countries, which collected data between 1994 and 1998: Belgium, Canada, Chile, the Czech Republic, Denmark, Finland, Great Britain (England and Wales), Germany (West-German respondents), Hungary, Ireland, Italy, Northern Ireland, Norway, New Zealand, Poland, Slovenia, Sweden, Switzerland (German-speaking part), and the United States.⁴ Since the performance of education systems is the central focus of this contribution, individuals who have not attended school in the nation studied and instead obtained their highest educational degree in a foreign country, that is, most first generation immigrants, are excluded from this analysis.

One attractive feature of the IALS survey is that it combines extensive measures of relevant capabilities of the adult population with information on respondents' as well as their parents' educational attainment for a reasonably large number of countries. Even if one were to consult comparative surveys that allow the assessment of only one of the two performance dimensions assessed here, the choices are quite limited. As a follow-up to the IALS, the Adult Literacy and Lifeskills Survey (ALL) of 2003 was implemented in only six countries (Bermuda, Canada, Italy, Norway, Switzerland, and the United States). Comparative researchers can be more hopeful about the future potential of a new and ongoing effort by the OECD that collects skill measures for the adult population in 23 countries (PIACC, Programme for the International Assessment of Adult Competencies, to be available in late 2013). For the assessment of educational equality, we have replicated our analyses for the countries analyzed here based on the Social Inequality module of the International Social Survey Program (ISSP) from 1999, which – unlike its 2009 version – contains information on both respondents' and parents' educational attainment. Since these sensitivity analyses are restricted to only 11 out of the 19 nations included here (namely, Canada, Czech Republic, Denmark, Germany, Hungary, Ireland, New Zealand, Poland, Slovenia, Sweden, and the United States), the results are subject to a much lower level of statistical precision but still yield the same substantive conclusions as those presented here (results available from the authors).

3 In particular, Brunello and Checchi (2007) have used the IALS to investigate institutional effects on literacy – an analysis we also engage in here. However, their analyses compare differences in literacy conditional on educational attainment. In general, it seems unclear what literacy measures that have been purged of the effects of educational participation mean. Our conceptual approach, in particular, advises against this strategy since we consider literacy to be an important outcome of educational participation.

4 The *Netherlands* have to be excluded from this analysis due to irregularities in the coding of educational degrees; *Scotland* is excluded due to the low number of cases but would otherwise constitute an interesting comparative case on its own (see Raffé et al. 1999); the restriction to *West Germany* is implemented by excluding individuals who grew up in the former German Democratic Republic, who by themselves are too small a group to be analyzed separately.

Measures of educational quality

The IALS applied a very comprehensive concept of functional literacy that in our view captures the essence of what may be considered the functional preconditions for social integration. It defines literacy as the ability to “use printed and written material to function in society” and measures it in three distinct dimensions (for details see Kirsch 2001): *Prose literacy* refers to the ability to understand and use information from a variety of texts, such as newspaper articles or poems; *document literacy* refers to the ability to locate and use information contained in a variety of formal documents, such as medical prescriptions or job applications; and *quantitative literacy* refers to the ability to master everyday mathematical skills such as those involved in balancing a checkbook or calculating tip. Each of these dimensions is assessed based on numerous items, which are combined via Item Response Theory scaling into a continuous measure ranging from 0 to 500. Since the literacy measures are highly correlated across these three dimensions ($r > .97$ in the analytic sample), we average them to obtain a comprehensive measure of functional literacy for adults aged 25 to 65. In addition to analyses of international differences in mean levels of literacy, we also investigate differences across the full distribution of literacy and focus on the upper end (90th percentile) and the bottom (10th percentile).

Measures of educational equality

We conceptualize educational equality as the degree to which individuals’ final educational degree is independent of the educational status attained by their parents. High independence, that is, a low association between the educational status of parents and that of their children indicates higher equality of educational opportunities. The strength of this association can be estimated in a loglinear framework. Pfeffer (2008) discusses the advantages of this method in detail and applies it to the same data to provide a parsimonious estimate of the overall degree of educational equality across all educational levels. Specifically, the uniform difference model (Xie 1992; Erikson and Goldthorpe 1992) proves most effective in producing an estimate of cross-national differences in educational equality:

$$f_{ijl} = \mu \gamma_i^O \gamma_j^D \gamma_k^C \gamma_{ik}^{OC} \gamma_{jk}^{DC} \exp \left[\Psi_{ij}^{OD} \Phi_k^C \right] \quad (1)$$

The central parameter of interest (Φ_k^C) estimates the degree of association between individuals’ highest degree attained (D) and the highest degree attained by either of their

parents (O) for each country (C) while constraining the pattern of intergenerational association in educational status to be constant across nations (Ψ_{ij}^{OD}) and controlling for cross-national differences in the aggregate distribution of educational degrees (Φ_{ik}^{OC} , Φ_{jk}^{DC}). After reverting the sign of these estimated “uniform difference” parameter estimates and centering them at the cross-national mean, higher values stand for higher levels of educational equality and zero indicates the cross-national average (for further details see Pfeffer 2008: pp.549-553).

Educational degree information in the IALS is provided in the original International Standard Classification of Educational Degrees (ISCED), which intends to maximize the cross-national comparability of national educational degrees while maintaining within-country validity. Of course, measures like the ISCED accomplish both of these goals only partly and new schemes continue to be developed in response to these shortcomings (Schneider 2008). We should acknowledge one main shortcoming of the original ISCED scheme, namely its failure to adequately capture qualitative differences within educational levels. Our measure of educational equality exclusively captures vertical inequalities and neglects important and multi-faceted forms of “horizontal differentiation”, such as informal tracking within schools, specifically distinctions between academic and vocational education, or quality and prestige differences between institutions, especially on the post-secondary level (see Gerber and Cheung 2008). A growing body of research focuses on these complex and sometimes more hidden forms of differentiating students within a given educational level. We encourage more cross-national comparative studies of horizontal differentiation that try to pin down the effects of these forms of differentiation on both education equality and quality. Our analysis of an arguably more fundamental form of educational differentiation should provide a convenient starting point. It is, however, also worth noting that there is evidence that the effects of institutional differentiation on educational equality are unbiased by certain aspects of horizontal differentiation, such as the distinction between vocational and academic tracks (see Pfeffer 2008: 548-549). Beyond the challenges posed by lacking comparability, the educational degree information is also subject to meaningful cross-national differences when it comes to its power in predicting individuals’ life chances, particularly their labor market success (Shavit and Müller 1998; Barone and van de Werfhorst 2011; Van de Werfhorst 2011). We discuss the direction in which cross-national differences in educational returns may bias our conclusions about institutional determinants of educational equality when we present the findings.

Institutional and macrostructural contexts

For the assessment of institutional characteristics of education systems, that is, the independent variables of our comparative analysis, we draw on existing classifications of countries along the institutional dimensions outlined above (see Müller and Shavit 1998; Buchmann and Dalton 2002; Pfeffer 2008; Buchmann and Park 2009). The institutional feature at the center of this contribution, differentiation, is measured in three categories: Education systems are considered weakly differentiated if most students attend comprehensive schools, if they are able to move from one track to another even if this does not necessarily occur very frequently, and if access to post-secondary education is not formally predetermined by the choice of one track. Highly differentiated systems, in contrast, divide students into separate schools of which only one or some types prepare for post-secondary education and others are ‘dead-end’ pathways that preclude the attainment of higher levels of education. Mobility between these schools is also very limited. Very highly differentiated systems follow the same pattern as highly differentiated systems, but select students for different types of secondary schools at an early age (typically grades four to five), and these selection decisions are basically irrevocable as mobility between school types is minimal.

We believe that that this qualitative and coarse, i.e., three-category, measure appropriately captures the *Gestalt* of institutional differentiation, others may prefer a different approach that draws on more detailed quantitative indicators of differentiation, such as the share of students assigned to differentiated learning environments during primary and secondary schooling, the number of different school types, or the typical age at which differentiation begins. We draw on these indicators collected by other researchers (Brunello and Checchi 2007; Horn 2009) for sensitivity analyses of the effects of institutional differentiation.

