How Student Performance Varies between Schools and the Role that Socio-economic Background Plays in This

INTRODUCTION

Nine-tenths of the student performance variation in PISA is within countries, and this chapter looks at…

Chapter 2 considered how well students in different countries perform in mathematics at age 15. The analyses reveal considerable variation in the relative standing of countries in terms of their students' capacity to put mathematical knowledge and skills to functional use. However, the analyses also suggest that differences between countries represent only about one-tenth of the overall variation in student performance in the OECD area.[1]

…how much of that variation is associated with performance differences among schools and with socio-economic groups…

Variation in student performance within countries can have a variety of causes, including the socio-economic backgrounds of students and schools; the ways in which teaching is organised and delivered in classes; the human and financial resources available to schools; and system-level factors such as curricular differences and organisational policies and practices.

This chapter starts by examining more closely the performance gaps shown in Chapter 2. It considers, in particular, the extent to which overall variation in student performance relates to differences in the results achieved by different schools. Next, it looks at how socio-economic background relates to student performance. In so doing, it describes the socio-economic gradients that relate students' performance in mathematics to their backgrounds. The chapter then considers these two phenomena in combination (between-school differences in performance and the impact of socio-economic background). In order to examine how socio-economic background is interrelated with equity in the distribution of learning opportunities.

…as well as at policy approaches for raising performance and improving equity in the distribution of learning opportunities.

Finally, the chapter considers the policy implications of these findings, discussing why different policy strategies are likely to be appropriate in different countries, according to the extent to which low performance is concentrated in particular schools and particular socio-economic groups.

Chapter 5 takes the analysis further by examining school resources, policies and practices that are associated with school performance as measured by PISA.

The overall impact of home background on student performance tends to be similar for mathematics, reading and science in PISA 2003.[2] Therefore, to simplify the presentation and avoid repetition, the chapter limits the analysis to student performance in mathematics, and it considers the combined mathematics scale rather than examining the four mathematics scales separately.

SECURING CONSISTENT STANDARDS FOR SCHOOLS: A PROFILE OF BETWEEN- AND WITHIN-SCHOOL DIFFERENCES IN STUDENT PERFORMANCE

School performance differences can arise from the separation of students…

Catering for the needs of a diverse student body and narrowing the gaps in student performance represent formidable challenges for all countries. The approaches that countries have chosen to address these demands vary. Some countries have comprehensive school systems with no, or only limited institutional differentiation.

They seek to provide all students with similar opportunities for learning by requiring each school and teacher to provide for the full range of student abilities, interests and backgrounds. Other countries respond to diversity by grouping students through tracking or streaming, whether between schools or between classes within schools, with the aim of serving students according to their academic potential and/or interests in specific programmes. And in many countries, combinations of the two approaches occur.

…but even comprehensive systems can see variation linked, for example, to geography and school quality.

Even in comprehensive school systems, there may be significant variation in performance levels between schools, due to the socio-economic and cultural characteristics of the communities that are served or to geographical differences (such as between regions, provinces or states in federal systems, or between rural and urban areas). Finally, there may be differences between individual schools that are more difficult to quantify or describe, part of which could result from differences in the quality or effectiveness of the instruction that those schools deliver. As a result, even in comprehensive systems, the performance levels attained by students may still vary across schools.

How do the policies and historical patterns that shape each country's school system affect and relate to the variation in student performance between and within schools? Do countries with explicit tracking and streaming policies show a higher degree of overall disparity in student performance than countries that have non-selective education systems? Such questions are particularly relevant to countries that observe large variation in overall mathematics performance (Table 4.1a).

Total variation in student performance is over a third greater in some countries than others…

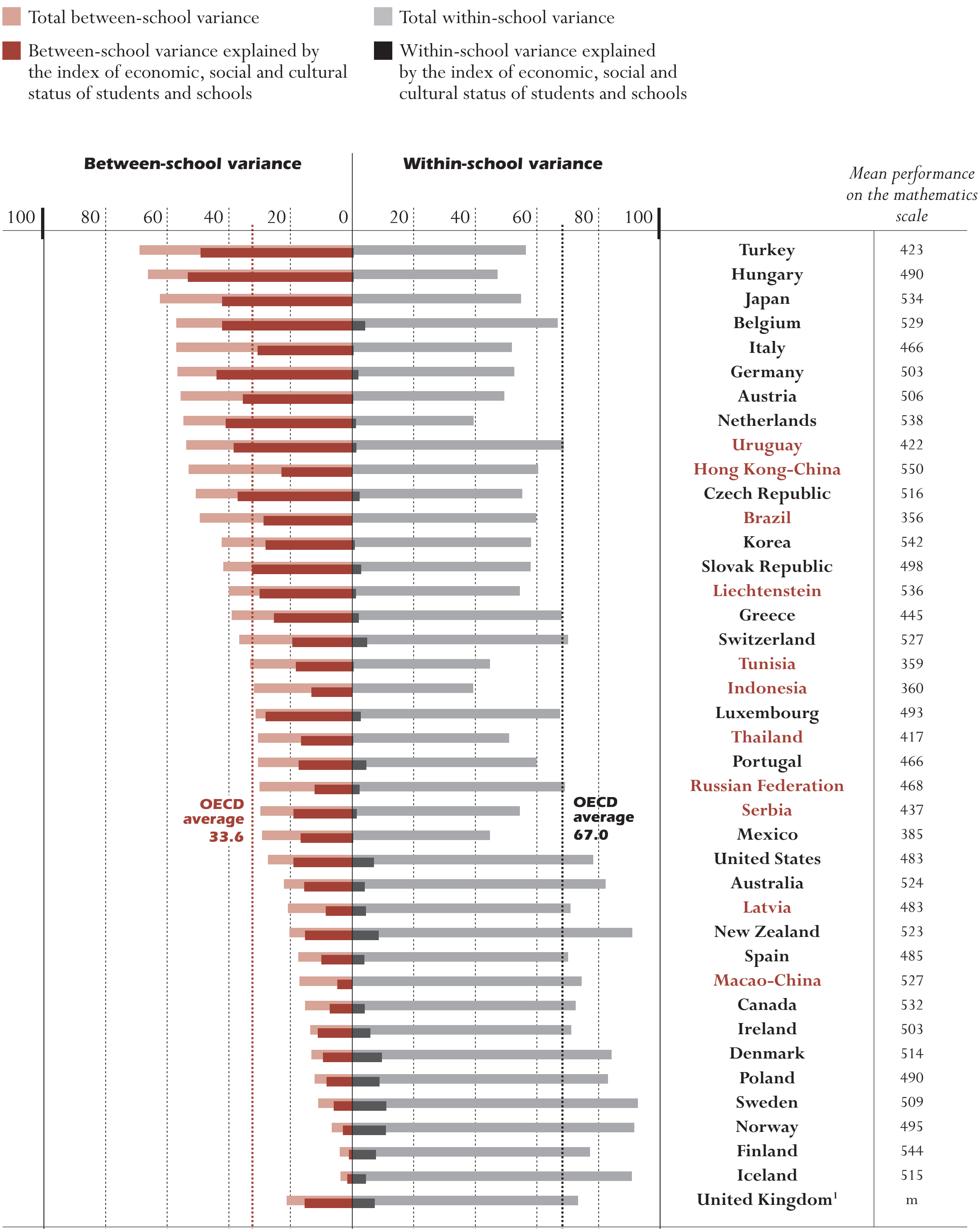
Figure 4.1 shows considerable differences in the extent to which mathematics competencies of 15-year-olds vary within each country (Table 4.1a). The total length of the bars indicates the observed variance in student performance on the PISA mathematics scale. Note that the values in Figure 4.1 are expressed as percentages of the average variance between OECD countries in student performance on the PISA mathematics scale, which is equal to 8 593 units.[3] A value larger than 100 indicates that variance in student performance is greater in the corresponding country than on average among OECD countries. Similarly, a value smaller than 100 indicates below-average variance in student performance. For example, the variance in student performance in Finland, Ireland and Mexico as well as in the PISA partner countries Indonesia, Serbia,[4] Thailand and Tunisia is more than 15 per cent below the OECD average variance. By contrast, in Belgium, Japan and Turkey as well as in the partner countries Brazil, Hong Kong-China and Uruguay, variance in student performance is 15 per cent above the OECD average level.[5]

…and how much of that variation is across different schools varies greatly.

For each country, a distinction is made between the variance attributable to differences in student results attained by students in different schools (between-school differences) and that attributable to the range of student results within schools (within-school differences).[6] In Figure 4.1, the length of the bars to the left of the central line shows between-school differences, and also serves to order countries in the figure. The length of the bars to the right of the central

Figure 4.1 ■ **Variance in student performance between schools and within schools on the mathematics scale**

Expressed as a percentage of the average variance in student performance in OECD countries



1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.1a.

line shows the within-school differences. Therefore, longer segments to the left of the central line indicate greater variation in the mean performance of different schools while longer segments to the right of the central line indicate greater variation among students within schools.

On average, there is half as much variance between schools as within them…

As shown in Figure 4.1, while all countries show considerable within-school variance, in most countries variance in student performance between schools is also considerable. On average across OECD countries, differences in the performance of 15-year-olds between schools account for 34 per cent of the OECD average between-student variance.

…but in some countries the between-school variance is twice the OECD average…

In Hungary and Turkey, variation in performance between schools is particularly large and is about twice the OECD average between-school variance. In Austria, Belgium, the Czech Republic, Germany, Italy, Japan and the Netherlands, as well as in the partner countries Hong Kong-China and Uruguay, the proportion of between-school variance is still over one-and-a-half times that of the OECD average level (see column 3 in Table 4.1a). Where there is substantial variation in performance between schools and less variation between students within schools, students tend to be grouped in schools in which other students perform at levels similar to their own. This may reflect school choices made by families or residential location, as well as policies on school enrolment or the allocation of students to different curricula. To capture variation between education systems and regions within countries, some countries have undertaken the PISA assessment at regional levels. Where such results are available, these are presented in Annex B2.

…while in others it is only a tenth and student differences are contained within schools.

The proportion of between-school variance is around one-tenth of the OECD average level in Finland and Iceland, and half or less in Canada, Denmark, Ireland, Norway, Poland, Sweden and in the partner country Macao-China. In these countries performance is largely unrelated to the schools in which students are enrolled (Table 4.1a). This suggests that the learning environment is similar in the ways that it affects the performance of students.

In some countries, parents can rely on high and consistent performance standards across schools in the entire education system.

It is noteworthy that Canada, Denmark, Finland, Iceland, Ireland, Norway, Sweden and the partner country Macao-China also perform well or at least above the OECD average level. Parents in these countries can be less concerned about school choice in order to enhance their children's performance, and can be confident of high and consistent performance standards across schools in the entire education system.

Socio-economic intake affects school differences, but so do differences in the value added by different schools…

While some of the variance between schools is attributable to the socio-economic background of students entering the school, some of it is also likely to reflect certain structural features of schools and schooling systems, particularly in systems where students are tracked by ability. Some of the variance in performance between schools may also attributable to the policies and practices of school administrators and teachers. In other words, there is an added value associated with attending a particular school.

...and in some of the best-performing countries, all schools seem to add roughly equal value.

It is important to note that some, though not all, high performing countries also show low or modest levels of between-school variance. This suggests that securing similar student performance among schools, perhaps most importantly by identifying and reforming poorly performing schools, is a policy goal that is both important in itself and compatible with the goal of high overall performance standards.

Performance variation among schools has been reduced in a few countries...

For most countries, these results are similar to those observed in the PISA 2000 assessment. However, there are some notable exceptions. For instance, in Poland, the move towards a more integrated education system since 1999 – as a consequence of which institutional differentiation now occurs mainly after the age of 15 – may have contributed to the observed dramatic reduction in the between-school variation in performance of 15-year-olds between schools.

...most significantly in Poland, where performance standards among the lowest performing students have markedly increased.

Between-school variance in Poland fell from more than half of the overall performance variance in Poland in 2000 (see column 9 in Table 4.1b) to just 13 per cent in 2003 (see column 13 in Table 4.1a).[7] Simultaneously, the average performance of 15-year-olds in Poland is now significantly higher in both mathematical content areas for which comparable trend data are available, and the overall performance gap between the lower and higher achievers is narrower than it was in 2000. As noted in Chapter 2, the increase in average mathematics performance is thus mainly attributable to an increase in performance at the lower end of the performance distribution (*i.e.,* the 5^{th}, 10^{th} and 25^{th} percentiles). This has occurred to such an extent that in 2003 fewer than 5 per cent of students fell below the performance standards that 10 per cent of Polish students had failed to attain in 2000 (Chapter 2, Table 2.1c, Table 2.1d, Table 2.2c and Table 2.2d). Performance differences among schools were also lower in other countries in 2003: for example, in Belgium, Greece and Mexico, the proportion of national variation in student performance attributable to between-school variance decreased by 8-10 percentage points.[8] In contrast, in Indonesia and Italy, the proportion of variance that lies between schools increased by more than 10 percentage points (see column 13 in Table 4.1 and column 9 in Table 4.1b).

THE QUALITY OF LEARNING OUTCOMES AND EQUITY IN THE DISTRIBUTION OF LEARNING OPPORTUNITIES

To understand what lies behind school differences, one must look at how socio-economic factors affect performance, how much this explains school differences, and how this relates to equity in learning opportunities.

Understanding why some schools show better performance results than others is an important key to school improvement. It requires an analysis that examines, in each country, the effects of student and school factors on both student performance within schools and student performance across schools. As a first step towards such an analysis, this section examines the interrelationship between student performance and socio-economic background, as measured by the PISA index of economic, social and cultural status. In a second step, the section then estimates the proportion of the variance in student performance between schools that is attributable to students' socio-economic backgrounds. In a third step, the section relates the findings to questions about equity in the distribution of learning opportunities.

A key objective of schools is to compensate for differences in student backgrounds, which exert a powerful influence.

Students come from a variety of socio-economic and cultural backgrounds. As a result, schools need to provide appropriate and equitable opportunities for a diverse student body. The relative success with which they do this is an important criterion for judging the performance of education systems. Identifying the characteristics of poorly performing students and schools can also help educators and policy-makers determine priorities for policy. Similarly, identifying the characteristics of high performing students and schools can assist policy-makers in promoting high levels of overall performance.

The results from PISA 2003 show that poor performance in school does not automatically follow from a disadvantaged home background. However, home background remains one of the most powerful factors influencing performance. The nature and extent of this influence is described in the following paragraphs.

The quarter of students whose parents have the best jobs are one-and-a-half proficiency levels ahead of those with the lowest-status jobs…

Parental occupational status, which is often closely interrelated with other attributes of socio-economic status, has a strong association with student performance (Table 4.2a). The average performance gap in mathematics between students in the top quarter of the PISA index of occupational status (whose parents have occupations in fields such as medicine, university teaching and law) and those in the bottom quarter (with occupations such as small-scale farming, truck-driving and serving in restaurants), amounts to an average of 93 score points, or more than one-and-a-half proficiency levels in mathematics.[9] Expressed differently, one standard deviation (*i.e.,* 16.4 units) on the PISA index of occupational status is associated with an average performance difference of 34 score points. Even when taking into account the fact that parental occupational status is interrelated with other socio-economic background factors and looking at the unique contribution of occupational status alone, an average score difference remains of 21 score points (see column 2 in Table 4.2).