As pointed out above, institutional differentiation may be the most important but far from only characteristic of education systems that differs between countries. Our measures of institutional standardization, the prevalence of private schooling, and the relative size of the post-secondary education sector are described in Appendix A.1. We treat these institutional features as control variables to assess whether they drive part of the effects of institutional differentiation on

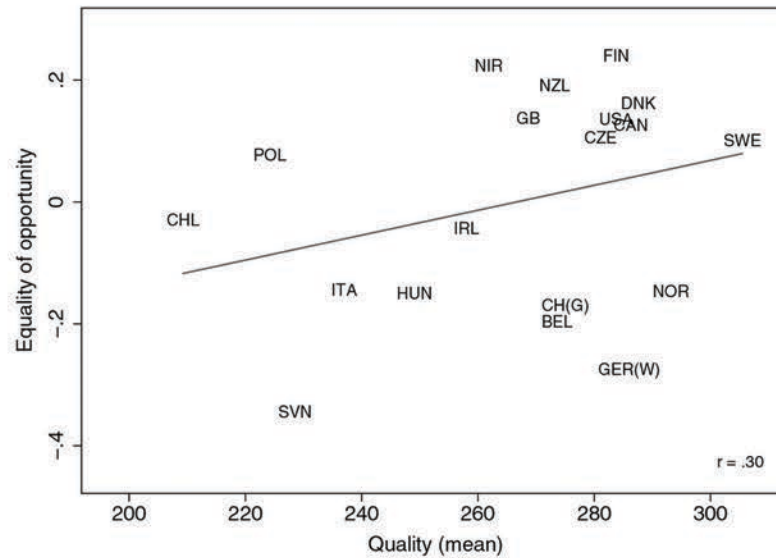
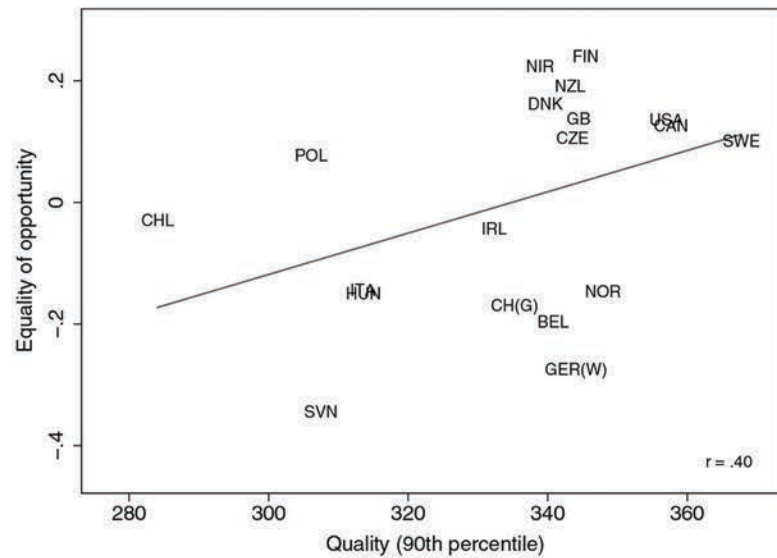
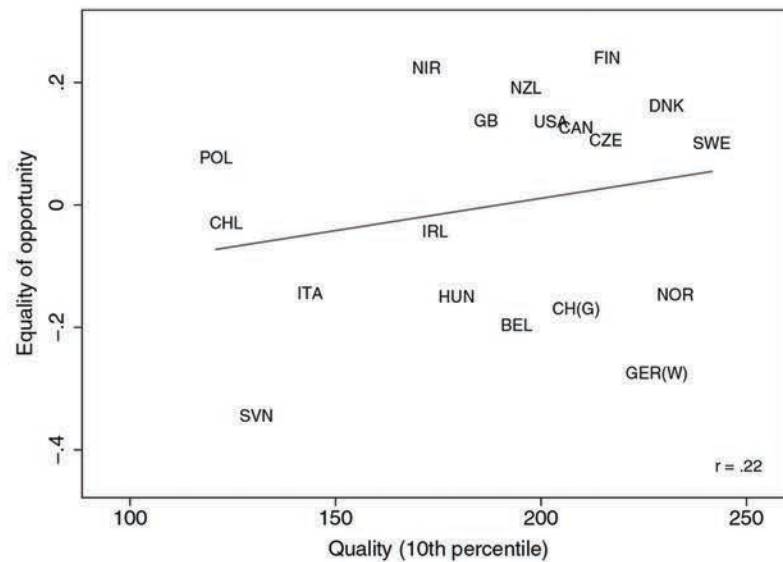
quality and equality. Similarly, we introduce controls for other macro-structural features of the nations studied, namely the level of economic development and the extent of social inequality (see Appendix A.1). Again, we stress that we neither seek to establish the causality or directionality of these effects nor should our analyses be construed as an exercise in capturing all determinants of educational quality and equality. Instead, we introduce these additional characteristics to reduce the potential bias resulting from the exclusive focus on school factors when assessing educational outcomes.

Our institutional and macro-economic measures are chiefly based on information from around the time at which the IALS data were collected. However, the educational participation of the individuals included in our analyses spans four full decades. While many of the institutional characteristics studied are subject to a great degree of path dependence, which limits the over-time variability of cross-national differences in these characteristics, some changes are certainly possible. Where available, we test the stability of our results to these potential changes by using institutional indicators based on different decades (see Appendix A.1) as well as a replication of our analyses based on the youngest cohort only, for which the timing of the institutional information is most appropriate, yielding the same substantive results (available upon request).

FINDINGS

The equality-quality tradeoff

We begin by reporting the relationship between a nation's degree of educational equality and educational quality. In Figure 2 (for country labels see Appendix A.1), we observe a clear though not perfect positive relationship between these two outcomes ($r = .30$). This is good news: Rather than implying a trade-off between equality and quality, education systems can perform high on both dimensions, as exemplified for instance by Scandinavian countries like Sweden, Denmark, or Finland. However, we can also already identify some exceptions to this general trend. Germany, for instance, stands out as a country with a rather high level of educational quality in combination with comparatively low levels of equality. The same could be said for Belgium, Switzerland, and Norway.

Figure 2: Equality and (mean) Quality**Figure 3:** Equality and Quality at the top**Figure 4:** Equality and Quality at the bottom

Earlier, we have alluded to the importance of investigating educational quality beyond mean levels (see also Hermann and Horn 2011). Figures 3 and 4 therefore report the relationship between educational equality and quality at the top and the bottom of the distribution of literacy, respectively. In particular the assumption of a trade-off between equality and quality at the top cannot be confirmed empirically. If anything, educational equality is even more clearly positively related to quality at the top of the distribution than at the bottom.

The positive correlation between equality and quality documented here already foreshadows that important institutional factors may influence both dimensions in the same direction. Below, we determine whether institutional differentiation is one such institutional characteristic that drives both educational equality and quality.

Institutional differentiation and educational equality

Our assessment of the relationship between institutional differentiation and educational equality replicates Pfeffer's (2008) analysis and extends it by considering additional macro-structural factors⁵. Model 1 in Table 1 reveals that highly differentiated education systems are marked by significantly less equality than education systems with a low degree of differentiation (reference category); very highly differentiated countries, of which there are two in our sample, do even worse in that regard⁶. In models 2 through 5, other institutional characteristics are added as separate controls, following a common strategy in comparative research that is based on a limited number of nations and that consequently lacks the statistical power to introduce all or at least more controls at once. The important conclusion to draw from the latter models is that the relationship between institutional differentiation and educational equality is largely unaffected by other institutional characteristics of education systems, which themselves do not appear to exert independent influences on the level of equality. Models 6 through 9 assess whether the effects of institutional differentiation are also stable to the inclusion of other macrostructural characteristics that have been hypothesized to impact educational equality. The answer is yes. None of the macro-structural factors exerts any notable influence on educational equality and thus leaves the main effects of institutional differentiation substantively unaltered.

As described above, an alternative approach to empirically assess the influence of institutional differentiation relies on more detailed, quantitative indicators of institutional contexts. Appendix A.2 reports the results based on such alternative specifications of the effects of institutional differentiation, which yield further evidence for the strong negative association between differentiation and educational equality.

⁵ As already mentioned, an additional replication of this analysis based on the ISSP-1999 data is also available from the authors.

⁶ We note that the assessment of statistical significance in comparative research does not aim at making inferences to a larger population of countries. The relation of coefficients and their standard errors nevertheless indicates the degree of confidence that we can hold in claiming these effects to be meaningful, that is, not just due to random error (see Kenworthy 2007).

Finally, we have alluded to the possibility that our assessment of educational equality relies on measures of educational degrees that may be more reliable predictors of future life chances and labor market success in some countries than in others. The question is whether these cross-national differences in educational returns challenge our conclusions about the negative relationship between differentiation and equality. Prior work has shown that in countries with higher institutional differentiation, educational degrees tend to be more closely tied to labor market outcomes (Allmendinger 1989; Müller and Shavit 1998). Consequently, inequality in educational opportunities, which has been shown to be higher in these countries, translates more directly into inequality in life chances; while in countries with less institutional differentiation, the degree to which those at the lower ranks of the educational hierarchy are also relegated to the lower ranks of the labor market may be comparatively weaker. This would suggest that we have presented conservative estimates of the negative relationship between differentiation and equality.

Institutional differentiation and educational quality

We now apply the same sequence of regression models to the outcome of average educational quality. Model 1 reported in Table 2 confirms a negative relationship between differentiation and educational quality if we focus on the difference between low and highly differentiated systems for the moment. The penalty of high institutional differentiation amounts to 37 points (more than half a standard deviation in the literacy score). As we can see in models 2, 3 and 5, this penalty is also observed when we take into account different levels of standardization, privatization, and adult training, respectively, which do not appear to influence educational quality. The relative size of the post-secondary sector (model 4), however, shows a clear and strong positive effect (on average, a 1.7 point increase in literacy for every one percent increase in the post-secondary graduation rate). We did expect higher education to increase average literacy – any other finding would have been disheartening. Since institutional differentiation and the size of the post-secondary sector are positively related – by definition, highly differentiated countries close off access to post-secondary education for part of the student population – the latter also mediates part of the observed effect of institutional differentiation, which drops from 37 to 28 points. That is, the negative association between differentiation and educational quality is partly explained by the rationing of higher education that is a more common feature of highly differentiated systems.

Table 1: Institutional and macro-economic context of equality

	1	2	3	4	5	6	7	8	9
Highly stratified	– 0.16*	– 0.16+	– 0.16*	– 0.17+	– 0.12	– 0.16	– 0.16+	– 0.17+	– 0.14
	(0.07)	(0.08)	(0.07)	(0.08)	(0.10)	(0.10)	(0.08)	(0.08)	(0.09)
Very highly stratified	– 0.32*	– 0.33*	– 0.30*	– 0.33*	– 0.29*	– 0.32*	– 0.32*	– 0.32*	– 0.32*
	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)	(0.13)	(0.12)	(0.12)	(0.12)
Standardized		0.01							
		(0.08)							
Private sector			0.08						
			(0.08)						
Rel. size of PSE				– 0.00					
				(0.01)					
Training					0.00				
					(0.00)				
GDP per capita						– 0.00			
						(0.06)			
Industrialization							– 0.00		
							(0.05)		
Income Gini								0.00	
								(0.01)	
Former Socialist									– 0.04
									(0.11)
N	19	19	19	19	19	19	19	19	19
R2	0.37	0.37	0.41	0.37	0.39	0.37	0.37	0.38	0.38

The remaining, unexplained association between educational quality and institutional differentiation could still be taken as evidence for the direct quality-reducing impact of institutional differentiation. However, that interpretation is challenged by the two countries with very high levels of institutional differentiation. As apparent in model 1 of table 2, the average

level of educational quality observed in the very highly differentiated context does not differ significantly from that of countries with a low degree of differentiation. In fact, once we control for the size of the post-secondary sector, there is tentative evidence for a slight quality advantage in very highly differentiated countries. One additional interpretation of this finding is that the main negative consequence of very high differentiation in terms of educational quality lies in its implied rationing of access to higher education.

Continuing with models 6 through 9, we observe that both hypotheses on the influence of macrostructural characteristics on educational quality are confirmed empirically: Wealthier countries show significantly higher levels of educational quality, whether we conceptualize national wealth as per capita gross domestic production (model 6) or the level of industrialization (model 7). More unequal countries, on the other hand, show lower levels of educational quality (model 8). Importantly, both macrostructural features also bias the effect of institutional differentiation. Considering either of these features decreases the gap between countries with high and low institutional differentiation by 30-40 percent. This biasing role of macrostructural features reflects what can already be inferred from glancing over the descriptive statistics in Appendix A.1: The highly differentiated countries in this sample also tend to be less well-off and more unequal, which has to be accounted for in the comparison of the outcomes of these institutional types. Finally, model 9 confirms the stability of the results to the consideration of a nations' experience of socialism. Again, the alternative specification of the effects of institutional differentiation as measured by quantitative indicators (see Appendix A.2) support the conclusions drawn from Table 2.

Institutional differentiation and educational quality at the top and the bottom

The evidence on the negative relationship between differentiation and educational quality presented above does not directly speak to the ideas that institutional differentiation may help maximize capabilities at the top and/or hurt the development of skills at the bottom. Here, we engage in further analyses of different points in the literacy distribution to investigate such potential heterogeneity in the effects of differentiation. Table 3 provides a first description of the distribution of literacy at the top, the mean, and the bottom across the three levels of institutional differentiation.

Table 2: Institutional and macro-economic context of quality

	1	2	3	4	5	6	7	8	9
Highly stratified	–	–	–	–	– 32.48*	– 22.22+	–	–	–
	36.64** (9.48)	36.85** (9.72)	36.66** (9.80)	27.86** (9.42)	(13.11)	(11.48)	29.40** (8.52)	25.84** (7.56)	36.79** (12.10)
Very highly stratified	– 1.69 (15.24)	– 0.04 (15.98)	– 1.58 (16.11)	8.44 (14.48)	1.34 (16.89)	– 8.84 (14.55)	– 0.10 (12.99)	– 2.58 (11.27)	– 1.69 (15.74)
Standardized		– 4.98 (10.15)							
Private sector			0.34 (10.23)						
Rel. size of PSE				1.65* (0.76)					
Training					0.21 (0.44)				
GDP per capita						13.08+ (6.74)			
Industrialization							13.22* (4.97)		
Income Gini								– 1.85** (0.49)	
Former Socialist									0.31 (14.24)
N	19	19	19	19	19	19	19	19	19
R2	0.50	0.51	0.50	0.62	0.51	0.60	0.66	0.74	0.50

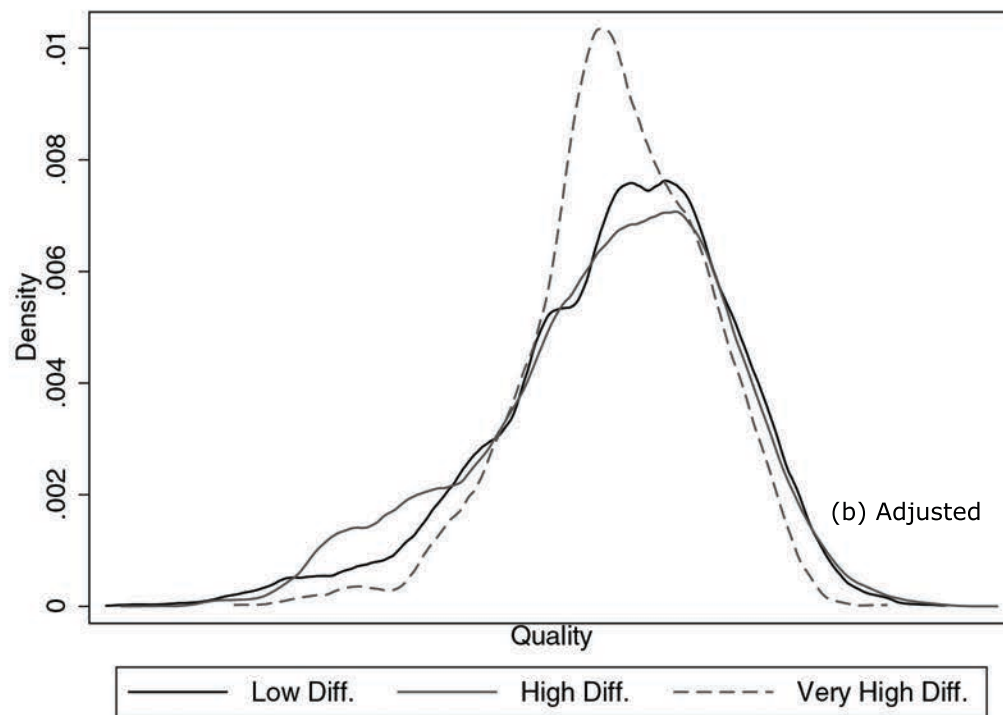
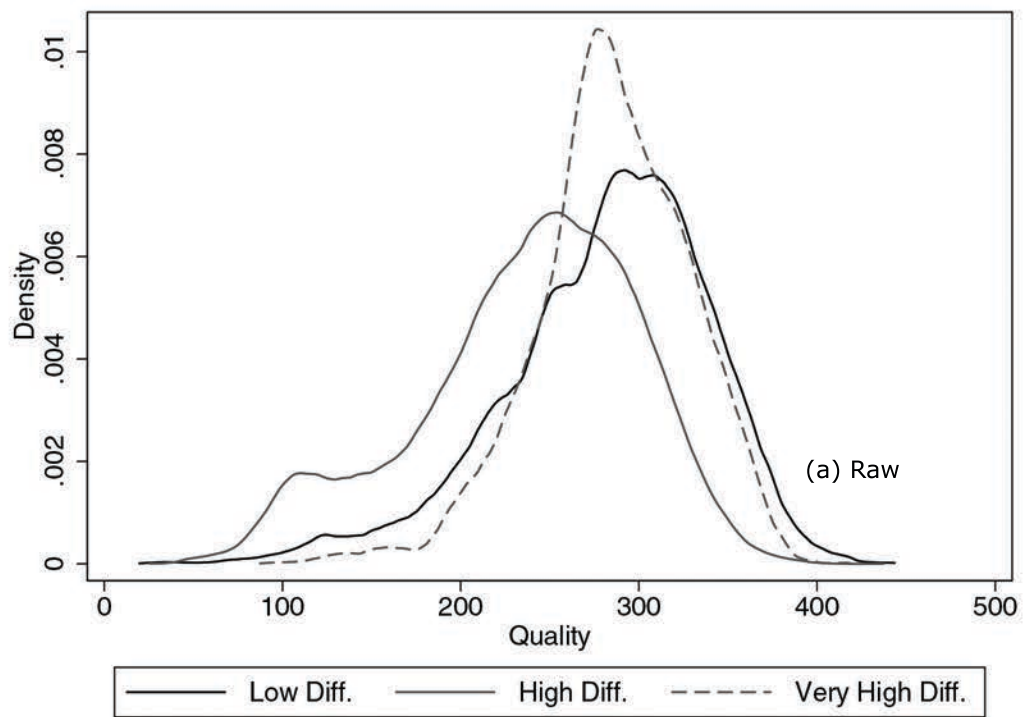
Table 3: Quality distribution by institutional differentiation