…but in some countries, the gap is much larger than in others.

In Belgium, France, Germany, Hungary, Luxembourg, the Slovak Republic and the partner country Liechtenstein, differences in performance are particularly large. In these countries, students whose parents have the highest-status jobs score on average about as well as the average student in Finland, the best-performing country in PISA 2003 across mathematics, reading and science. In contrast, students whose parents have the lowest-status jobs score little higher than students in the lowest performing OECD countries. Looked at differently, in Belgium, Germany, Luxembourg and the partner country Liechtenstein, students in the lowest quarter of the distribution of parental occupations are 2.3 times or more likely to be among the bottom quarter of performers in mathematics (see column 11 in Table 4.2a).

A student's predicted score is one proficiency level higher if his or her mother completed secondary education than if she did not…

Parental education (Table 4.2b and Table 4.2c) may also be of significant educational benefit for children. The relationship between mothers' educational attainments and students' performance in mathematics is shown to be positive and significant in all participating countries.[10] The gap in mathematics performance between students whose mothers have completed upper secondary education and those whose mothers have not is on average 50 score points, and reaches around

60 score points or more in Germany, Mexico, the Slovak Republic, Switzerland, Turkey and the partner country Brazil. In fact, in Germany, the students whose mothers or fathers did not complete upper secondary education are three times more likely to be in the bottom quarter of mathematics performers than the average student (Table 4.2b and Table 4.2c).

…and higher still if she completed tertiary education.

On average across OECD countries, a mother's tertiary education adds another 24 score points to the student's advantage in mathematics (Table 4.2b). Even when controlling for the influence of other socio-economic factors, each year of additional formal education of parents[11] adds an average of 5 score points (see column 3 in Table 4.2).

In addition to their own level of education, which is of course less amenable to policy, parents' support for their children's education is widely deemed to be an essential element of success at school. When parents interact and communicate well with their children, they can offer encouragement, demonstrate their interest in their children's progress, and generally convey their concern for how their children are faring, both in and out of school. Indeed, PISA 2000 demonstrated the important relationship between parental involvement and children's academic success. It also suggested that educational success may be related to patterns of communication between parents and children (OECD, 2001a). An important objective for public policy may therefore be to support parents, particularly those whose own educational attainment is limited, in order to facilitate their interactions both with their children and with their children's schools in ways that enhance their children's learning. PISA 2006 will further examine these questions, and will also include a new international option of a parents' questionnaire.

The separate influence of cultural capital is almost as strong as that of parental occupation.

Possessions and activities related to "classical" culture (*e.g.,* classic literature, books of poetry or works of art) also tend to be closely related to performance (Table 4.2d). The possession of the kind of cultural capital on which school curricula often tend to build, and which examinations and tests assess, appears closely related to student performance in mathematics. While advantages of cultural possessions are related to other home background characteristics, their effects in isolation are generally strong. Even when controlling for other socio-economic background factors, one unit on the PISA index of cultural possessions is associated with an average score difference of 12 score points on the PISA mathematics scale, an association that is almost as strong as the association with parental occupation (see column 4 in Table 4.2).

A single parent may find it harder to support students' learning, and in some countries, students with single parents are much more likely to be among the lowest performers…

As noted above, the family environment can help to promote academic performance. Parents may read to young learners, assist them with homework and, in some countries, volunteer to help in schools. For older students, a supportive family environment can also be helpful with respect to homework, encouragement, and attendance at meetings with teachers or school administrators. Providing and maintaining such an environment may be difficult when students live in a single-parent family, where parents often find themselves having to cope with the dual responsibility of work and their children's education. For some countries,

the PISA results suggest a large performance gap for students from single-parent families (Table 4.2e). In Belgium, Ireland, the Netherlands, Sweden and the United States students from single-parent families are 1.5 times or more likely to be among the bottom quarter of mathematics performers than the average student that lives with both parents.

…even controlling for other factors, which points to a need for extra support.

Even when controlling for the influence of other socio-economic factors, an average gap of 18 score points remains between students from single parent and other types of families. This gap is between 25 and 30 score points in Belgium, Ireland and the United States (see column 5 in Table 4.2).

Evidence that children in families with two parents perform better might seem to be discouraging for single-parent families. However, evidence of disadvantage is a starting point for the development of policy. The issue is how to facilitate effective home support for children's learning in ways that are relevant to the circumstances of single parents. Strategic allocation of parental time to activities with the greatest potential effect will increase efficiency where time is limited. Policy questions for education systems and individual schools when interacting with parents relate to the kind of parental engagement that should be encouraged. Obviously, education policies in this area need to be examined in conjunction with policies in other areas, such as those relating to welfare and the provision of childcare.

In some countries, a significant proportion of 15-year-olds have immigrant backgrounds and some do not speak the local language at home…

Finally, over recent decades, most OECD countries have experienced increased migration, much of it of people whose home language is not the language of instruction in the schools that their children attend. One can consider the situation of these groups by looking successively at first-generation students (those born in the country but with parents born outside), non-native students (themselves born abroad) and students who speak a language at home most of the time which is different from any of the official languages of the country where they live.

…and those with immigrant parents typically perform significantly lower.

In countries in which first-generation students represent at least 3 per cent of the students assessed in PISA 2003, a comparison of the mathematics performance of first-generation students with that of native students tends to show large and statistically significant differences in favour of native students. This is the case in all countries except Australia, Canada and the partner countries Latvia, Liechtenstein, Macao-China and Serbia (Table 4.2f). The results are broadly similar to those revealed by PISA 2000 for reading literacy.

This is cause for concern where such students are most numerous…

Concern about such differences is especially justified in those countries where significant performance gaps are combined with comparatively large percentages of first-generation students, such as France, Germany, Luxembourg, the Netherlands, Switzerland and the United States.

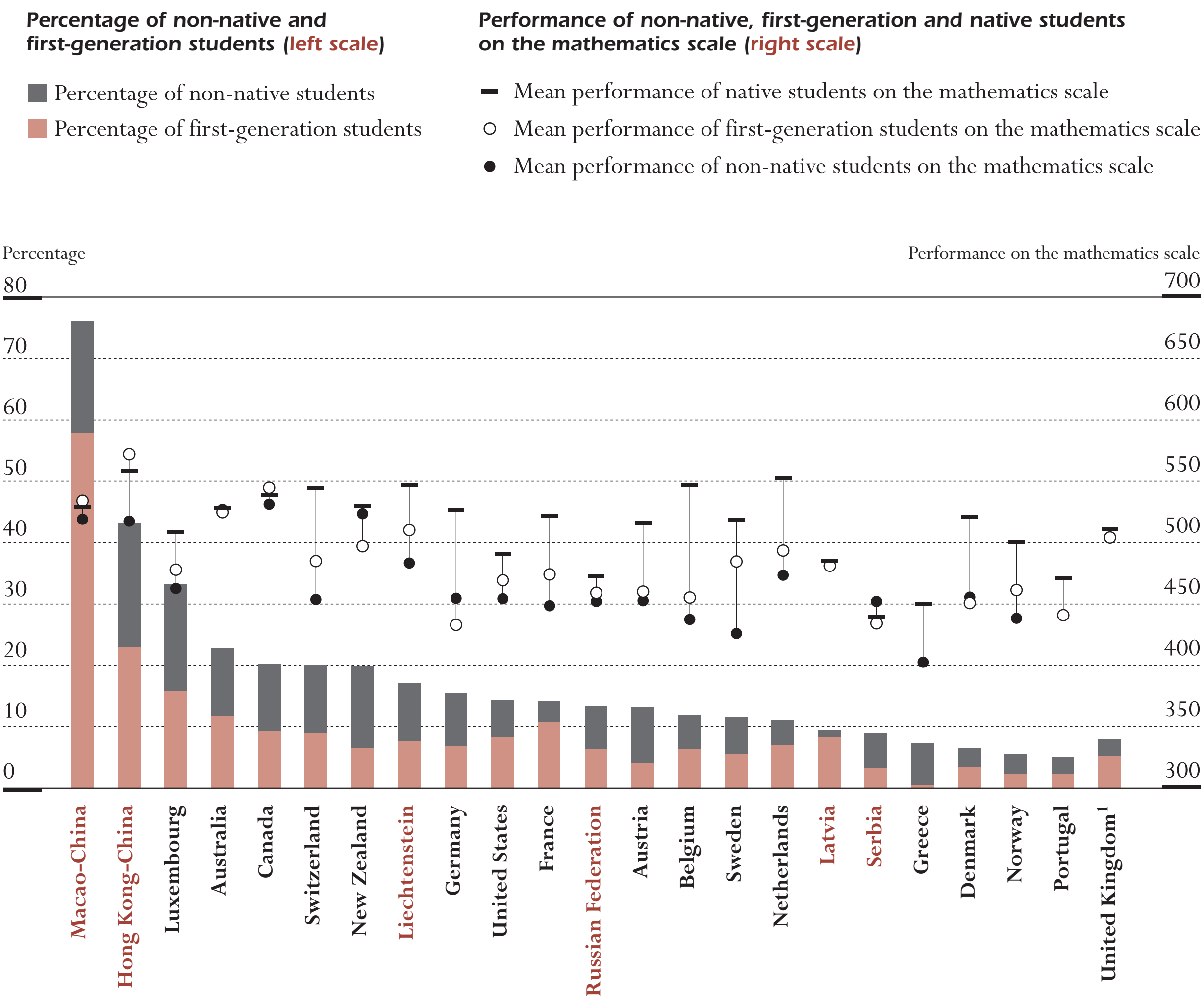
…and particularly where they have experienced the same curriculum as others born in the country.

In Germany, the country with the largest such disparities, the performance gap amounts to 93 score points on the mathematics scale, equivalent to an average performance difference of over two grade levels (Box 2.2). These are troubling differences because both groups of students were born in the country where the

assessment took place and, presumably, had experienced the same curriculum that the national education system offers to all students. Despite whatever similarities there might be in their educational histories, something about being a first-generation student leads to a relative disadvantage in these countries (a disadvantage which is reduced – but does not disappear – when controlling for socio-economic background, as discussed below).

As one would expect, non-native students tend to lag even further behind native students than do first-generation students, with the largest performance gap, 109 score points, found in Belgium (Table 4.2f and Figure 4.2).

Figure 4.2 ■ **Place of birth and student performance**



Note: Only countries with at least 3 per cent of students in at least one of these categories.
1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.2f.

Both the difficulties of adapting to a new system and language difficulties can play a part in performance…

The nature of the educational disadvantage experienced by students who have an ethnic minority background and/or are the children of migrants is substantially influenced by the circumstances from which they come. Educational disadvantage in the country of origin can be magnified in the country of adoption even though, in absolute terms, their educational performance might have been raised. These students may be academically disadvantaged either because they are immigrants entering a new education system or because they need to learn a new language in a home environment that may not facilitate this learning. In either case, they may be in need of special or extra attention. Focused help in the language of instruction is one policy option that is often adopted for such students. For example, students who do not speak the language of assessment at home in Belgium, Germany, the Netherlands and Switzerland are at least 2.5 times more likely to be in the bottom quarter of mathematics performance (Table 4.2g). More generally, being a non-native student or speaking a language at home that is different from the language of assessment have a negative impact on mathematics performance of, on average across OECD countries, 19 and 9 score points respectively (Table 4.2).

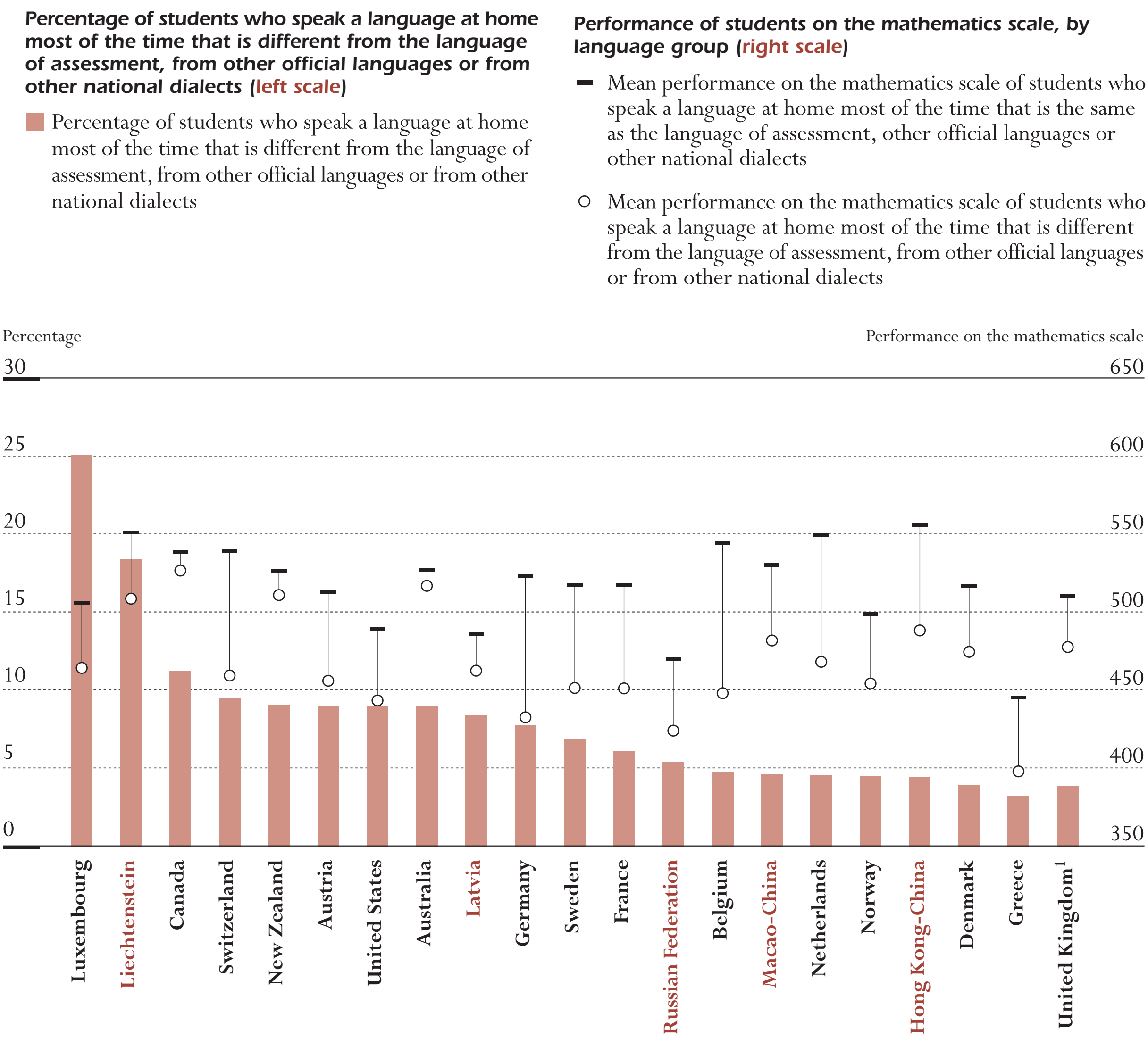
…but in some countries, students seem to succeed in overcoming these difficulties.