	Low Diff.	High Diff.	Very High Diff.
10th Percentile	210	160	218
Mean	282	246	281
90th Percentile	348	319	340
N	9	8	2

We observe that very highly differentiated systems and systems with a low degree of differentiation are similar not only in terms of mean achievement but also in terms of the bottom and the top of the distribution. Countries in the middle position of institutional differentiation, on the other hand, perform comparatively poorly at all points of the distribution chosen here and particularly so at the bottom. Again, taking this as evidence that individuals with lower skill levels would suffer disproportionately from institutional differentiation is complicated by the finding that countries with a very high level of differentiation show a comparatively high literacy level at the bottom of the distribution.

Controls for other institutional and macro-economic characteristics affect the associations between differentiation and quality at the top and the bottom (Tables 6 and 7 in Appendix A.3) in much the same way they affect educational quality at the mean (Table 2): The influence of institutional differentiation is reduced when controlling for the size of the post-secondary sector, the level of economic development, and the degree of social inequality, but it is not affected by the inclusion of other institutional indicators, such as those for institutional standardization, privatization, and (at the top) the incidence of adult training. The negative effects of high differentiation are still stronger at the bottom of the distribution than at the top, independent of other institutional and macro-economic controls. That is, while countries with a high level of institutional differentiation appear to lag behind in the production of literacy in general, they may especially impede the skill growth of those at the bottom. But, again, broad claims about the quality-reducing effects of differentiation would be premature given the results for the very highly differentiated systems: The multiple regression models again yield tentative evidence for a slight quality advantage across the skill distribution.

At this point, we therefore briefly entertain an explanation of the comparatively positive performance of the two very highly differentiated systems, Germany and Switzerland. Besides their exceptional degree of institutional differentiation, the education systems of these two countries also share an particularly strong system of vocational education (Müller and Shavit 1998). The famed Germanic apprenticeship model combines formal school-based instruction on the upper secondary level and company-based training for skilled manual and non-manual occupations. It has been noted that vocational education in these countries is more successful in conferring important skills than the vocational sector of most other education systems (e.g., Köllö 2006). In additional analyses not reported here (but available from the authors), we assess this possible explanation for the performance of these systems empirically. The IALS data contain an indicator for the nature of respondents' secondary school degree for many of the countries included in this analysis, which allows a somewhat imprecise but still informative distinction between vocationally oriented, academically oriented, and other terminal degrees on the upper secondary level. A comparison of mean literacy scores among respondents who report upper secondary education as their highest degree of education reveals that those holding a terminal vocational degree in Germany and Switzerland do indeed fair well compared to those holding such degree in other countries. However, the main difference in literacy outcomes between these two countries and the rest appears to lie in academically oriented education: German and Swiss respondents with a terminal academically oriented degree (*Abitur* and *Matura*, respectively) outperform their counterparts in most other countries, joining the Scandinavian countries at the top of the literacy ranking. As the regression results discussed above (Table 2) attest, this advantage in adult literacy is, however, reduced by the role of the academic track in rationing access to university studies. Nevertheless, the finding is that these two countries are very successful in producing educational quality for a selective part of the population. Wide-spread resistance against nascent educational reform efforts in Switzerland and, more so, in Germany that seek to diminish the degree of institutional differentiation is typically framed as a need to conserve exactly these highly successful academic tracks. We return to this point in the conclusions.

Figure 5: Institutional differentiation and distribution of quality

Lastly, we provide a yet more detailed look at the full distribution of educational quality beyond the two arbitrarily chosen percentiles. Figure 5a depicts the shape of the full distribution of educational quality across the three types of institutional differentiation. The earlier finding of lower average literacy in nations with a highly differentiated education system is reflected in the left shift of the distribution of educational quality in these countries. Also, a notable bulge at the lower end of this distribution reflects the earlier finding (based on an examination of the 10th percentile) of higher penalties of institutional differentiation at the bottom. The same cannot be said for countries with very highly differentiated education systems. Here, the distribution of educational quality seems to be slightly compressed (see also Table 3), although it should be kept in mind that this curve refers to values from only two countries while the “low differentiation” curve averages the distribution of nine countries and is therefore more likely to produce a smoother distribution. If these curves are displayed for each country separately, the countries with very high institutional differentiation indeed do not stand out as countries with an exceptionally compressed quality distribution (available from the authors).

From the regression analyses presented above we have learned that the effects of institutional differentiation are reduced when controlling for other institutional and macro-structural factors. It is thus equally important to adjust for these additional factors when comparing these distributions. To do so, we use individual literacy scores that are purged of all institutional and macrostructural influences assessed so far. We generate this adjusted measure by regressing individuals’ literacy scores on all institutional and macrostructural features (except for the differentiation indicator) and subtracting the predicted score from the observed one. The resulting distributions of these adjusted scores (Figure 5b) are much more similar across institutional types. In other words, controlling for all contextual characteristics at once (which is not feasible in the macro-level regression models above) greatly reduces the quality differences between systems with different levels of differentiation. The quality distribution from the middle upward is now virtually identical in low and highly differentiated systems. But even after these adjustments, we can still observe a slightly more pronounced left skew for highly differentiated systems caused by a persisting bulge at the bottom of the distribution. The adjusted literacy distribution in very highly differentiated countries remains practically unchanged from the raw distribution. Overall, this again demonstrates that controlling for other characteristics of nations besides the institutional feature at the center of interest is vital to prevent a biased assessment of institutional effects. In this case, the quality-decreasing effect of high differentiation as a central feature of national education systems is considerably less pronounced once we control for some additional, theoretically relevant characteristics of these countries.

SUMMARY AND CONCLUSION

This contribution assessed two of the most fundamental functions of national education systems, the creation of skills that enable individuals' integration into society and the provision of opportunities for social mobility. We have described and explained cross-national differences in the quality of educational outcomes and the degree of equality in educational opportunity by drawing on an approach that circumvents the considerable conceptual limitations entailed in widely used data from international student assessments. We have laid our explanatory focus on the arguably most central institutional characteristic of national education systems, the differentiation of learning opportunities at the secondary level, while also considering the role of other institutional characteristics and macro-structural factors.

The results presented here contain several positive messages. First and foremost, we could not detect any evidence for a trade-off between educational quality and equality (of opportunity). Quite the opposite is the case: Countries with better outcomes on one of these performance dimensions also tend to do better on the other dimension. Educational policy makers therefore do not have to choose between two valued outcomes when attempting to reform education systems.

One of the most influential features of national education systems, which is amenable to reform, is the nature and intensity of student selection into different educational tracks and school types. For this specific institutional characteristic, the presented analyses confirmed clear, consistent, negative effects on educational equality. The fact that this association is stable to the consideration of other institutional and macroeconomic features provides more confidence in the potential equality-enhancing effects of reforms that decrease institutional differentiation (cf., Meghir and Palme 2005; Pekkarinen et al. 2009). Opposition to this type of reforms has mainly been based on the concern that less differentiated education systems may produce poorer quality outcomes. The empirical evidence produced here does not lend support to this concern. Countries with a reasonably high degree of differentiation are in fact marked by lower levels of educational quality, although a large part of this disadvantage arises from other factors, such as a relatively small post-secondary education sector, lacking economic growth, and high levels of economic inequality. This contribution shows that it is important to consider such characteristics to adequately explain cross-national differences in educational quality. It should, however, also be noted that even with these controls in place we still observe a higher proportion of adults with very low literacy outcomes in highly differentiated systems.

A sweeping critique of institutional differentiation as the perpetrator of low levels of literacy, on the other hand, also seems unwarranted. The countries included in this analysis with the most highly differentiated education systems, namely Germany and Switzerland, do not suffer from comparatively lower quality at the bottom. Nor, for that matter, do they show significantly higher quality at the top. General statements about the quality-enhancing or quality-restricting effects of institutional differentiation are challenged by these two cases and limited by the fact that other institutional characteristics and macro-structural features play an important role in accounting for differences in educational quality between systems of varying degrees of institutional differentiation. A conservative interpretation of the findings presented nevertheless suggests that ambitious educational reforms aimed at increasing equality of educational opportunities by decreasing the differentiation of the education system could be able to do so at no cost in terms of educational quality. This conclusion may be particularly relevant for those countries in which institutional differentiation is highest, Germany and Switzerland, and resistance to reform still substantial. In addition, arguments in the defense of high differentiation that (in many cases wrongly) assume superior educational quality on the secondary level fail to appreciate the quality-reducing effect of the restricted access to post-secondary education that typically accompanies high institutional differentiation.

We have begun this project with the aim of establishing answers to fundamental sociological questions about the performance of education systems and have argued that an existing and growing field of comparative research based on data from international student assessments provides only indirect and ultimately inadequate evidence to address these questions. However, based on our empirical findings, we now also need to acknowledge that some of the conclusions drawn in our research are very much in line with conclusions drawn in the research based on international student assessments (while others, such as those on the impact of the size of the post-secondary sector, could only be assessed in our contribution). In particular, both find no trade-off between average levels of capabilities and the degree of socio-economic inequality in educational outcomes. Furthermore, both find institutional differentiation to be the most important characteristic impacting these two dimensions of educational performance. We have provided a number of arguments why the possibility to infer institutional effects, especially effects of institutional differentiation, from comparisons based on student assessment data is severely limited. Although the conceptual limitations of these data remain, we suspect that their users will greet the partial overlap in conclusions as welcome but indirect evidence for the

potential of these data to inform a sociological perspective on the performance of education systems. In our view, that does not supplant the need for direct evidence on how widely used international student test score data relate to those final capabilities most relevant for social integration as well as to individuals' future life chances. This direct evidence would ideally come from longitudinal extensions to some of these large-scale comparative studies.

The analytical approach applied here also invites a number of improvements and extensions. First, as we have pointed earlier, our assessment of educational equality has only selectively attended to horizontal inequalities in education, that is, differences in quality and type within a given educational level. Future research may seek to assess how the (vertical) educational equality assessed here relates to horizontal equalities. In fact, similar to existing theories on the development of educational equality over time (Lucas 2001), one may hypothesize a trade-off between these two dimensions, with horizontal inequalities being more important in nations with low vertical inequality. Second, we have based our analysis of educational quality on a measure of literacy that can be viewed as an important, but certainly not the only relevant capability for social integration. Future research and data collections may seek to assess different capabilities that are relevant for integration into the "knowledge society", such as the ability to weight the trustworthiness of different sources of information or the ability to engage in complex reasoning. Although the investigation of the distributional shape of our literacy measure did not lead to any concern about ceiling effects, one may still raise the objection that investigations of educational quality at the top of the distribution should draw on measures other than literacy: If the further economic growth of most industrialized nations chiefly relies on technical innovations and creativeness, the quality at the top that is most crucial may not be the ability to perform basic math tasks and understand written materials, but to engage in the creative solution of complex analytical problems. Finally, in the future, researchers will be able to draw on other and new comparative datasets to assess the performance of education systems. It should be noted that, in doing so, they will not necessarily be restricted to datasets containing information on both dimensions of educational performance, like in the dataset used here, but may combine information from a variety of sources to separately estimate and explain the degree of equality and quality in education.

References

- Allmendinger, Jutta. 1989. *Career Mobility Dynamics*. Berlin: Max-Planck-Institut für Bildungsforschung.
- Ammermüller, Andreas. 2005. "Educational Opportunities and the Role of Institutions." *ZEW Discussion Paper* 05-44.
- Argys, Laura M, Daniel I Rees, and Dominic J Brewer. 1996. "Detracking America's Schools: Equity at Zero Cost?" *Journal of Policy Analysis and Management* 15:623–645.
- Arum, Richard, Adam Gamoran, and Yossi Shavit. 2007. "More Inclusion Than Diversion: Expansion, Differentiation, and Market Structure in Higher Education." In *Stratification in Higher Education. A Comparative Study*, volume 15, chapter One, pp. 1–38. Stanford, CA: Stanford University Press.
- Baker, David P and David L Stevenson. 1986. "Mothers' Strategies for Children's School Achievement. Managing the Transition to High School." *Sociology of Education* 59:156–166.
- Barone, Carlo and Herman G. van de Werfhorst. 2011. "Education, cognitive skills and earnings in comparative perspective." *International Sociology* 26:483–502.
- Barr, Rebeca and Robert Dreeben. 1983. *How Schools Work*. Chicago: The University Of Chicago Press.
- Barro, Robert J. 1998. *Determinants of Economic Growth. A Cross-Country Empirical Study*. Cambridge: MIT Press.
- Beller, Emily and Michael Hout. 2006. "Welfare States and social mobility. How educational and social policy may affect cross-national differences in the association between occupational origins and destinations." *Research in Social Stratification and Mobility* 24:353–365.
- Blossfeld, Hans-Peter and Yossi Shavit. 1993a. *Persistent Inequality. Changing Educational Attainment in Thirteen Countries*. Boulder: Westview Press.
- Blossfeld, Hans-Peter and Yossi Shavit. 1993b. "Persisting Barriers: Changes in Educational Opportunities in Thirteen Countries." In *Persistent Inequality: Changing Educational Attainment in Thirteen Countries*, edited by Yossi Shavit and Hans-Peter Blossfeld, volume 15, pp. 1–23. Boulder, CO: Westview Press.
- Bowles, Samuel and Herbert Gintis. 1976. *Schooling in Capitalist America. Educational Reform and the Contradictions of Economic Life*. New York: Basic Books.
- Braverman, Harry. 1974. *Labor and Monopoly Capital. The Degradation of Work in the Twentieth Century*. New York / London: Monthly Review Press.
- Breen, Richard and Jan O Jonsson. 2005. "Inequality of Opportunity in Comparative Perspective. Recent Research on Educational Attainment and Social Mobility." *Annual Review of Sociology* 31:223–243.
- Breen, Richard, Ruud Luijkx, Walter Müller, and Reinhard Pollak. 2009. "Nonpersistent Inequality in Educational Attainment. Evidence from Eight European Countries." *American Journal of Sociology* 114:1475–1521.
- Brown, Giorgina, John Micklewright, Sylke V Schnepf, and Robert Waldmann. 2007. "International surveys of educational achievement: how robust are the findings?" *Journal of the Royal Statistical Society. Series A* 170:623–636.
- Brunello, Giorgio and Daniele Checchi. 2007. "Does school tracking affect equality of opportunity? New international evidence." *Economic Policy* 22:781–861.
- Brunello, Giorgio, Massimo Giannini, and Kenn Ariga. 2007. "The Optimal Timing of School Tracking: A General Model with Calibration for Germany." In *School and the Equal Opportunity Problem*, edited by Ludger Woessmann and Paul E. Peterson, chapter 6, pp. 129–156. Cambridge.
- Brunello, Giorgio, Lorenzo Rocco, Kenn Ariga, and Roki Iwahashi. 2012. "On the efficiency costs of de-tracking secondary schools in Europe." *Education Economics* 20:117–138.
- Buchmann, Claudia. 2002. "Measuring Family Background in International Studies of Education: Conceptual Issues and Methodological Challenges." In *Methodological Advances in Cross-National Surveys of Educational Achievement*, edited by National Research Council, pp. 150–197. Washington: National Academy Press.