Nevertheless, the results show that some countries appear to be more effective in minimising the performance disadvantage for students with a migration background. The most impressive example is the partner country Hong Kong-China. Here, 23 per cent of students have parents born outside Hong Kong-China and another 20 per cent of students were born outside Hong Kong-China themselves (though many of them come from mainland China). And yet, all three student groups – whether non-native students, first-generation students, or students who speak at home a language that is different from the language of assessment – score well above the OECD average. Also, a large performance difference between first-generation and non-native students suggests that for students for whom there was sufficient time for the education system to integrate them, this has occurred successfully. Australia and Canada are other examples of countries with large immigrant populations and strong overall student performance. However, the profile of these countries' immigrant populations differs substantially from that in most other participating countries, so that comparisons are difficult to make. In particular, the fact that in these countries there is virtually no performance difference between native students and foreign-born students – with many of the foreign-born students likely to have been educated at least for some years in their country of origin – suggests that many students enter the system with already strong levels of performance. This is very different, for example, from the situation in Belgium, the Netherlands, Sweden and Switzerland. This contrast becomes even clearer when the separate impact of the language spoken at home is also taken into account (Table 4.2).

Country comparisons need to take account of different characteristics of immigrant populations.

When interpreting performance gaps between native students and those with a migrant background, it is important to account for differences among countries in terms of such factors as the national origin as well as the socio-economic, educational and linguistic background of immigrant populations.

Figure 4.3 ■ **Home language and student performance**



Note: Only countries with at least 3 per cent of students in this category.
1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.2g.

The composition of immigrant populations, in turn, is shaped by immigration policies and practices and the criteria used to decide who will be admitted into a country vary considerably across countries (OECD, 2003f). While some countries tend to admit relatively large numbers of immigrants each year and often with a low degree of selectivity, other countries have much lower and often more selective migrant inflows. In addition, the extent to which the social, educational and occupational status of potential immigrants is taken into account in immigration and naturalisation decisions differs across countries. As a result, immigrant populations tend to have more advantaged backgrounds in some countries than in others.

Research shows that the proportion of students with a migration background does not relate to the extent to which these students are more or less successful than their peers from native families (Stanat, 2004). Thus, the size of immigrant populations alone does not seem to explain international variations in the performance gap between these student groups. By contrast, the degree to which students with a migrant background are disadvantaged in terms of their socio-economic and educational background has been shown to relate to their relative performance levels, as observed in the countries participating in PISA 2000 (Stanat, 2004). PISA 2003 confirms these findings. Figure 4.4 shows that in countries where the educational and socio-economic status of immigrant families is comparatively low, the performance gaps between students with and without migrant backgrounds tends to be larger.

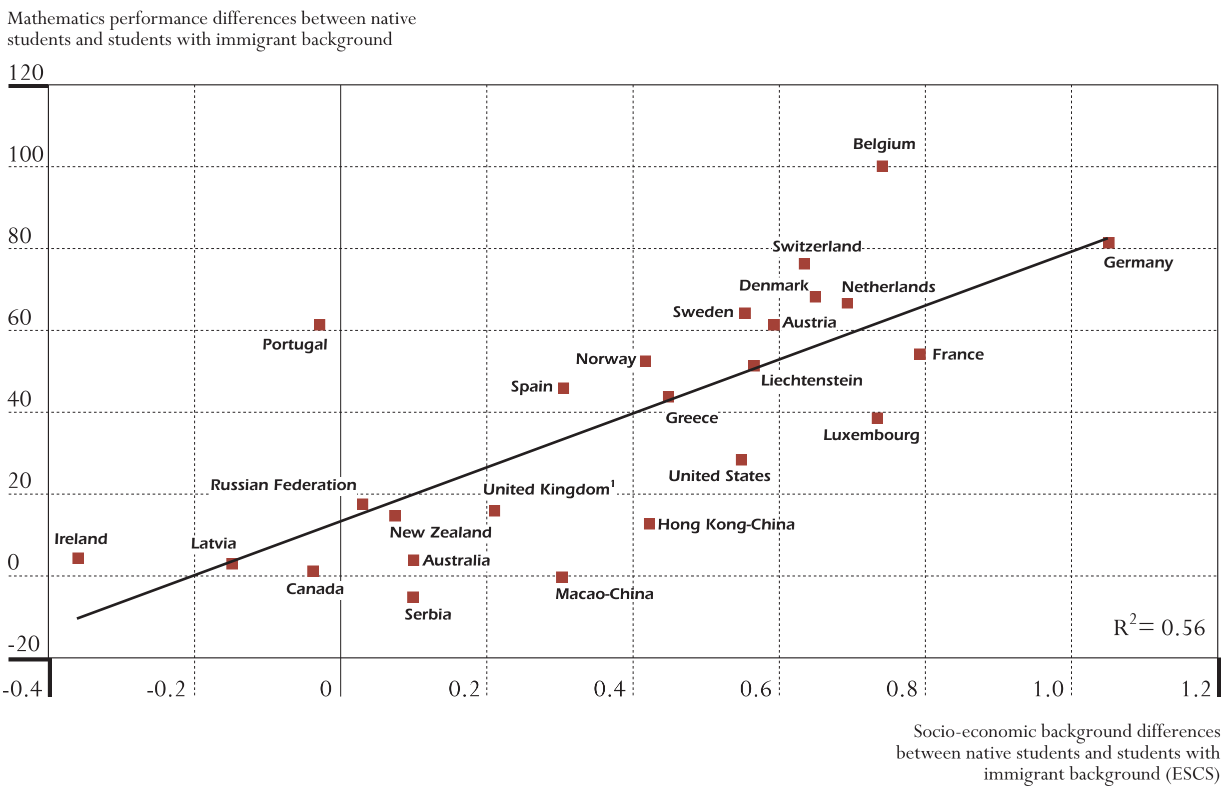
The size of the immigrant population apparently has no effect, its socio-economic composition does.

To gauge the extent to which between-country differences in the relative performance of students with a migration background can be attributed to the composition of their immigrant populations, an adjustment for the socio-economic background of students can be made. As was already apparent in Figure 4.2,

Controlling for this factor reduces and in some cases eliminates the migration effect.

Figure 4.4 ■ **Student performance differences and socio-economic background differences by students' immigrant background**

Relationship between differences in mathematics performance between native students and students with immigrant background and socio-economic background differences between these two groups of students



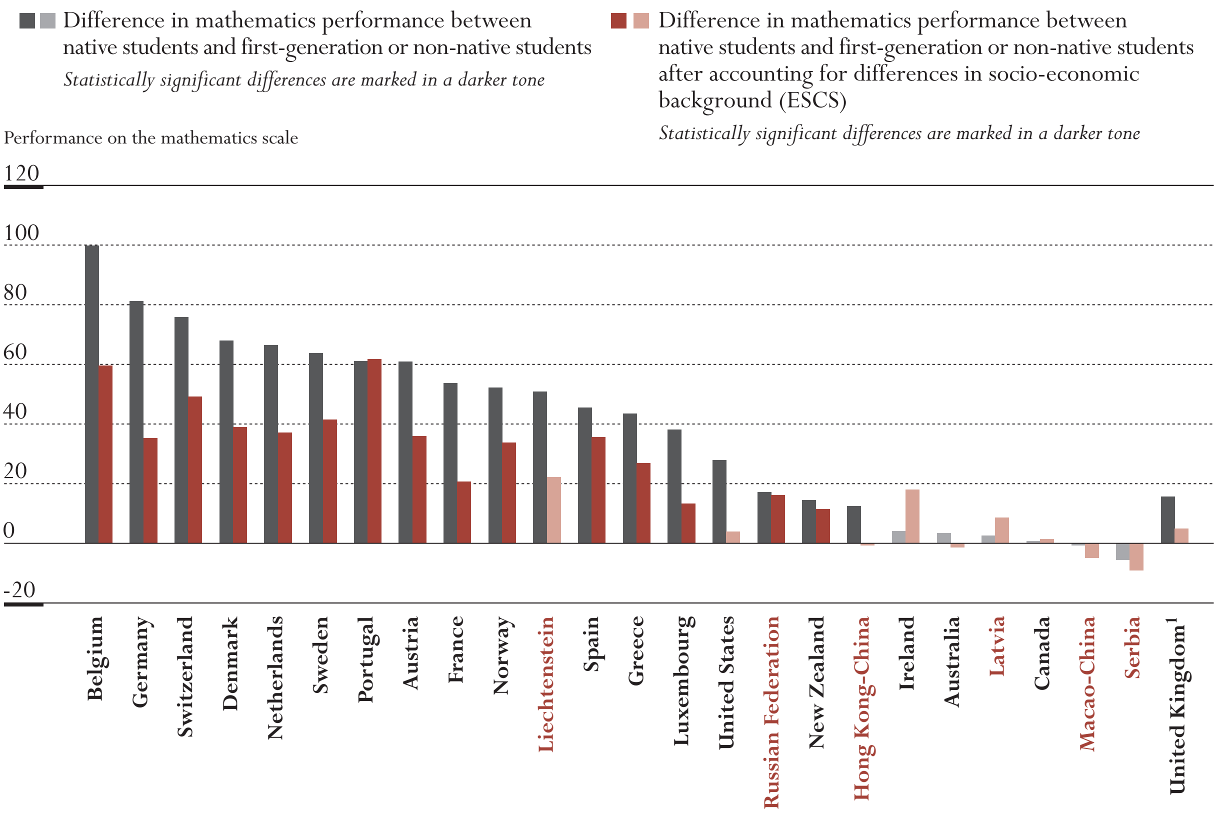
1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.2f.

the statistically significant performance gap between native students, on the one hand, and first generation as well as non-native students, on the other, varies across the OECD countries from almost 100 points in Belgium to 42 points in Luxembourg and the United States, and no statistically significant differences in Australia, Canada and New Zealand. After students' socio-economic background, as measured by the PISA index of economic, social and cultural status, is taken into account, the performance gap between native students and students from families with a migration background is reduced considerably in most countries. This is shown in Figure 4.5 and Table 4.2h. In Belgium, for example, the difference decreases from 100 to 60 points and in Germany from 81 to 35 points. In the United States, the performance gap is reduced such that it is no longer statistically significant.[12]

Yet there remain big differences between the relative performance of immigrants in different countries…

At the same time, the magnitude of the performance gap between immigrant and native students continues to vary considerably, even when their socio-economic and educational background is taken into account. Countries like Belgium and Switzerland continue to be among those exhibiting the largest disparities between students with migrant backgrounds and those from native families.

Figure 4.5 ■ **Differences in mathematics performance associated with students' immigrant background**



Note: This figure shows data for countries with more than 3 per cent of students in the aggregated category of non-native and first-generation students.
1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.2h.

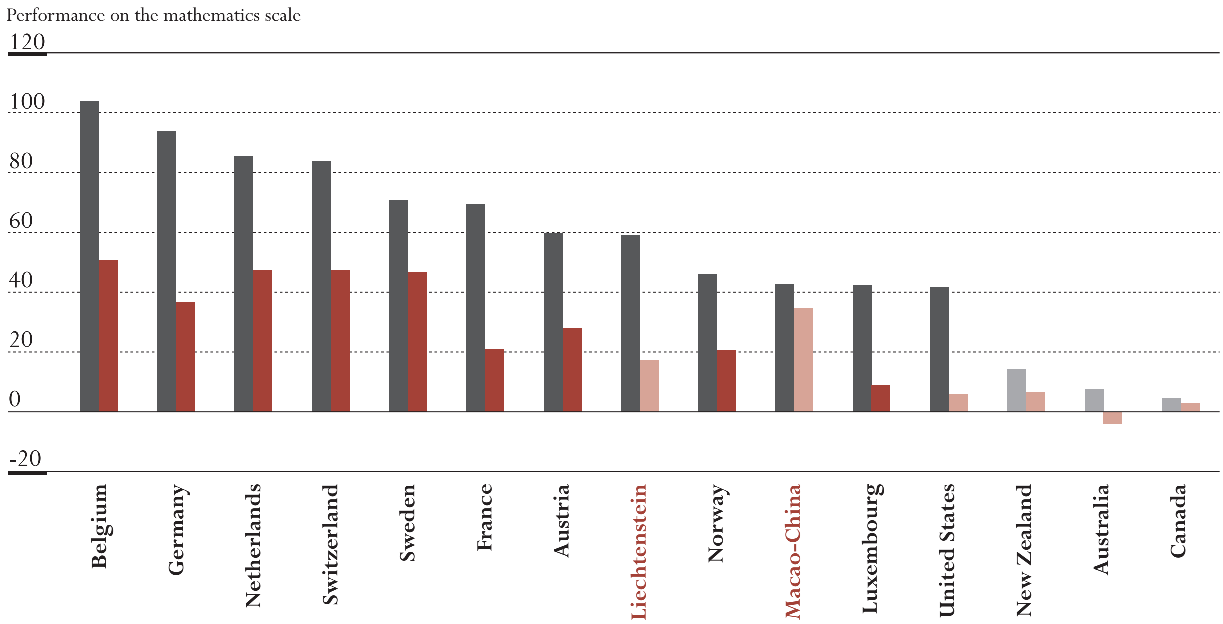
Figure 4.6 ■ **Differences in mathematics performance associated with students' immigrant background and home language**

■■ Difference in mathematics performance between native students and first-generation or non-native students who speak a language at home that is different from the language of assessment, from other official languages or from other national dialects

Statistically significant differences are marked in darker tone

■■ Difference in mathematics performance between native students and first-generation or non-native students who speak a language at home that is different from the language of assessment, from other official languages or from other national dialects after accounting for differences in socio-economic background (ESCS)

Statistically significant differences are marked in darker tone



Note: Only countries with at least 3 per cent of students in this category.
Source: OECD PISA 2003 database, Table 4.2h.

This suggests that, in addition to the composition of countries' immigrant populations, other factors determine between-country differences in immigrant students' relative school success.

…and even after controlling for language background, such country differences remain.

One such factor might be the language background of immigrants in the different countries. The extent to which immigrants have to overcome language barriers varies considerably across countries. In countries with colonial histories, for example, many immigrants already speak the official language of the country at the time of their arrival. Using the language that students speak at home as a proxy, Figure 4.6 shows the between-country differences that result when this factor is accounted for. Taking this factor into account slightly reduces the between-country variation in mathematics performance differences. Statistically significant differences range from 42 score points for the United States to 104 score points in Belgium. When socio-economic background is also accounted for, the between-country variation becomes even smaller but continues to remain substantial, ranging from 9 score points in Luxembourg to 51 score points in Belgium.

The separate and collective influence of the various home background factors can be measured…

Figure 4.7 summarises, for each country, the degree to which various features of home background are associated with mathematics performance. These features are: parental occupational status; parents' level of education converted into years of schooling; possessions related to "classical" culture; family structure; students' nationality and that of their parents; and the language spoken at home. Since these features tend to be associated with each other – for example a student whose parents are better educated is also likely to have parents in higher-status occupations – the graph displays the influence of these features together and shows the variance in student performance explained by each feature once the influence of the others has been accounted for. The final bar in Figure 4.7 shows the variance explained by all six factors together (Table 4.2).

…showing that home background makes a substantial contribution to student differences.

Overall across the OECD countries, the combined influence of this set of student-level socio-economic variables explains 17 per cent of the variance in mathematics performance, ranging from less than 10 per cent in Canada, Iceland and the partner countries Indonesia, Macao-China and the Russian Federation, to more than 20 per cent in Belgium, Germany, Hungary and Portugal (see the last column in Table 4.2). These findings have potentially important implications for policy-makers. Skills in mathematics are an important foundation for lifelong learning and enhance future opportunities for employment and earnings. As a consequence, countries in which the relationship between socio-economic background and student performance is strong do not fully capitalise on the skill potential of students from disadvantaged backgrounds. Human capital may thus be wasted and intergenerational mobility from lower to higher socio-economic status limited. The poorer performing students will almost certainly be the ones least likely to obtain the employment opportunities that offer the promise of economic mobility. This is a loss not just for individuals, but also for societies increasingly dependent on the many effects of human capital.

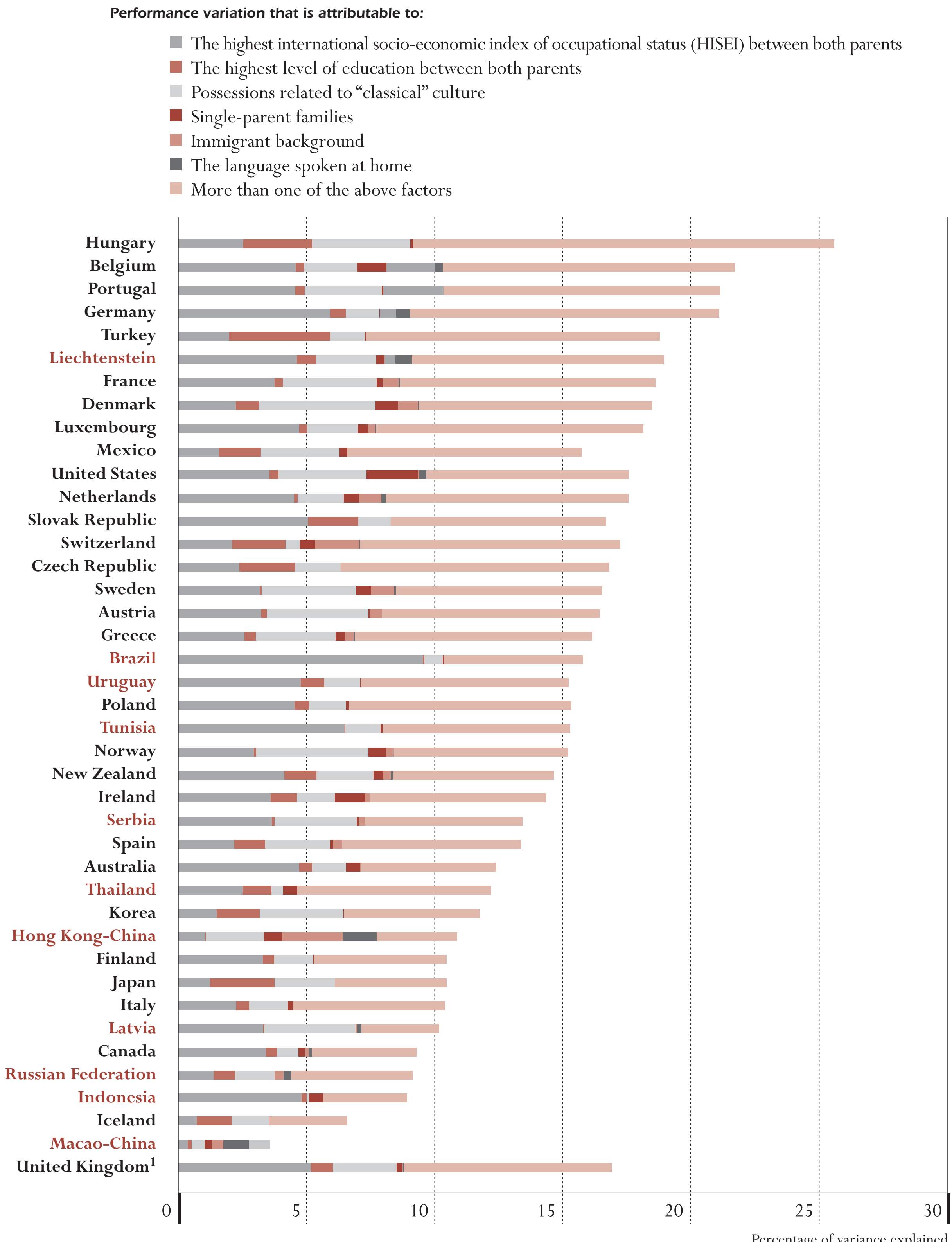
National research sometimes shows that home background influences student development throughout childhood…

Achieving an equitable distribution of learning outcomes without losing high performance standards thus represents an important challenge. Analyses at the national level have often been discouraging. For example, using longitudinal methods, researchers who have tracked children's vocabulary development have found that growth trajectories for children from differing socio-economic backgrounds begin to differ early on (Hart and Risely, 1995) and that when children enter school the impact of socio-economic background on both cognitive skills and behaviour is already well established. Furthermore, during the primary and middle school years, children whose parents have low incomes and low levels of education, or are unemployed or working in low-prestige occupations, are less likely to do well in academic pursuits, or to be engaged in curricular and extra-curricular school activities than children growing up in advantaged socio-economic contexts (Datcher, 1982; Finn and Rock, 1997; Johnson *et al.,* 2001; Voelkl, 1995).

…and that schools seem to make little difference.

National research also suggests that schools appear to make little difference in overcoming the effects of disadvantaged home backgrounds. Indeed, it has sometimes been argued that if school systems become more inclusive –

Figure 4.7 ■ **Effect of student-level factors on student performance in mathematics**



1. Response rate too low to ensure comparability (see Annex A3).
Source: OECD PISA 2003 database, Table 4.2.

for example, by increasing the proportion of young people who complete secondary school – then quality is bound to suffer.

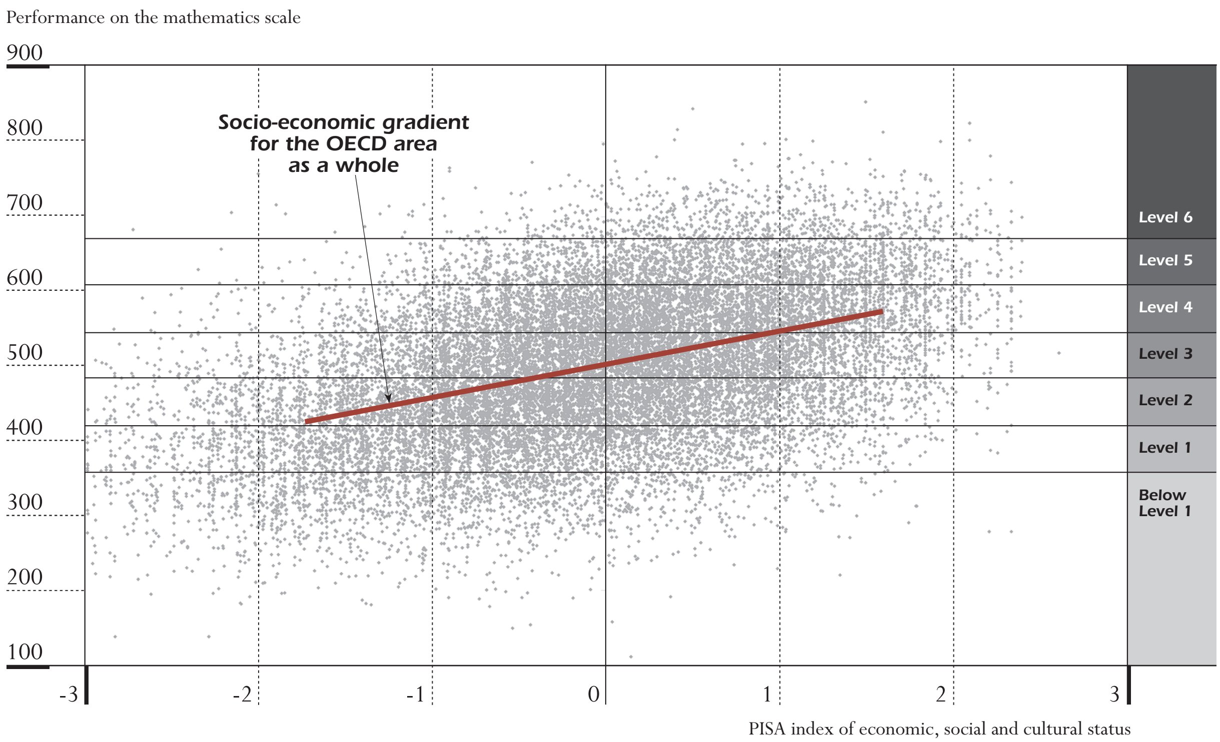
The international perspective of PISA, however, indicates that it is possible to attain socio-economic equity at a high level of overall educational quality.

The international evidence from PISA is more encouraging. It is the case that in all countries, students with more advantaged home backgrounds tend to have higher PISA scores. However, the comparisons of the relationship between student performance and the various aspects of socio-economic background examined above show that some countries simultaneously demonstrate high average quality and relatively high equality of outcomes among students from different socio-economic backgrounds. Thus, wide disparities in student performance are not a necessary condition for a country to attain a high level of overall performance.

This can be analysed by using an overall index of home background…

This finding can be examined more systematically when the different economic, social and cultural aspects of background are combined into a single index, as is done in the following discussion. This index includes the highest International Socio-Economic Index of Occupational Status (ISEI) of the parents or guardians, the highest level of education of the parents converted into years of education,[13]

Figure 4.8 ■ **Relationship between student performance in mathematics and socio-economic background for the OECD area as a whole**



Note: Each dot represents 538 students from the OECD area.
Source: OECD PISA 2003 database.

an index of the educational resources in the home,[14] and the number of books at home. The index is referred to in the following text as the PISA index of economic, social and cultural status, or simply, at times, the students' socio-economic background (see Annex A1).

...which can be mapped against performance...

Figure 4.8 depicts the relationship between student performance and the student index of economic, social and cultural status, for the combined OECD area. The figure describes how well students from differing socio-economic backgrounds perform on the PISA mathematics scale. This relationship is affected both by how well education systems are performing and the extent of dispersion of the economic, social and cultural factors that make up the index (Box 4.1).

...with a gradient indicating socio-economic equity of school outcomes.

An understanding of this relationship, referred to as the *socio-economic gradient,* is a useful starting point for analysing the distribution of educational opportunities. From a school policy perspective, understanding the relationship is also important because it indicates how equitably the benefits of schooling are being shared among students from differing socio-economic backgrounds, at least in terms of student performance.

Box 4.1 ■ **How to read Figure 4.8**

Each *dot* on this graph represents 538 15-year-old students in the combined OECD area. Figure 4.8 plots their performance in mathematics against their economic, social and cultural status.

The *vertical axis* shows student scores on the mathematics scale, for which the mean is 500. Note that since the standard deviation was set at 100 when the PISA scale was constructed, about two-thirds of the dots fall between 400 and 600. The different shaded areas show the six proficiency levels in mathematics.

The *horizontal axis* shows values on the PISA index of economic, social and cultural status. This has been constructed to have a mean of 0 and a standard deviation of 1, so that about two-thirds of students are between +1 and –1.

The *dark line* represents the international socio-economic gradient, which is the best-fitting line showing the association between mathematics performance and socio-economic status across OECD countries.

Since the focus in the figure is not on comparing education systems but on highlighting a relationship throughout the combined OECD area, each student in the combined OECD area contributes equally to this picture – *i.e.,* larger countries, with more students in the PISA population, such as Japan, Mexico and the United States, influence the international gradient line more than smaller countries such as Iceland or Luxembourg.

This shows that students with progressively more advantaged socio-economic backgrounds perform progressively better in mathematics, on average…

Figure 4.8 points to several findings:

- Students from more advantaged socio-economic backgrounds generally perform better. This finding, already noted above, is shown by the upward slope of the gradient line.
- A given difference in socio-economic status is associated with a gap in student mathematics performance that is roughly the same throughout the distribution – *i.e.,* the marginal benefit of extra socio-economic advantage neither diminishes nor rises by a substantial amount as this advantage grows. This is shown by the fact that the socio-economic gradient is nearly a straight line. The gradient is, however, not exactly straight: in fact, the relationship between the index of economic, social and cultural status and performance in mathematics is slightly stronger for students with lower levels of socio-economic status than for those with higher levels.[15]

…but also that many students perform much better or worse than predicted.

- The relationship between student performance and the index of economic, social and cultural status is not deterministic, in the sense that many disadvantaged students shown on the left of the figure score well above what is predicted by the international gradient line while a sizeable proportion of students from privileged home backgrounds perform below what their home background would predict. For any group of students with matched backgrounds, there is thus a considerable range of performance.