- Buchmann, Claudia and Ben Dalton. 2002. "Interpersonal influences and educational aspirations in 12 countries. The importance of institutional context." *Sociology of Education* 75:99–122.
- Buchmann, Claudia and Hyunjoon Park. 2009. "Stratification and the formation of expectations in highly differentiated educational systems." *Research in Social Stratification and Mobility* 27:245–267.
- Coleman, James S. 1968. "The Concept of Equality of Educational Opportunity." *Harvard Educational Review* 38:7–22.
- DiPrete, Thomas A and Gregory M Eirich. 2006. "Cumulative Advantage as a Mechanism for Inequality. A Review of Theoretical and Empirical Developments." *Annual Review of Sociology* 32:271–297.
- Downey, Douglas B, Paul T von Hippel, and Beckett A Broh. 2004. "Are Schools the Great Equalizer? Cognitive Inequality during the Summer Months and the School Year." *American Sociological Review* 69:613–635.
- Duflo, Esther, Pascaline Dupas, and Michael Kremer. 2011. "Peer Effects , Teacher Incentives , and the Impact of Tracking. Evidence from a Randomized Evaluation in Kenya." *American Economic Review* 101:1739–1774.
- Durkheim, Emile. 1922. [1965] *Education and Sociology*. New York: Free Press.
- Erikson, Robert and John H Goldthorpe. 1992. *The Constant Flux. A Study of Class Mobility in Industrial Societies*. Oxford: Clarendon Press.
- Figlio, David N. and Marianne E. Page. 2002. "School Choice and the Distributional Effects of Ability Tracking: Does Separation Increase Inequality?" *Journal of Urban Economics* 51:497–514.
- Gamoran, Adam. 1987. "The Stratification of High School Learning Opportunities." *Sociology of Education* 60:135–155.
- Gamoran, Adam and Robert Mare. 1989. "Secondary School Tracking and Educational Inequality. Compensation, Reinforcement, or Neutrality?" *American Journal of Sociology* 94:1146–1183.
- Gerber, Theodore P and Sin Yi Cheung. 2008. "Horizontal Stratification in Postsecondary Education. Forms, Explanations, and Implications." *Annual Review of Sociology* 34:299–318.
- Gesthuizen, Maurice, Heike Solga, and Ralf Künster. 2011. "Context Matters. Economic Marginalization of Low-educated Workers in Cross-national Perspective." *European Sociological Review* 27:264–280.
- Hallinan, Maureen T. 1988. "Equality of Educational Opportunity." *Annual Review of Sociology* 14:249–268.
- Hallinan, Maureen T. 1994. "Tracking. From Theory to Practice." *Sociology of Education* 67:79–84.
- Hanushek, Eric A and Ludger Woessmann. 2006. "Does Educational Tracking Affect Performance and Inequality? Differences-in-Differences Evidence Across Countries." *The Economic Journal* 116:C63–C76.
- Hanushek, Eric A. and Ludger Woessmann. 2008. "The Role of Cognitive Skills in Economic Development." *Journal of Economic Literature* 46:607–668.
- Hauser, Robert M. 2009. "On "Quality and Equity in the Performance of Students and Schools"." *Center for Demography and Ecology Working Paper No. 2009-06*.
- Haveman, Robert, Gary Sandefur, Barbara Wolfe, and Andrea Voyer. 2004. "Trends in Children's Attainments and Their Determinants as Family Income Inequality Has Increased." In *Social Inequality*, edited by Kathryn M Neckerman, pp. 149–188. New York: Russell Sage Foundation.
- Haveman, Robert and Barbara Wolfe. 1995. "The Determinants of Children's Attainments: A Review of Methods and Findings." *Journal of Economic Literature* 33:1829–1878.
- Hermann, Zoltan and Daniel Horn. 2011. "How inequality of opportunity and mean student performance are related?"
- Hersh Salganik, Laura and Dominique Simone Rychen. 2003. *Key competencies for a successful life and a well-functioning society*. Cambridge: Hogrefe & Huber.
- Heyns, Barbara. 1978. *Summer Learning and the Effects of Schooling*. New York / San Francisco / London: Academic Press.
- Hoffmeyer-Zlotnik, Jürgen H P. 2003. "The Classification of Education as a Sociological Background Characteristic." In *Advances in Cross-National Comparison. A European Working Book for Demographic and Socio-Economic Variables*, edited by Jürgen H P Hoffmeyer-Zlotnik and Christof Wolf, pp. 245–256. New York: Kluwer Academic / Plenum Publishers.

- Hopper, Earl I. 1968. "A Typology for the Classification of Educational Systems." *Sociology* 2:29–46.
- Horn, Daniel. 2009. "Age of selection counts: A cross-country analysis of educational institutions." *Educational Research and Evaluation* 15:343–366.
- Hout, Michael. 2007. "Maximally Maintained Inequality Revisited. Irish Educational Mobility in Comparative Perspective." In *Changing Ireland, 1989-2003*, edited by Maire NicGhiolla Phadraig and Elizabeth Hilliard.
- Hout, Michael and Thomas A DiPrete. 2006. "What we have learned. RC28's contributions to knowledge about social stratification." *Research in Social Stratification and Mobility* 24:1–20.
- Jencks, Christopher, Marshall Smith, Henry Acland, Mary Jo Bane, David Cohen, Herbert Ginthis, Barbara Heyns, and Stephan Michelson. 1972. *Inequality. A Reassessment of the Effect of Family and Schooling in America*. New York: Basic Books.
- Kenworthy, Lane. 2004. *Egalitarian Capitalism. Jobs, Incomes, and Growth in Affluent Countries*. Rose Series in Sociology. New York: Russell Sage Foundation.
- Kenworthy, Lane. 2007. "Toward improved use of regression in macro-comparative analysis." *Comparative Social Research* 24:343–350.
- Kerckhoff, Alan C. 1993. *Diverging Pathways. Social Structure and Career Deflections*, volume 55. Cambridge: Cambridge University Press.
- Kerckhoff, Alan C. 1995. "Institutional Arrangements and Stratification Processes in Industrial Societies." *Annual Review of Sociology* 15:323–347.
- Kerckhoff, Alan C. 2001. "Education and Social Stratification Processes in Comparative Perspective." *Sociology of Education* 74:3–18.
- Kingston, Paul W, Ryan Hubbard, Brent Lapp, Paul Schroeder, and Julia Wilson. 2003. "Why Education Matters." *Sociology of Education* 76:53–70.
- Kirsch, Irwin. 2001. "The International Adult Literacy Survey (IALS): Understanding What Was Measured." Technical report.
- Köllo, János. 2006. "Workplace Literacy Requirements and Unskilled Employment in East-Central and Western Europe." *Budapest Working Papers on the Labour Market 2006/7*.
- Labaree, David F. 1997. "Public Goods, Private Goods. The American Struggle Over Educational Goals." *American Educational Research Journal* 34:39–81.
- Lieberson, Stanley. 1991. "Small N's and Big Conclusions. An Examination of the Reasoning in Comparative Studies Based on a Small Number of Case." *Social Forces* 70:307–320.
- Lucas, Samuel R. 2001. "Effectively Maintained Inequality. Education Transitions, Track Mobility, and Social Background Effects." *American Journal of Sociology* 106:1642–1690.
- Marks, Gary N. 2005. "Cross-National Differences and Accounting for Social Class Inequalities in Education." *International Sociology* 20:483–505.
- Marks, Gary N, John Cresswell, and John Ainley. 2006. "Explaining Socioeconomic Inequalities in Student Achievement. The role of home and school factors." *Educational Research and Evaluation* 12:105–128.
- Meghir, Costas and Mårten Palme. 2005. "Educational Reform, Ability, and Family Background." *American Economic Review* 95:414–425.
- Müller, Walter and Wolfgang Karle. 1993. "Social Selection in Educational Systems in Europe." *European Sociological Review* 9:1–23.
- Müller, Walter and Yossi Shavit. 1998. "The Institutional Embeddedness of the Stratification Process. A Comparative Study of Qualifications and Occupations in Thirteen Countries." In *From School to Work. A Comparative Study of Educational Qualifications and Occupational Destinations*, edited by Yossi Shavit and Walter Müller, p. 550. Oxford: Clarendon Press.
- Oakes, Jeannie. 1985. *Keeping Track. How Schools Structure Inequality*. New Haven: Yale University Press, 2nd edition.
- OECD (Organization for Economic Cooperation and Development). 2005. *Definition and Selection of Competencies. Executive Summary*. Paris: OECD Publishing.
- OECD (Organization for Economic Cooperation and Development). 2007. "Quality and Equity in the Performance of Students and Schools." In *Science Competencies for Tomorrow's World*, pp. 169–212.

- Okun, Arthur M. 1975. *Equality and Efficiency. The Big Tradeoff*. Washington: Brookings Institution.
- Park, Hyunjoon and Pearl Kyei. 2011. "Literacy Gaps by Educational Attainment: A Cross-National Analysis." *Social Forces* 89:879–904.
- Pekkarinen, Tuomas, Roope Uusitalo, and Sari Kerr. 2009. "School Tracking and Development of Cognitive Skills." *IZA Discussion Paper No. 4058*.
- Pfeffer, Fabian T. 2008. "Persistent inequality in educational attainment and its institutional context." *European Sociological Review* 24:543–565.
- Porter, Andrew C and Adam Gamoran. 2002. "Progress and Challenges for Large-Scale Studies." In *Methodological Advances in Cross-National Survey of Educational Achievement*, edited by National Research Council, pp. 3–23. Washington: National Academy Press.
- Psacharopoulos, George. 1992. "The Contribution of Education to Economic Growth. International Comparisons." In *The Economics of Education*, edited by Mark Blaug, pp. 470–490. London: Edward Elgar.
- Raffe, David, Karen Brannen, Linda Croxford, and Chris Martin. 1999. "Comparing England, Scotland, Wales and Northern Ireland. The case for 'home internationals' in comparative research." *Comparative Education* 35:9–25.
- Raftery, Adrian E and Michael Hout. 1993. "Maximally Maintained Inequality. Expansion, Reform, and Opportunity in Irish Education 1921–75." *Sociology of Education* 66:41–62.
- Ramirez, Francisco O, Xiaowei Luo, Evan Schofer, and John W Meyer. 2006. "Student Achievement and National Economic Growth." *American Journal of Education* 113:1–29.
- Raudenbush, Stephen W and Ji-Soo Kim. 2002. "Statistical Issues in Analysis of International Comparisons of Educational Achievement." In *Methodological Advances in Cross-National Survey of Educational Achievement*, edited by National Research Council, pp. 267–294. Washington: National Academy Press.
- Reardon, Sean F. 2011. "The Widening Academic Achievement Gap Between the Rich and the Poor: New Evidence and Possible Explanations." In *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, edited by Richard Murnane and Greg Duncan. New York: Russell Sage Foundation.
- Robert, Peter. 2010. "Social origin, school choice, and student performance." *Educational Research and Evaluation* 16:107–129.
- Rubinson, Richard. 1986. "Class Formation, Politics, and Institutions. Schooling in the United States." *American Journal of Sociology* 92:519–548.
- Sacerdote, Bruce. 2011. "Peer Effects in Education. How Might They Work, How Big Are They and How Much Do We Know Thus Far?" In *Handbook of the Economics of Education*, volume 3, chapter 4, pp. 249–277. Elsevier B.V.
- Scharpf, Fritz W and Vivien A Schmidt (eds.). 2000. *Welfare and Work in the Open Economy. Diverse Responses to Common Challenges*, volume 2. Oxford: Oxford University Press.
- Schneider, Silke (ed.). 2008. *The International Standard Classification of Education (ISCED-97). An Evaluation of Content and Criterion Validity for 15 European Countries*. Mannheim: Mannheimer Zentrum für Europäische Sozialforschung (MZES).
- Schultz, Theodore W. 1961. "Education and Economic Growth." In *Social Forces Influencing American Education*, edited by Nelson B Henry, pp. 46–88. Chicago: University Of Chicago Press.
- Schütz, Gabriela, Heinrich W. Ursprung, and Ludger Wößmann. 2008. "Education Policy and Equality of Opportunity." *Kylos* 61:279–308.
- Shavit, Yossi, Richard Arum, and Adam Gamoran (eds.). 2007. *Stratification in Higher Education: A Comparative Study*. Social Inequality Series. Stanford: Stanford University Press.
- Shavit, Yossi and Walter Müller. 1998. *From School to Work. A Comparative Study of Educational Qualifications and Occupational Destinations*. Oxford: Clarendon Press.
- Stevenson, David Lee and David P Baker. 1991. "State Control of the Curriculum and Classroom Instruction." *Sociology of Education* 64:1–10.
- Summers, Anita A. and Barbara L. Wolfe. 1977. "Do schools make a difference?" *American Economic Review* 67:639–352.

- Treiman, Donald J. 1970. "Industrialization and Social Stratification." In *Social Stratification. Research and Theory for the 1970s*, edited by Edward O Laumann, pp. 207–234. Indianapolis: Bobbs-Merrill.
- Treiman, Donald J and Kam-Bor Yip. 1989. "Educational and Occupational Attainment in 21 Countries." In *Cross-National Research in Sociology*, edited by Melvin L Kohn, pp. 373–394. London: Sage.
- Van de Werfhorst, Herman G. 2011. "Skill and education effects on earnings in 18 Countries. The role of national educational institutions." *Social Science Research* 40:1078–1090.
- Van de Werfhorst, Herman G. and Jonathan J.B. Mijs. 2010. "Achievement Inequality and the Institutional Structure of Educational Systems. A Comparative Perspective." *Annual Review of Sociology* 36:407–428.
- Woessmann, Ludger. 2008. "How Equal Are Educational Opportunities? Family Background and Student Achievement in Europe and the United States."
- Woessmann, Ludger. 2009. "International Evidence on School Tracking. A Review." *CESifo DICE Report* 1:26–32.
- Xie, Yu. 1992. "The Log-Multiplicative Layer Effect Model for Comparing Mobility Tables." *American Sociological Review* 57:380–395.
- Zimmer, Ron W and Eugenia F Toma. 2000. "Peer Effects in Private and Public Schools across Countries." *Journal of Policy Analysis and Management* 19:75–92.

APPENDICES

A.1 Institutional and Macrostructural Features

Country	Code	Differ.	Stand.	Priv.	PSE	Train.	GDP	Ind.	Gini	F.Soc.
Belgium	BEL	high	low	high	17	24.2	18,496	0.55	29.8	no
Canada	CAN	low	low	low	14.2	37.0	19,274	1.27	28.3	no
Chile	CHL	high	high	high	8.7	26.1	3,093	-1.42	54.5	no
Czech Rep.	CZE	high	high	low	16.6	27.6	5,249	0.32	25.7	yes
Denmark	DNK	low	high	high	19.7	61.3	24,458	0.18	21.3	no
Finland	FIN	low	high	low	13.2	63.6	19,970	-0.24	22.8	no
Germany	GER	v. high	high	low	13.6	17.7	19,430	0.42	28.3	no
Great Britain	GB	low	low	high	16.9	46.6	19,671	0.58	31.2	no
Hungary	HUN	high	high	low	13.3	18.2	4,139	-0.81	29.4	yes
Ireland	IRL	low	high	low	8.9	28.1	13,533	-1	32.4	no
Italy	ITA	high	high	low	14.4	32.5	16,176	-0.51	34.8	no
New Zealand	NZL	low	high	low	14.2	52.7	11,431	-0.29	33.1	no
N. Ireland	NIR	high	low	high	13.7	37.3	19,671	0.58	31.2	no
Norway	NOR	low	high	low	28.5	52.2	27,301	0.19	25.6	no
Poland	POL	high	high	low	9.2	14.6	3,053	-1.36	38.9	yes
Slovenia	SVN	high	low	low	7.4	40.8	8,004	0.79	26.4	yes
Sweden	SWE	low	high	low	14	46.1	22,974	0.46	21.1	no
Switzerland	CH	v. high	high	low	9.8	48.5	33,030	-0.03	26.7	no
United States	USA	low	low	high	31.2	41.5	28,263	1.69	36.1	no

Notes

Differentiation:

The classification of countries according to the degree of differentiation follows the criteria described on page 25 and are derived from narrative descriptions of national education systems. For a brief description of each system that illustrates the arguments behind these classificatory decisions (as well those for standardization and privatization) see Pfeffer (2008).

Standardization:

Classification of countries according to the overall degree of standardization of educational governance and contents. Classifying the British system as unstandardized can be debated (see also Müller and Shavit 1998: 12). The same holds for Slovenia. Reclassifying these cases as standardized does not affect the reported conclusions.

Privatization:

Published figures on the share of private enrollment are subject to a good deal of historical change (for instance, Chile implemented radical privatization policies in the 1980s). They are therefore not used as strict and precise measures but instead to supplement a broad categorization based on narrative accounts.