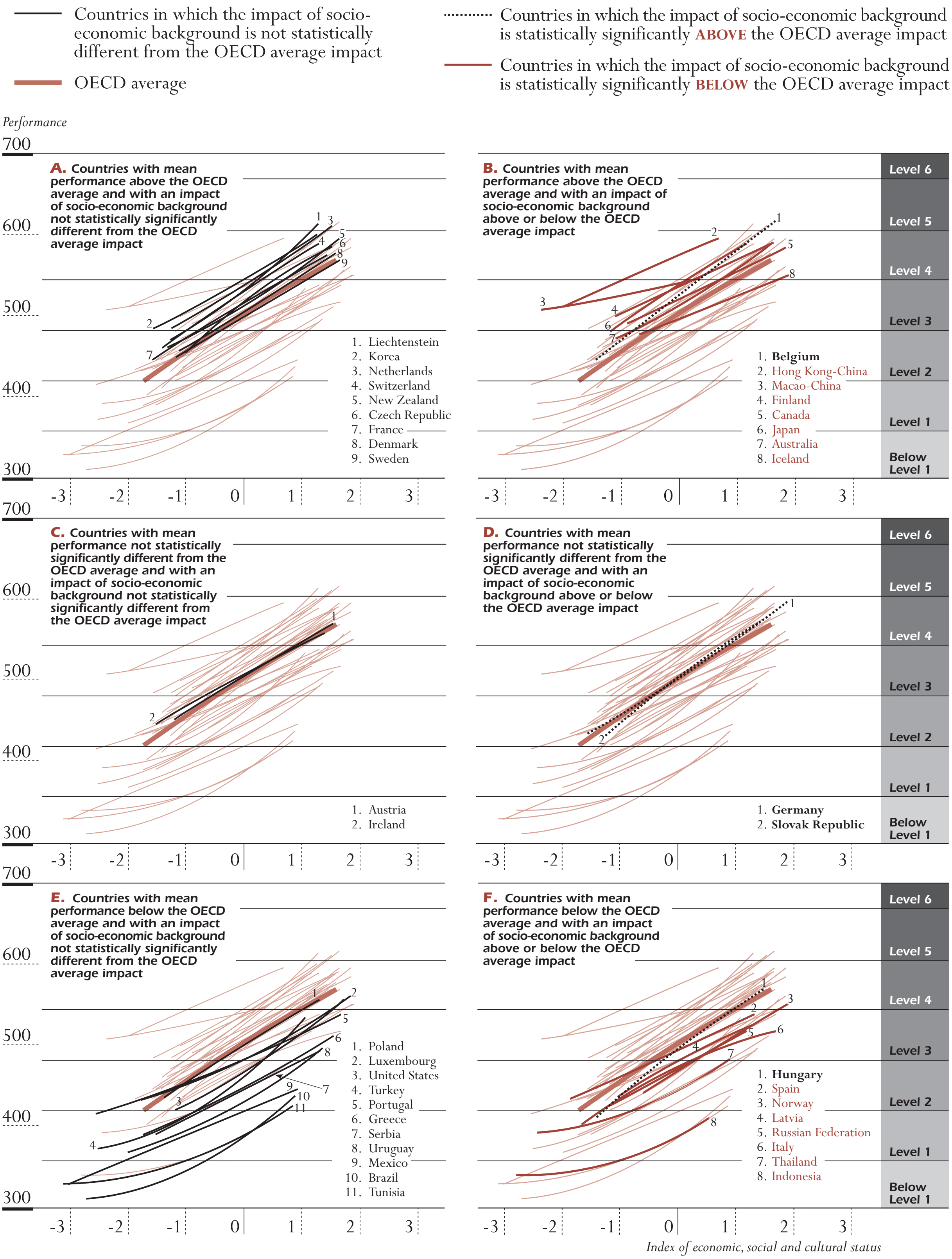
The strength of this relationship differs across countries.

To what extent is this relationship an inevitable outcome of socio-economic differences as opposed to an outcome that is amenable to public policy? One approach to answering this question lies in examining to what extent countries succeed in moderating the relationship between socio-economic background and student performance. For each country, Figure 4.9 displays the relationship between student performance on the mathematics scale and the index of economic, social and cultural status separately. Figure 4.9A and Figure 4.9B highlight countries with mathematics performance statistically significantly above the OECD average; Figure 4.9C and Figure 4.9D highlight countries with mathematics performance not statistically different from the OECD average; and Figure 4.9E and Figure 4.9F highlight countries with mathematics performance statistically significantly below the OECD average.

There are countries in which students tend to perform well, irrespective of their socio-economic background…

Countries with above-average mathematics performance and with an impact of socio-economic background not different from the OECD average are shown by the black lines in Figure 4.9A. Countries with above-average mathematics performance and a weaker-than-average relationship between performance and socio-economic background, indicated by a red line in Figure 4.9B, succeed in achieving high overall performance with modest socio-economic disparities. In countries with above-average mathematics performance and a stronger-than-average relationship with socio-economic background, indicated by a dashed black line in Figure 4.9B, high performance levels are mainly due to very high performance standards among students from advantaged socio-economic backgrounds.

Figure 4.9 ■ **Relationship between student performance in mathematics and socio-economic background**



Source: OECD PISA database, 2003.

...as well as countries with below-average performance and large socio-economic disparities.

Countries with below-average mathematics performance and with an impact of socio-economic background not different from the OECD average are shown by the black lines in Figure 4.9E. Countries with below-average performance and a weaker-than-average relationship with socio-economic background are indicated by a red line in Figure 4.9F. While, in these countries, the impact of socio-economic disparities on student performance is comparatively small, this is mainly because students from both advantaged and disadvantaged socio-economic backgrounds perform comparatively poorly. Finally countries with below-average performance and stronger-than-average relationships with socio-economic background are indicated by a dashed black line in Figure 4.9F. In these countries, socio-economic disparities are large and overall performance is poor.

Countries in which performance is not statistically significantly different from the average and the strength of the relationship between socio-economic background and performance is also not different from the OECD average are shown with a black line in Figure 4.9C, while countries with a stronger or weaker than average relationship are shown in Figure 4.9D by the dashed black lines.

The gradient can be described in terms of...

In describing Figure 4.9 and the equivalent distribution of performance in each country as shown in Table 4.3a, several aspects of the gradient should be noted, including how strongly socio-economic background predicts performance, how well students with average background perform, how much difference it makes to have stronger or weaker socio-economic background, and how wide are the socio-economic differences in the student population. More specifically, the features of the relationship between socio-economic background and performance can be described in terms of:

...how much of the performance variation is explained by student background...

- The *strength of the relationship between mathematics performance and socio-economic background*. This refers to how much individual student performance varies above and below the gradient line. This can be seen for the combined OECD area in Figure 4.8 by the dispersion of dots above and below the line. For individual countries, column 3 of Table 4.3a gives the explained variance, a statistic that summarises the strength of the relationship by indicating the proportion of the observed variation in student scores that can be attributed to the relationship shown by the gradient line. If this number is low, relatively little of the variance in student performance is associated with students' socio-economic background; if it is high, the reverse is the case. On average across OECD countries, 17 per cent of the variance in student performance in mathematics within each country is associated with the PISA index of economic, social and cultural status.[16] However, this figure ranges from 7 per cent or less in Iceland and in the partner countries Hong Kong-China, Indonesia and Macao-China to more than 22 per cent in Belgium, Germany, Hungary, the Slovak Republic and Turkey.

...how well a student with an internationally average socio-economic background performs...

- The *level of the gradient lines* in Figure 4.9 – their average height – is given in column 2 of Table 4.3a. This shows the average mathematics score reached by those students in each country that have an economic, social and cultural background equal to the average across OECD countries. The level of a gradient for

a country can be considered an indication of what would be the overall level of performance of the education system if the economic, social and cultural background of the student population were identical to the OECD average.

...the amount of difference that socio-economic background makes, on average, to performance...

- The *slope of the gradient line* is an indication of the extent of inequality in mathematics performance attributable to socio-economic factors (see column 4 in Table 4.3a) and is measured in terms of how much difference one unit on the socio-economic background scale makes to student performance in mathematics. Steeper gradients indicate a greater impact of economic, social and cultural status on student performance, *i.e.,* more inequality. Gentler gradients indicate a lower impact of socio-economic background on student performance, *i.e.,* more equality. It is important to distinguish the slope from the strength of the relationship. For example, Germany and Japan show a similar slope with one unit of difference on the socio-economic background scale corresponding, on average, to 47 and 46 score points, respectively, on the mathematics performance scale. However, in Japan, there are many more exceptions to this general trend so that the relationship only explains 12 per cent of the performance variation, while in Germany student performance follows the levels predicted by socio-economic background more closely, with 23 per cent of the performance variation explained by socio-economic background. On average across OECD countries, the slope of the gradient is 42 (see note 16). This means that students' scores on the mathematics scale are, on average in OECD countries, 42 score points higher for each extra unit on the index of economic, social and cultural status. The unit on the index of economic, social and cultural status is one standard deviation, meaning that about two-thirds of the OECD student population score within a range of two units. In the case of Poland, for example, which has a gradient very close to the OECD average, the average mathematics score of students with socio-economic scores one unit below average is 445, similar to the average score of a Greek student, and the average mathematics score of students one unit above the socio-economic status mean is 535, *i.e.,* similar to the average performance of Japan.

...and the range of backgrounds experienced by students in each country.

- The *length of the gradient lines* is determined by the range of socio-economic scores for the middle 90 per cent of students (between the 5th and 95th percentiles) in each country (see column 5c in Table 4.3a), as well as by the slope. Columns 5a and 5b in Table 4.3a show the 5th and the 95th percentiles of the PISA index of economic, social and cultural status spanned by the gradient line. The length of the gradient line indicates how widely the student population is dispersed in terms of socio-economic background. Longer projections of the gradient lines represent a wider dispersion of socio-economic background in the student population within the country in question.

In some countries, a given difference in socio-economic background makes over twice as much difference to predicted performance than in others.

Figure 4.9 and Table 4.3a point to several findings:

- First, countries vary in the strength and slope of the relationship between socio-economic background and student performance. The figure not only shows countries with relatively high and low levels of performance on the mathematics scale, but also countries which have greater or lesser degrees

of inequality in performance among students from different socio-economic backgrounds. It is worth emphasising the considerable extent of this difference. Consider two students. One is from a less advantaged background, say, one standard deviation below the OECD average on the PISA index of economic, social and cultural status and the other from a relatively privileged background, say, one standard deviation above the OECD average on the PISA index of economic, social and cultural status. The predicted performance gap between these two students varies between countries by a factor of over two. Column 4 in Table 4.3a can be used to calculate this difference. The mathematics score point difference shown in this column is associated with a one standard deviation change in the PISA index of economic, social and cultural status – the two students in this example are separated by two standard deviations. This means that in Iceland this gap is 56 score points but in Belgium and Hungary it is 110 score points, equivalent to two proficiency levels (in each case double the gradient slope, *i.e.,* comparing students two standard deviations apart). The figure also shows clearly that high performance does not have to come at the expense of inequality, as some of the countries with the highest levels of performance have relatively gentle gradients.

Some countries need to cope with a much wider range of student backgrounds.

- Second, the range of the index of economic, social and cultural status spanned by the gradient lines varies widely between countries. Figure 4.9 shows that the range of backgrounds of the middle 90 per cent of the student population spans less than 2.5 index points on the index in Japan, Norway and the partner countries Latvia and the Russian Federation, but around 4 index points or more in Mexico, Portugal and the partner country Tunisia. These figures show that some countries' education systems need to cope with students from a wider range of socio-economic backgrounds than others (see column 5 in Table 4.3a).

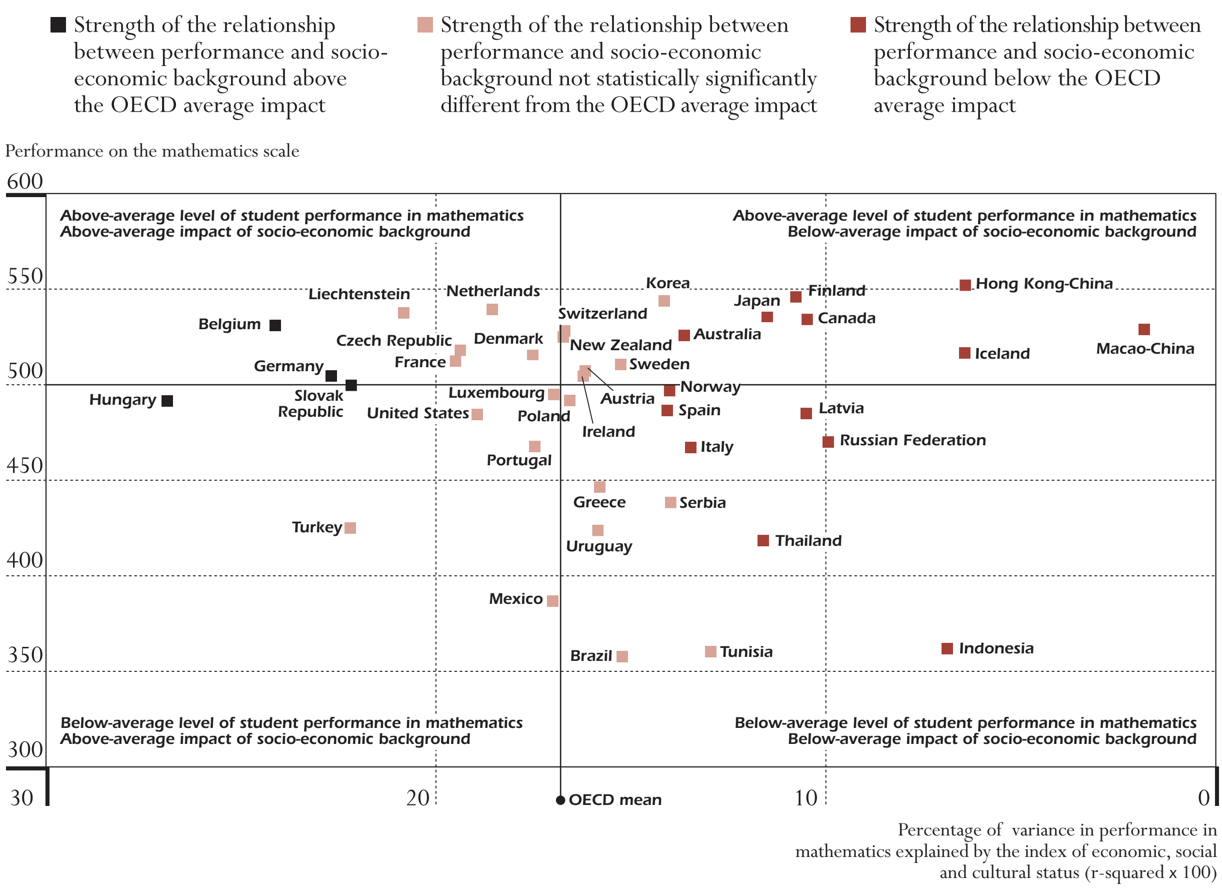
In most countries, an advantaged socio-economic background shows benefits for performance to equal degrees along a continuum, but in some the greatest gains are at the lower end and in others at the high end.

- Third, the gradients for many countries are roughly linear, that is, each increment on the index of economic, social and cultural status is associated with a roughly constant increase in performance on the mathematics scale. One might have expected that the gradients would be steep at low levels of economic, social and cultural status, and then level off at higher status levels, signalling that above a certain level of socio-economic background there would be progressively less advantage in terms of student performance. Indeed, the gradients follow this pattern in some countries, namely the Czech Republic, Hungary, Italy and the Slovak Republic (with column 8 in Table 4.3a showing statistically significant negative values). However, in Australia, Germany, Luxembourg, New Zealand, Turkey and the United States and the partner countries Brazil, Indonesia, Liechtenstein, Thailand, Tunisia and Uruguay the gradients display the opposite pattern – they are relatively gentle at low levels of socio-economic status, and become steeper at higher levels (with column 8 in Table 4.3a showing statistically significant positive values). In these countries, among the more advanced group of students, home background makes a greater difference to student performance in mathematics. In other words, the greater the socio-economic advantage, the greater the advantage it has in terms of student performance.