Post-secondary education:

Given that the IALS data consist of nationally representative samples, a convenient way to measure the inclusiveness of the post-secondary sector is to compute the population share of post-secondary degree holders directly from these data. Accordingly, this characteristic is indicated by a continuous

measure of the percentage of tertiary degree holders (ISCED6/7) in the total population aged 25 to 65. Using measures from independent education statistics yields the same substantive conclusions (available from the authors).

Training & Adult Education:

Again taking advantage of the fact that the IALS data are nationally representative, this variable consists of the share of respondents indicating that they have participated in professional training or adult education within the preceding year.

GDP:

GDP per capita data from the year 1990 (in constant 2000 US dollars) stem from the Worldbank Indicators database. This and the remaining indicators of macroeconomic context are not available separately for Northern Ireland. We assign Great Britain's value, but analyses without Northern Ireland yield virtually the same results.

Industrialization:

Following Treiman and Yip (1989), this index is based on the percentage of the population that does not work in agriculture and the per capita energy consumption for the 1970s (averaged and mean mean-standardized). Due to missing data for Slovenia (at that time still part of Yugoslavia), the index value cannot be constructed for this case and is instead imputed based on the GDP per capita value. Excluding Slovenia for this analysis does not change the results.

Gini:

Gini coefficients of disposable household income come from the mid 1990s (depending on availability in each country) from OECD and UN-WIDER data sources.

Former Socialist:

A dummy indicator for former socialist countries.

A.2 Alternative specification of institutional differentiation

Here, we report coefficients from alternative specifications of the effects of institutional differentiation as a sensitivity test for our findings reported in the main text. We draw on quantitative indicators of differentiation from published work by Brunello and Checchi (2007) (indicated by BC) as well as Horn (2009) (indicated by H; regressions based on these indicators exclude Chile and Slovenia, for which this information has not been assessed). Tables 4 and 5 follow the same sequence of models as that reported in Tables 1 and 2 but report only the coefficients for the different indicators of institutional differentiation. These indicators are:

- Age of Selection: The typical age of students at which educational differentiation begins. Indicators have been constructed for the 1980s (Brunello/Checchi) and 1990s (Brunello/Checchi and Horn).
- Percent Tracked: The typical length of school tracking, measured as the share of time spent in a differentiated context on the primary and secondary level (for details see Brunello and Checchi 2007: p. 798), again constructed for both the 1980s and 1990s.
- Number of School Types: The number of school types or distinct educational programs available for 15-year olds as reported by the OECD (Horn 2009)

Table 4: Institutional and macro-economic context of equality

	1	2	3	4	5	6	7	8	9
Age of Selection (BC80)	0.05** (0.01)	0.05** (0.01)	0.05** (0.01)	0.05** (0.02)	0.05* (0.02)	0.05** (0.01)	0.06** (0.02)	0.05** (0.01)	0.05** (0.01)
Age of Selection (BC90)	0.04* (0.01)	0.04* (0.02)	0.04* (0.01)	0.04* (0.02)	0.04 (0.02)	0.05* (0.02)	0.04* (0.02)	0.04* (0.01)	0.04* (0.02)
Age of Selection (H)	0.05** (0.02)	0.05* (0.02)	0.05* (0.02)	0.05** (0.02)	0.04+ (0.02)	0.07*** (0.02)	0.05** (0.02)	0.05** (0.02)	0.06** (0.02)
Percent Tracked (BC80)	-0.63** (0.16)	-0.71*** (0.17)	-0.60** (0.17)	-0.64** (0.18)	-0.61** (0.21)	-0.66** (0.17)	-0.74*** (0.18)	-0.63** (0.17)	-0.62** (0.17)
Percent Tracked (BC90)	-0.49* (0.17)	-0.57** (0.19)	-0.45* (0.18)	-0.48* (0.19)	-0.43+ (0.23)	-0.56** (0.19)	-0.56** (0.19)	-0.49* (0.17)	-0.49* (0.19)
Number of School Types (H)	-0.07** (0.02)	-0.07* (0.02)	-0.07* (0.02)	-0.08** (0.02)	-0.06+ (0.03)	-0.09** (0.02)	-0.07* (0.03)	-0.07** (0.02)	-0.09** (0.02)

Note: Linear regression coefficients; s.e. in parantheses (+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$)

Table 5: Institutional and macro-economic context of quality

	1	2	3	4	5	6	7	8	9
Age of Selection (BC80)	3.08 (2.53)	3.31 (2.71)	3.24 (2.62)	1.11 (2.39)	-1.08 (3.20)	0.42 (2.07)	0.35 (2.39)	2.38 (1.76)	2.06 (2.49)
Age of Selection (BC90)	2.66 (2.37)	2.94 (2.58)	2.82 (2.45)	0.95 (2.20)	-1.79 (3.07)	-0.91 (2.03)	0.20 (2.20)	1.94 (1.66)	1.18 (2.46)
Age of Selection (H)	1.56 (2.50)	1.46 (2.64)	1.44 (2.64)	0.76 (2.38)	-4.73 (2.84)	-1.44 (2.31)	0.56 (1.96)	1.49 (1.70)	-0.97 (2.63)
Percent Tracked (BC80)	-36.04 (30.91)	-41.24 (34.23)	-39.69 (32.31)	-10.77 (29.30)	4.85 (35.72)	-8.71 (24.58)	1.03 (29.64)	-36.10+ (20.62)	-21.69 (30.80)
Percent Tracked (BC90)	-30.18 (29.03)	-36.37 (33.06)	-33.66 (30.44)	-7.94 (27.09)	16.18 (34.83)	9.73 (24.28)	3.93 (27.40)	-28.63 (19.73)	-9.48 (30.80)
Number of School Types (H)	-4.67 (3.40)	-4.77 (3.70)	-4.73 (3.70)	-2.53 (3.61)	1.07 (4.21)	-1.76 (3.16)	-1.40 (2.96)	-3.18 (2.36)	-2.17 (3.61)

Note: Linear regression coefficients; s.e. in parantheses (+ p<.10, * p<.05, ** p<.01, *** p<.001)

A.3 Institutional and macro-economic context of high and low quality

Table 6: Institutional and macro-economic context of quality at the top (90th percentile)

	1	2	3	4	5	6	7	8	9
Highly stratified	-29.87** (7.69)	-30.36*** (7.40)	-29.91** (7.95)	-23.74** (7.96)	-29.69* (10.72)	-17.81+ (9.25)	-22.63** (6.02)	-22.39** (6.89)	-29.06** (9.82)
Very highly stratified	-8.73 (12.38)	-4.81 (12.17)	-8.37 (13.07)	-1.65 (12.23)	-8.60 (13.82)	-14.71 (11.72)	-7.14 (9.18)	-9.35 (10.27)	-8.73 (12.77)
Standardized		-11.78 (7.73)							
Private sector			1.08 (8.30)						
Rel. size of PSE				1.15+ (0.64)					
Training					0.01 (0.36)				
GDP per capita						10.93+ (5.43)			
Industrialization							13.21** (3.51)		
Income Gini								-1.28* (0.45)	
Former Socialist									-1.62 (11.55)
N	19	19	19	19	19	19	19	19	19
R2	0.49	0.56	0.49	0.58	0.49	0.60	0.74	0.67	0.49

Note: Linear regression coefficients; s.e. in parantheses (+ p<.10, * p<.05, ** p<.01, *** p<.001)

Table 7: Institutional and macro-economic context of quality at the bottom (10th percentile)

	1	2	3	4	5	6	7	8	9
Highly stratified	-49.81** (13.86)	-49.65** (14.29)	-49.81** (14.32)	-37.40* (13.92)	-42.38* (19.09)	-34.00+ (17.69)	-42.18** (13.79)	-34.66** (11.48)	-51.49* (17.68)
Very highly stratified	8.49 (22.29)	7.17 (23.50)	8.43 (23.56)	22.83 (21.38)	13.91 (24.61)	0.65 (22.42)	10.17 (21.04)	7.24 (17.10)	8.49 (23.00)
Standardized		3.95 (14.93)							
Private sector			-0.18 (14.96)						
Rel. size of PSE				2.34+ (1.12)					
Training					0.37 (0.64)				
GDP per capita						14.34 (10.38)			
Industrialization							13.93 (8.05)		
Income Gini								-2.60** (0.74)	
Former Socialist									3.36 (20.81)
N	19	19	19	19	19	19	19	19	19
R2	0.49	0.49	0.49	0.60	0.50	0.54	0.57	0.72	0.49

Note: Linear regression coefficients; s.e. in parantheses (+ p<.10, * p<.05, ** p<.01, *** p<.001)



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