In the remaining 24 countries in PISA, these effects are small and not statistically significant. The finding that in all countries gradients tend to be linear, or only modestly curved across the range of economic, social and cultural status, has an important policy implication. Many socio-economic policies are aimed at increasing resources for the most disadvantaged, either through taxation or by targeting benefits and socio-economic programmes to certain groups. The PISA results suggest that it is not easy to establish a low economic, social and cultural status baseline, below which performance sharply declines. Moreover, if economic, social and cultural status is taken to be a surrogate for the decisions and actions of parents aimed at providing a richer environment for their children – such as taking an interest in their school work – then these findings suggest that there is room for improvement at all levels on the socio-economic continuum. The fact that it is difficult to discern a baseline, however, does not imply that differentiated student support is not warranted. Targeted efforts can be very effective in reducing disparities, as shown, for example, in successful efforts by many countries to close gender gaps in student performance.

Figure 4.10 ■ **Performance in mathematics and the impact of socio-economic background**

Average performance of countries on the PISA mathematics scale and the relationship between performance and the index of economic, social and cultural status



Note: OECD mean used in this figure is the arithmetic average of all OECD countries.
Source: OECD PISA 2003 database, Table 4.3a.

Comparing the strength of the socio-economic gradient with average student performance…

Figure 4.10 summarises the findings by contrasting average performance in mathematics (as shown on the vertical axis) with the strength of the relationship between socio-economic background and mathematics performance (as shown on the horizontal axis). The latter can be viewed as an indicator of equity in the distribution of learning opportunities, with perfect equity being defined by a situation in which students' performance is unrelated to their socio-economic background. Canada, Finland, Japan and the partner country Hong Kong-China, represented in the upper right quadrant of the figure, are examples of countries that display high levels of student performance in mathematics and, at the same time, a below-average impact of economic, social and cultural status on student performance. By contrast, Hungary and Turkey, displayed in the lower left quadrant, are examples of countries with below-average student performance in mathematics and an above-average impact of socio-economic background on performance. Belgium, the Czech Republic and the Netherlands are examples of countries characterised by high average performance levels but in which performance is comparatively strongly related to socio-economic background. Finally, Italy, Norway and Spain are countries in which average performance in mathematics is below the OECD average but not strongly related to student background. Although Mexico and Turkey show below average performance in mathematics associated with an average impact of socio-economic background, it is important to note that because only around half of 15-year-olds in these countries are enrolled in school (the smallest proportion among all participating countries, see Table A3.1) and thus represented in PISA, the impact of socio-economic background on the mathematics performance of 15-year-olds is probably underestimated.

…shows that quality and equity do not need to be considered as competing policy objectives.

The figure highlights that countries differ not just in their overall performance, but also in the extent to which they are able to reduce the association between socio-economic background and performance. PISA suggests that maximising overall performance and securing similar levels of performance among students from different socio-economic backgrounds can be achieved simultaneously. The results suggest therefore that quality and equity need not be considered as competing policy objectives.

The results mirror those observed in PISA 2000 for mathematics. However, some countries are exceptions to this similarity: in Australia and the United States the relationship between student performance and socio-economic background appears weaker in 2003, and in Belgium, Italy and the partner country Liechtenstein the relationship appears stronger in 2003 (see Table 4.3b for the PISA 2000 results).[17]

The differing overall socio-economic composition of countries puts their performance in a different light.

When comparing the relationship between socio-economic background and student performance, it is important to take into account marked differences in the distribution of socio-economic characteristics between countries. Table 4.3a presents key characteristics of the distribution of the PISA index of economic, social and cultural status in 2003. As noted before, PISA's socio-economic index was constructed such that roughly about two-thirds of the OECD student population are between the values of -1 and 1, with an average score of 0 (*i.e.,* the mean for

the combined student population from participating OECD countries is set to 0 and the standard deviation is set to 1). Countries with negative mean indices (see column 6 in Table 4.3a), most notably Mexico, Portugal, Turkey and the partner countries Brazil, Hong Kong-China, Indonesia, Macao-China, Thailand and Tunisia, are characterised by a below-average socio-economic background and thus face far greater overall challenges in addressing the impact of socio-economic background. This makes the high performance achieved by students in Hong Kong-China and Macao-China all the more impressive. However, it also places a different perspective on the observed below-average performance of the remaining countries mentioned. In fact, a hypothetical adjustment that assumes an average index of economic, socio-economic and cultural status across OECD countries would result in an increase of mathematics performance in Turkey from 423 to 468 score points, the observed performance level in Portugal. Portugal's average performance would, in turn, change from 466 to 485 score points, which is almost on a par with the observed performance level of Spain and the United States. Such adjusted scores are shown in column 2 in Table 4.3a. In contrast, in countries such as Canada, Iceland, Norway and the United States, which operate in much more favourable socio-economic conditions, adjusting for this advantage would lower their scores considerably. Obviously, such an adjustment is entirely hypothetical – countries operate in a global market place where actual, rather than adjusted, performance is all that counts. Moreover, the adjustment does not take into consideration the complex cultural context of each country. However, in the same way that proper comparisons of the quality of schools focus on the added value that schools provide (accounting for the socio-economic intake of schools when interpreting results), users of cross-country comparisons need to keep in mind the differences among countries in economic, social and educational circumstances.

It is not only the average socio-economic background but the range of socio-economic backgrounds found among students that affects the challenges education systems face…

The challenges that education systems face depend not just on the average socio-economic background of a country. They also depend on the distribution of socio-economic characteristics within countries. Such heterogeneity in socio-economic characteristics can be measured by the standard deviation, within each country, of student values on the PISA index of economic, social and cultural status (see column 7 in Table 4.3a). The greater this socio-economic heterogeneity in the family background of 15-year-olds, the greater the challenges for teachers, schools and the entire education system. In fact, many of the countries with below-average socio-economic status, most notably Mexico, Portugal, Turkey and the partner country Tunisia, also face the difficulty of significant heterogeneity in the socio-economic background of 15-year-olds.

…and that can compound the effect of the steepness of the socio-economic gradient.

Even countries with average levels of socio-economic background differ widely in the socio-economic heterogeneity of their populations. For example, both France and Japan have a level in the PISA index of economic, social and cultural status that is near the OECD average. However, while Japan has the most homogeneous distribution of socio-economic characteristics among OECD countries, France has a comparatively wide variation. Similarly, among

the countries with the highest overall levels of socio-economic status, Canada, Iceland, Norway and Sweden show a narrow range in distribution of socio-economic characteristics, whereas the United States shows comparatively large socio-economic disparities.

As a result, the impact of the gradient on student performance is larger in socio-economically more heterogeneous populations.

In countries in which the student population is very heterogeneous, similar socio-economic gradients will have a much larger impact on the performances gap than in countries that have socio-economically more homogeneous student populations. For example, Germany and Poland have socio-economic gradients with similar slopes: *i.e.,* in both countries a given socio-economic difference is associated with a similar difference in performance. Since the distribution of socio-economic characteristics is much more heterogeneous in Germany than in Poland, the performance gap among students in the top and bottom quarters of the PISA index of economic, social and cultural background is much larger in Germany than in Poland (Table 4.4).

Some countries have over ten times as many students as others with backgrounds that would put them in the least advantaged one-sixth of OECD students.

Countries with a low average level of socio-economic background and a wide distribution of socio-economic characteristics face particular challenges in meeting the needs of disadvantaged students, even more so if the distribution of socio-economic background characteristics is skewed towards disadvantage, as indicated by a positive index of skewness in Table 4.3a (see column 9). For example, in Mexico and Turkey, as well as in the partner countries Indonesia, Thailand and Tunisia, more than half of all students come from a socio-economic background below that experienced by the least advantaged 15 per cent of students in OECD countries (see column 10 in Table 4.3a). By contrast, in Canada, Iceland and Norway, less than 5 per cent of students have a socio-economic background below that of the least advanced 15 per cent of all OECD students.

SOCIO-ECONOMIC DIFFERENCE, SCHOOL DIFFERENCE AND THE ROLE THAT EDUCATION POLICY CAN PLAY IN MODERATING THE IMPACT OF SOCIO-ECONOMIC DISADVANTAGE

While education systems cannot alter students' backgrounds, schools can potentially moderate their impact.

Many of the factors of socio-economic disadvantage are not directly amenable to education policy, at least not in the short term. For example, the educational attainment of parents can only gradually improve, and average family wealth depends on the long-term economic development of a country as well as the development of a culture which promotes individual savings. The importance of socio-economic disadvantage, and the realisation that aspects of such disadvantage only change over extended periods of time, give rise to a vital question for policy-makers: to what extent can schools and school policies moderate the impact of socio-economic disadvantage on student performance? The overall relationship between socio-economic background and *student* performance provides an important indicator of the capacity of education systems to provide equitable learning opportunities. However, from a policy perspective, the relationship between socio-economic background and *school* performance is even more important as it indicates how equity is interrelated with systemic aspects of education.

The relationship between performance and socio-economic background tends to be stronger at school than at student levels…

Figure 4.1 reveals large differences among countries in the extent to which student performance varies among schools. Table 4.1a takes this further by showing the between-school and within-school components of variation in student performance that are attributable to students' socio-economic background. In other words, it looks at the strength of the relationship between socio-economic background and student performance both within and between schools. It is evident that there are marked differences among countries in the percentage of within-school variation that can be attributed to socio-economic background. At the same time, in most countries, this percentage is considerably smaller than the between-school performance differences that can be attributed to socio-economic background.

…particularly in those countries in which schools differ in their socio-economic intake…

Belgium, the Czech Republic, Germany, Hungary and the partner country Uruguay are countries in which schools differ considerably in their socio-economic intake even though, within schools, student populations tend to have a comparatively homogeneous socio-economic background. In Belgium, the Czech Republic, Germany, Hungary, the Slovak Republic and the United States and the partner country Uruguay, the between-school variance in student performance that is attributable to students' socio-economic background accounts for more than 12 per cent of the OECD average between-student variance (see columns 5 and 6 in Table 4.1a) and for Belgium, Germany and Hungary this figure rises to over 40 per cent if the additional effect of the whole school's socio-economic composition on each student's performance is taken into account as well (see columns 7 and 8 in Table 4.1a). By contrast, within schools, socio-economic background in each of these three countries accounts for less than 5 per cent of the performance variance (see column 6 in Table 4.1a).

…but there are other countries where schools differ mainly for reasons unrelated to student background.

Canada, Finland, Iceland, Japan, Mexico, Norway and Sweden and the partner countries Hong Kong-China, Indonesia and Macao-China are among the countries in which the socio-economic background of individual students accounts for 5 per cent or less of performance variance across schools (see columns 5 and 6 in Table 4.1a). However, Japan stands out in this group of countries in that the picture changes significantly once the socio-economic intake of schools as a whole is taken into account. When the additional effect of the whole school's socio-economic composition on each student's performance is taken into account, the percentage of explained variance in school performance rises from around 3 per cent of the OECD average variance in student performance to 42 per cent (see columns 5 and 7 in Table 4.1a).

To understand this further, one needs to consider both how student background influences performance within a school…

An examination is needed of how within-school and between-school variance is attributable to socio-economic background. This is required in order to understand which policies might help to simultaneously increase overall student performance and moderate the impact of socio-economic background (*i.e.,* to raise and flatten a country's socio-economic gradient line). The following section examines the impact of socio-economic difference on student performance, as measured by the socio-economic gradient. To this end, the gradient for a

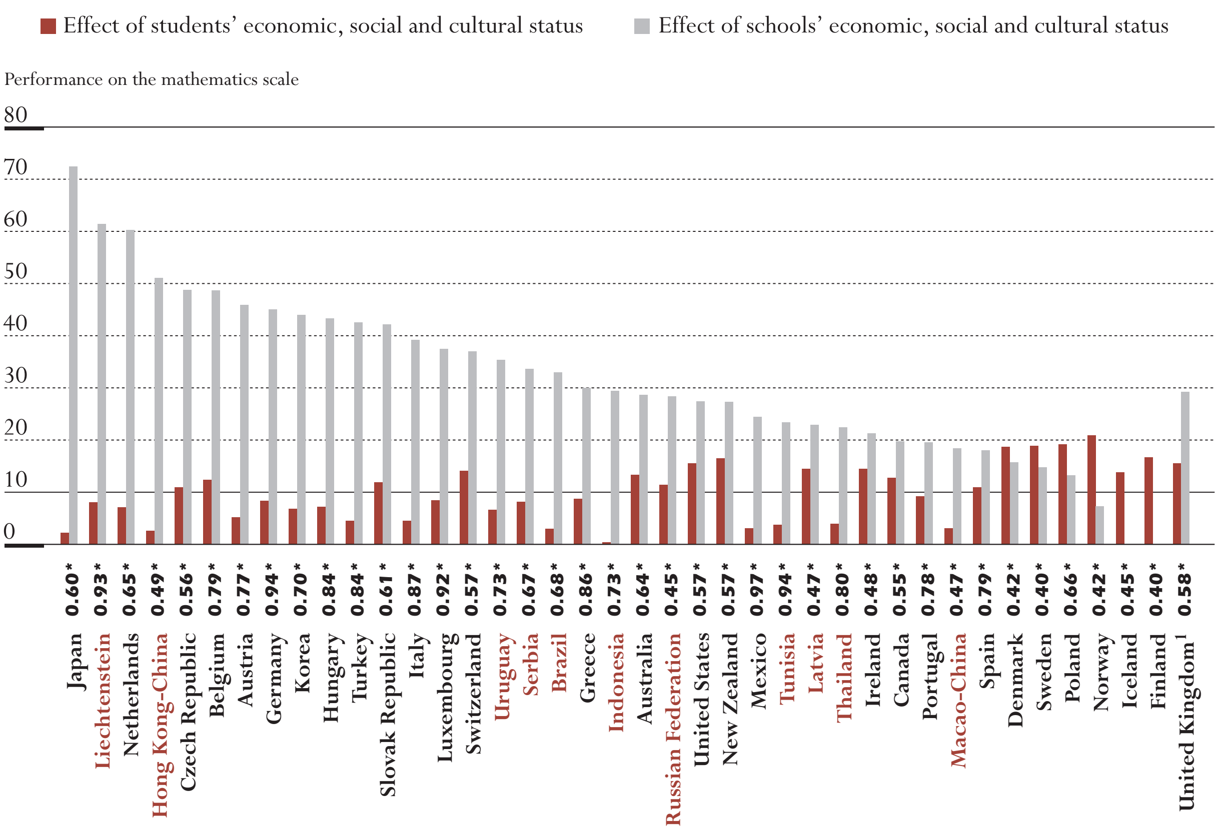
country can be broken down into two parts: a *within-school* gradient and a *between-school* gradient. The *within-school* gradient describes how students' socio-economic background is related to their performance within a common school environment. The *between-school* gradient describes how schools' average level of performance is related to the average economic, social and cultural status of their student intake.[18]

...and how schools' performances differ according to the socio-economic background of their intakes.

Figure 4.13 at the end of this chapter shows the average performance, and the socio-economic composition of the student intake, for each school in the PISA sample. Socio-economic composition is measured by the mean PISA index of economic, social and cultural status in the school. Each dot in the chart represents one school, with the size of the dot proportionate to the number of 15-year-olds enrolled in the school. This shows first that in some countries students are highly segregated along socio-economic lines, whether because of residential segregation, economic factors or selection within the school system.

Figure 4.11 ■ **Effects of students' and schools' socio-economic background on student performance in mathematics**

Differences in performance on the mathematics scale associated with half a student-level standard deviation on the index of economic, social and cultural status



* Interquartile range of the school-level average mean index of economic, social and cultural status.

1. Response rate too low to ensure comparability (see Annex A3).

Source: OECD PISA 2003 database, Table 4.5 (Half values of Columns 2 and 7 respectively).

The figure also shows the overall gradient between socio-economic background and student performance (black line) (which was already shown in Figure 4.9). Finally, the figure displays the between-school gradient (thick dashed black line) and the average within-school gradient (thin dashed black line). Schools above the between-school gradient line (thick dashed black line) perform better than would be predicted by their socio-economic intake. Schools below the between-school gradient line perform below their expected value.

The gradients shown here indicate performance differences associated with a fixed amount of difference in socio-economic background.

Figure 4.11 compares the slopes of within-school and between-school gradients across countries that are shown at the end of this chapter. The slopes represent, respectively, the gap in predicted scores of two students within a school separated by a fixed amount of socio-economic background, and the gap in predicted scores of two students with identical socio-economic backgrounds attending different schools where the average background of their fellow-students is separated by the same fixed amount. The slopes were estimated with a multi-level model that included the PISA index of economic, social and cultural status at the student and school levels. The lengths of the bars in Figure 4.11 indicate the differences in scores on the PISA mathematics scale that are associated with a difference of half of an international standard deviation on the PISA index of economic, social and cultural status for the individual student (red bar) and for the average of the student's school (grey bar). Half a student-level standard deviation was chosen as the benchmark for measuring performance gaps because this value describes realistic differences between schools in terms of their socio-economic composition: on average across OECD countries, the difference between the 75th and 25th quartiles of the distribution of the school mean index of economic, social and cultural status is 0.77 of a student-level standard deviation. This value ranges from 0.42 standard deviations or less in Denmark, Finland, Norway and Sweden to 0.90 or more standard deviations in Germany, Luxembourg and Mexico and in the partner countries Liechtenstein and Tunisia (see column 11 in Table 4.5).

The results show that the effect of the school's socio-economic intake counts for more than an individual's own socio-economic background.

In almost all countries, and for all students, the relatively long grey bars in Figure 4.11 indicate the clear advantage in attending a school whose students are, on average, from more advantaged socio-economic backgrounds. Regardless of their own socio-economic background, students attending schools in which the average socio-economic background is high tend to perform better than when they are enrolled in a school with a below-average socio-economic intake. In the majority of OECD countries the effect of the average economic, social and cultural status of students in a school – in terms of performance variation across students – far outweighs the effects of the individual student's socio-economic background.

Relatively socio-economically advantaged schools confer well over half a proficiency level of performance advantage over the range measured here, and in some countries much more…

All of this is perhaps not surprising, but the magnitude of the differences is striking. In Austria, Belgium, the Czech Republic, Germany, Hungary, Japan, Korea, the Netherlands, the Slovak Republic and Turkey, as well as in the partner countries Hong Kong-China and Liechtenstein, the effect on student performance of a school's average economic, social and cultural status is very substantial. In these countries, half a unit on the index of economic, social and cultural status at the school level is equivalent to between 40 and 72 score points (half of the value shown in column 7 in Table 4.5). Consider the case of two hypothetical students in any of these countries, living in families with average socio-economic background, as measured by the index of economic, social and cultural status. One student attends a school in a socio-economically advantaged area, in which the mean index of economic, social and cultural status of the school's intake is a quarter of a (student-level) standard deviation above the OECD average. Most of this student's peers will therefore come from families that are more affluent than his or her own. The other student attends a school in a more disadvantaged area: the school's mean economic, social and cultural background is a quarter of a standard deviation below the OECD average, so that the student comes from a more affluent family than his or her peers. Figure 4.11 indicates that the first student would be likely to have a much higher mathematics performance than the second student, by between 40 and 72 score points depending on the country in this list.

Socio-economic differences at student levels are much less predictive for performance than the schools' socio-economic context. Consider the case of two students in the same country living in families whose different economic, social and cultural status give them scores on the index a quarter of a student-level standard deviation above and a quarter below the mean. If these students attend the same school, with an average socio-economic profile, they would have a much smaller gap in their predicted performance of a mere 2 score points in Japan and 12 score points in Belgium and the Slovak Republic (half of the value shown in column 2 in Table 4.5).

…although these differences must be interpreted in the context of how much socio-economic background actually varies in school averages.

In the interpretation of Figure 4.11, it needs to be borne in mind that differences in the averages of schools' socio-economic backgrounds are naturally smaller than comparable differences between individual students, given that every school's intake is mixed in terms of socio-economic variables. To aid in the interpretation, the typical range of the average socio-economic status of schools has been added to Figure 4.11.

Various influences potentially lie behind the effect of socio-economic intake, including the learning climate, teaching quality and peer interaction…

The manner in which students are allocated to schools within a district or region, or to classes and programmes within schools, can have implications for the contextual effect, in terms of the teaching and learning conditions in schools that are associated with educational outcomes. A number of studies have found that schools with a higher average socio-economic status among their student intake tend to have several advantages. They are likely to have fewer disciplinary problems, better teacher-student relations, higher teacher morale, and a general school climate that is oriented towards higher performance. Such schools also often have a faster-paced curriculum. Talented and motivated teachers are more likely to be attracted to schools with higher socio-economic status, and less likely to transfer to another school or to leave the profession. Some of the contextual effect associated with high socio-economic status may also stem from peer interactions that occur as talented students work with each other. The potential influence of such classroom and school factors is examined further in Chapter 5.

Some of the contextual effect might also be due to factors which are not accounted for in PISA. For example, the parents of a student attending a more socio-economically advantaged school may, on average, be more engaged in the student's learning at home. This may be so even though their socio-economic background is comparable to that of the parents of a student attending a less-privileged school. Another caveat is relevant to the previously mentioned example of the two hypothetical students of similar ability, who attended schools with different average socio-economic intakes. This relates to the fact that because no data on the students' earlier achievement are available from PISA, it is not possible to infer ability and motivation. Therefore, it is also not possible to determine whether and to what extent the school background directly or indirectly determines students' performance (for example, indirectly through a process of student selection or self-selection).

…as well as harder-to-measure influences including parental engagement and prior student ability and motivation.

Two different messages emerge about the ways to increase both quality and equality. On the one hand, socio-economic segregation may bring benefits for the advantaged that will enhance the performance of the elite and, perhaps as a consequence, overall average performance. On the other hand, segregation of schools is likely to decrease equality. However, there is strong evidence that this dilemma can be resolved from countries that have achieved both high quality and high equality. Just how other countries might match this record is the key question. Moving all students to schools with higher socio-economic status is a logical impossibility and the results shown in Figure 4.11 should not lead to the conclusion that transferring a group of students from a school with a low socio-economic intake to a school with a high socio-economic intake would automatically result in the gains suggested by Figure 4.11. That is, the estimated contextual effects shown in Figure 4.11 are descriptive of the distribution of school performance, and should not necessarily be interpreted in a causal sense.

In any attempt to develop education policy in the light of the above findings, there needs to be some understanding of the nature of the formal and informal selection mechanisms that contribute to between-school socio-economic segregation, and the effect of this segregation on students' performance. In some countries, socio-economic segregation may be firmly entrenched through residential segregation in major cities, or by a large urban/rural socio-economic divide. In other countries, structural features of the education system tend to stream or track students from different socio-economic contexts into programmes with different curricula and teaching practices (see also Chapter 5). The policy options are either to reduce socio-economic segregation or to mitigate its effects.

Socio-economic segregation may be due to geographic factors or to structural features of the educational system.

IMPLICATIONS FOR POLICY

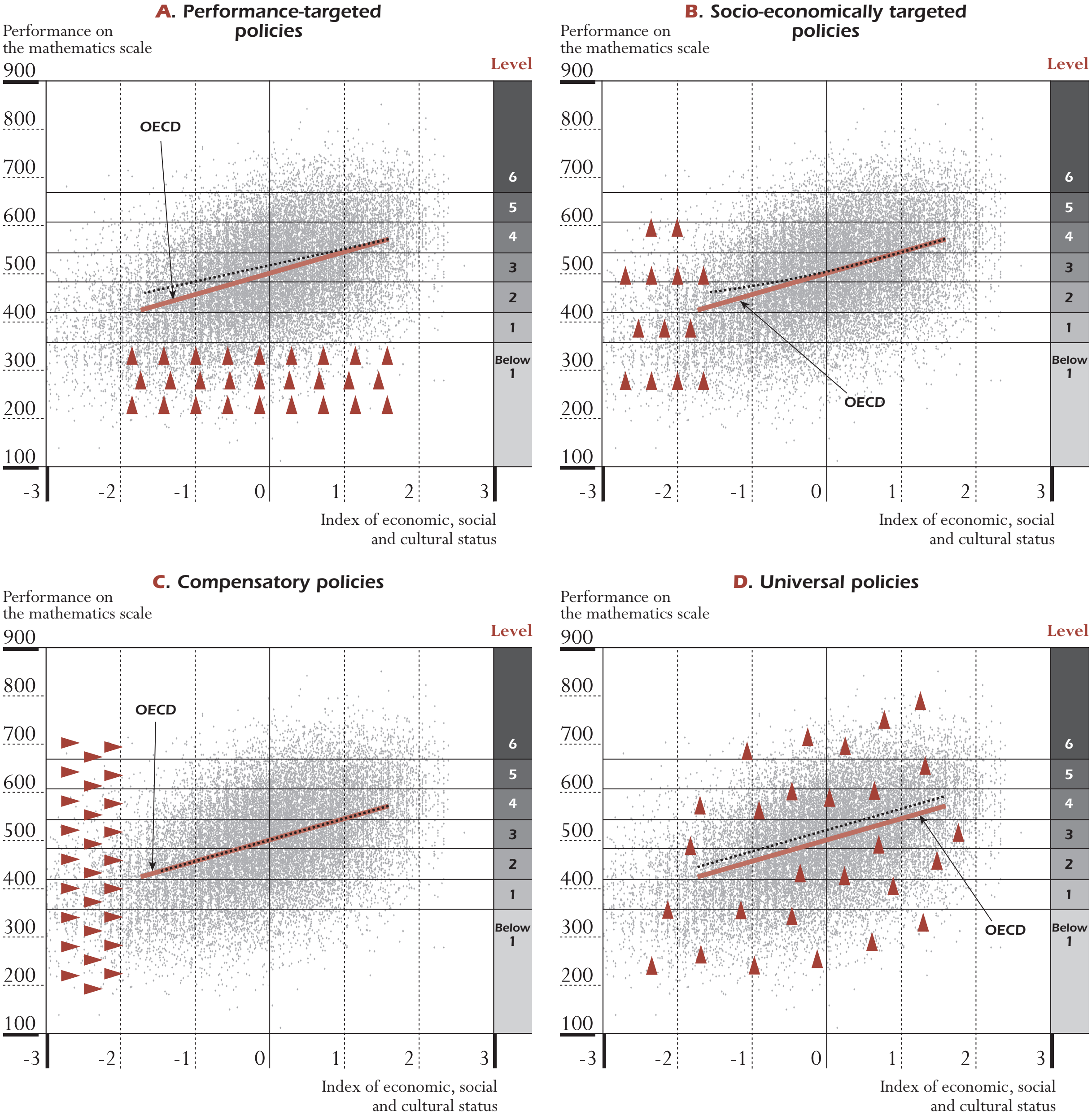
Home background influences educational success, and experiences at school often appear to reinforce its effects. Although PISA shows that poor performance in school does not automatically follow from a disadvantaged socio-economic background, socio-economic background does appear to be a powerful influence on performance.

Experiences at school too often reinforce rather than mitigate home background.

This could be because privileged children are better able to take advantage of education or because schools find them easier to nurture…

This represents a significant challenge for public policy striving to provide learning opportunities for all students irrespective of their socio-economic backgrounds. National research evidence from various countries has often been discouraging. Schools have appeared to make little difference. Either because privileged families are better able to reinforce and enhance the effect of schools, or because schools are better able to nurture and develop young people from privileged backgrounds, it has often appeared that schools reproduce existing patterns of privilege, rather than bringing about a more equitable distribution of outcomes.

Figure 4.12 ■ **Performance-targeted, socio-economically targeted, compensatory and universal policies**



Source: OECD PISA 2003 database.

…yet some countries combine greater equity with high performance.

The international comparative perspective that emerges from PISA is more encouraging. While all countries show a clear positive relationship between home background and educational outcomes, some countries demonstrate that high average quality and equality of educational outcomes can go together.

Policies trying to live up to these international benchmarks can take several forms…

This chapter has identified a set of indicators that, taking an internationally comparative perspective, can help policy makers to identify strategies aimed at raising performance and improving equity in the distribution of educational opportunities. Although all policy choices need to be defined within the respective national socio-economic, economic and educational contexts, international comparisons can provide some indication as to the kinds of policy that may be most effective. To assess their potential impact on raising performance and improving equity, policies can be classified as follows (Willms, 2004).

…some try to help students with low performance by providing them with extra instructional resources…

- *Performance-targeted policies* provide a specialised curriculum or additional instructional resources for particular students based on their levels of academic performance. For example, some schooling systems provide early prevention programmes that target children who are deemed to be at risk of school failure when they enter early childhood programmes or school, while other systems provide late prevention or recovery programmes for children who fail to progress at a normal rate during the first few years of elementary school. Some performance-targeted programmes aim to provide a modified curriculum for students with high academic performance, such as programmes for gifted students. More generally, policies that involve the tracking or streaming of students into different types of programmes could be considered performance-targeted as they strive to match curriculum and instruction to students' academic ability or performance. Grade repetition is also sometimes considered a performance-targeted policy, because the decision to have a student repeat a grade is usually based mainly on school performance. However, in many cases grade repetition does not entail a modified curriculum or additional instructional resources and therefore does not fit the definition of a performance-targeted policy used here. Figure 4.12a illustrates the intended impact of this type of policy. This figure builds on Figure 4.8 and shows student performance on the vertical axis and students' socio-economic background on the horizontal axis. The focus of performance-targeted policies is at the lower end of the performance scale, irrespective of the socio-economic background of students (indicated by upward-moving arrows at the lower end of the vertical axis in the chart, irrespective of students' positions on the horizontal axis). The solid line in Figure 4.12a indicates the currently observed slope of the relationship between socio-economic background and student performance whereas the dotted line indicates the slope that would result from successfully implemented policies of this type.

…some help students from less advantaged backgrounds…

- *Socio-economically targeted policies* provide a specialised curriculum or additional instructional resources for students from disadvantaged socio-economic backgrounds. An example is the Head Start pre-school programme in the United States for children from disadvantaged socio-economic backgrounds,

although there is a wide range of programmes that target at risk children and young persons. Some approaches select students on the basis of a risk factor other than socio-economic background, such as whether the student is a recent immigrant, a member of an ethnic minority, or living in a low-income community. The important distinction is that these programmes select students based on the family's socio-economic background rather than on their cognitive ability. Figure 4.12b illustrates the intended impact of this type of policy (indicated by the upward-moving arrows), as well as its intended outcome (indicated by the dotted gradient line). The focus is at the lower end of the socio-economic scale, irrespective of student performance (indicated by upward-moving arrows at the left end of the horizontal axis in the chart, irrespective of students' positions on the performance scale).

…or with economic resources helping to improve their circumstances.

- *Compensatory policies* provide additional economic resources to students from disadvantaged socio-economic backgrounds. These policies could be considered a subset of the previously mentioned policies that use socio-economic targeting, as they target students from disadvantaged socio-economic backgrounds, rather than students with low cognitive performance. However, the emphasis is on improving the economic circumstances of students from poor families, rather than on providing a specialised curriculum or additional educational resources. The provision of free lunch programmes for students from poor families is an example. More generally, and in many countries, the provision of transfer payments to poor families is the one of the primary policy levers at the national level. The distinction between compensatory policies and socio-economically-targeted policies is not always clear. For example, some jurisdictions have compensatory funding formulas that allocate educational funds to schools differentially, based on schools' socio-economic intake. In some sense this is a compensatory policy, but it could also be considered a socio-economically targeted policy in as much as the intention is to provide additional educational resources to students with disadvantaged socio-economic backgrounds. Figure 4.12c illustrates the intended impact of this type of policy (indicated by arrows pointing towards the right end of the socio-economic scale, irrespective of students' positions on the performance scale) as well as the intended outcome (indicated by the dotted gradient line).

Others try to raise performance for everyone…

- *Universal policies* strive to increase the educational performance of all children through reforms that are applied equally across the schooling system. Generally, universal policies are aimed at altering the content and pace of the curriculum, improving instructional techniques, or improving the learning environment in schools and classrooms. Some jurisdictions responded to PISA 2000 results by introducing major school reforms, introducing full-day schooling, altering the school-entry age, or increasing the time spent on language classes. These are all universal policies. Many universal policies strive to improve children's learning environments by changing the structural features of schools. There has also been an effort to increase parents' involvement in schooling in several ways, including greater involvement at home and greater participation in school governance. Many universal policies are directed at

changing teacher practice or aim at increasing the accountability of schools and schooling systems through the assessment of student performance. The underlying belief is that increased accountability will motivate administrators and teachers to improve the learning environment of schools and classrooms and provide better instruction. Figure 4.12d illustrates the intended impact of this type of policy as well as its intended outcome (indicated by the dotted gradient line).

- Finally, *inclusive policies* strive to include marginalised students into mainstream schools and classrooms. Inclusive practices often concentrate on including students with disabilities in regular classrooms, rather than segregating them in special classes or schools. This report considers inclusive policies to broadly encompass reforms aimed at including any type of student who may be segregated, whether with disabilities, students from ethnic minorities, or students from disadvantaged socio-economic backgrounds. Some inclusive policies try to reduce between-school socio-economic segregation by means such as redrawing school catchment boundaries, amalgamating schools, or creating magnet schools in areas with low socio-economic status.

...while yet others aim at integrating disadvantaged students, including through a reduction in socio-economic segregation.

A question that often confronts school administrators is whether efforts to improve student performance should be targeted mainly at those with low performance or low socio-economic background. The overall slope of the socio-economic gradient, together with the proportion of performance variation explained by socio-economic background, are useful indicators for assessing this question. Countries with relatively flat gradients are likely to find performance-based policies more effective in raising performance among students. Conversely, countries with steep socio-economic gradients might find some combination of performance-targeted and socio-economically-targeted policies more effective. For example, as noted earlier, Canada, Finland, Iceland, Italy, Luxembourg, Mexico, Portugal and Spain, as well as the partner countries Indonesia, Hong Kong-China, Macao-China, Thailand and Tunisia, are characterised by gradients that are flatter than that at the OECD average level (Table 4.3a). In these countries, a relatively smaller proportion of their low-performing students come from disadvantaged backgrounds and also school performance is largely unrelated to a school's socio-economic intake. Thus, by themselves, policies that specifically target students from disadvantaged backgrounds would not address the needs of many of the country's low-performing students. Moreover, if the goal is to ensure that most students achieve some minimum level of performance, socio-economically targeted policies in these countries would be providing services to a sizeable proportion of students who have high performance levels.

In deciding between policy approaches targeted at socio-economic disadvantage and at low student performance, countries with relatively gradual socio-economic gradients may see more benefit from the latter.

By contrast, in countries where the impact of socio-economic background on student performance is strong, socio-economically targeted policies would direct more of the resources towards students who are likely to require these services. As an illustration, compare Finland and Germany in Figure 4.13. By focusing on the left area of the chart, socio-economically-targeted policies would exclude many schools and students in Finland with comparatively low performance but

Targeting socio-economic disadvantage might be more effective, however, in countries where low performance and disadvantaged background are more closely associated...

from advantaged backgrounds shown in the bottom right area of the graph. By contrast, performance targeted policies would reach most of the lower-performing students and schools. In Germany, where the relationship between socio-economic background and student performance is much stronger, socio-economically-targeted interventions are likely to have a much stronger impact, as a much larger proportion of students and schools are located in the lower-left quadrant of the figure.

...although in countries with steep gradients, such targeting will still not benefit many students if the strength of the effect is low.

However, the case for socio-economically-targeted policies can still be overstated for countries with steep socio-economic gradients. In countries with steep socio-economic gradients, but where the variation explained by socio-economic background is only moderate, there tends to be a sizeable group of poorly performing students with higher socio-economic background. In most cases, socio-economically targeted policies are directed at the students from families with very low socio-economic background. For example, for the Czech Republic, as one shifts vertically in Figure 4.13 to the left – *i.e.,* as one focuses on lower levels of socio-economic background – the proportion of schools and students with low levels of performance which is not covered by these policies increases. Thus, in such situations socio-economically-targeted policies are likely to miss a large proportion of students who have relatively poor performance.

Improvement strategies can focus on individual students or on schools, depending on the extent to which performance varies among schools...

Performance-targeted policies can be classified into two types: those aimed at improving the overall performance of low-performing schools, and those aimed at improving the performance of low-performing students within schools. The proportion of performance variation between schools, described at the beginning of this chapter (Table 4.1a), can provide a useful indicator in judging the appropriateness of particular policy approaches.

...with some countries needing to focus on the problem of low-performing schools and others facing mainly within-school differences.

If there is little performance variation between schools, as in Canada, Denmark, Finland, Iceland, Ireland, Norway, Poland or Sweden, then within-school policies aimed at improving the performance of low-performing students are likely to be more effective. By contrast, in countries such as Austria, Belgium, the Czech Republic, Germany, Hungary, Italy, Japan, the Netherlands and Turkey and the partner countries Brazil and Hong Kong-China, large performance differences between schools would suggest that policies target low-performing schools, at least within each type of school where the education system is stratified.

In some countries, greater concentrations of disadvantaged students suggest a stronger case for targeting socio-economic disadvantage.

Two variables – the skewness of the distribution of socio-economic background, as a within-country measure of disadvantage, and the proportion of students in each country that are in the lowest sixth of the international distribution of socio-economic background – help to assess the appropriateness of compensatory policies that seek to meet the needs of students from disadvantaged families by compensating for their economic circumstances (see columns 9 and 10 in Table 4.3a). Among OECD countries, the value for skewness is -0.31 (indicating that the socio-economic background of 15-year-olds is skewed towards socio-economic advantage). Among the partner countries the value is 0.16 (indicating

that the socio-economic background of 15-year-olds is skewed towards socio-economic disadvantage). And in some of the lower-income partner countries (but also in the Czech Republic, Poland, Portugal and Turkey), skewness is more than 1.5 times this number. These figures indicate a greater need for compensatory policies in some low-income countries. As previously noted, however, this kind of policy by itself – like socio-economically targeted policies – cannot substantially raise and level socio-economic gradients. Such a policy is likely to be most effective if implemented alongside universal, as well as performance and socio-economically-targeted, strategies.

In countries with greater socio-economic segregation across schools, overall differences by socio-economic background tend to be larger…

Table 4.5 also provides an inclusion index (see column 12) (Willms, 2004). The smaller the index value, the more schools are segregated by socio-economic background. The larger the index value, the less schools are segregated by socio-economic background.[19] Across countries, the relationship between average performance and the inclusion index is positive. This suggests that countries with greater socio-economic inclusion tend to have higher overall performance. Furthermore, the relationship between the socio-economic gradients and the index of socio-economic inclusion in OECD countries is negative, indicating that countries with greater socio-economic inclusion tend to have flatter gradients. Taken together, these results suggest that more inclusive schooling systems have both higher levels of performance and fewer disparities among students from differing socio-economic backgrounds. In some countries, socio-economic segregation can be deeply entrenched due to economic divides between urban and rural areas, as well as residential segregation in cities. However, segregation can also stem from educational policies that stream children into certain kinds of programmes early in their school careers (see also Chapter 5).

…and in these countries some schools may need more resources to compensate, whereas in other countries any improvements will need to be found within schools.

To increase quality and equity (*i.e.,* to raise and flatten the gradient) in such countries would require specific attention to between-school differences. Reducing the socio-economic segregation of schools would be one strategy, while allocating resources differentially to schools and programmes and seeking to provide students with differentiated and appropriate educational opportunities are others. In countries where the inclusion index is low, it is important to understand how the allocation of school resources within a country is related to the socio-economic intake of its schools. In other countries, there is relatively little socio-economic segregation between schools – *i.e.,* schools tend to be similar in their average socio-economic intake. In these countries, quality (the level) and equality (the slope of the gradient) are mainly affected by the relationship between student performance and the socio-economic background of individual students within each school. To increase quality and equality in these countries will require actions that predominantly focus within schools. Reducing the segregation within schools of students of differing economic, social and cultural status would be one strategy, and might require a review of classroom streaming practices. More direct assistance for poorly performing students may also be needed. In these countries, it is important to understand how the allocation of resources within schools is related to the socio-economic characteristics of their students.

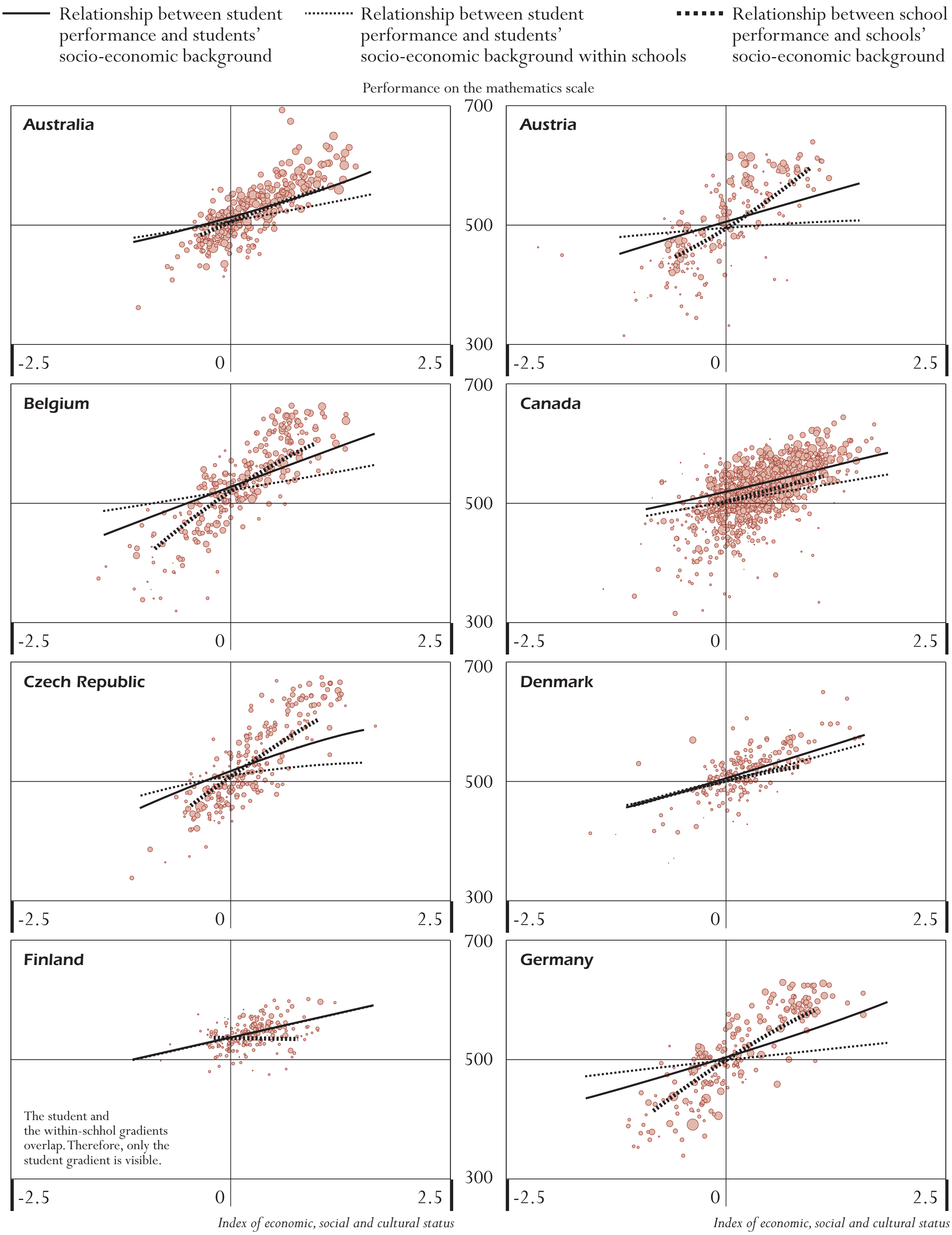
Policy considerations need to take account of long-term influences on 15-year-olds' performance…

Finally, when considering the information furnished by PISA, policy analysts tend to focus their attention on the schooling system, particularly on features of the secondary system. This is natural, as PISA is an assessment of students at age 15. Indeed, the analyses pertaining to school effectiveness presented in this report are based on data describing school offerings at the late primary or secondary levels. However, PISA is not an assessment of what young people learned during their previous year at school, or even during their secondary school years. It is an indication of the learning development that has occurred since birth. A country's results in PISA depend on the quality of care and stimulation provided to children during infancy and the pre-school years, and on the opportunities children have to learn both in school and at home during the elementary and secondary school years.

…and to take a broad view, including the early childhood years and families.

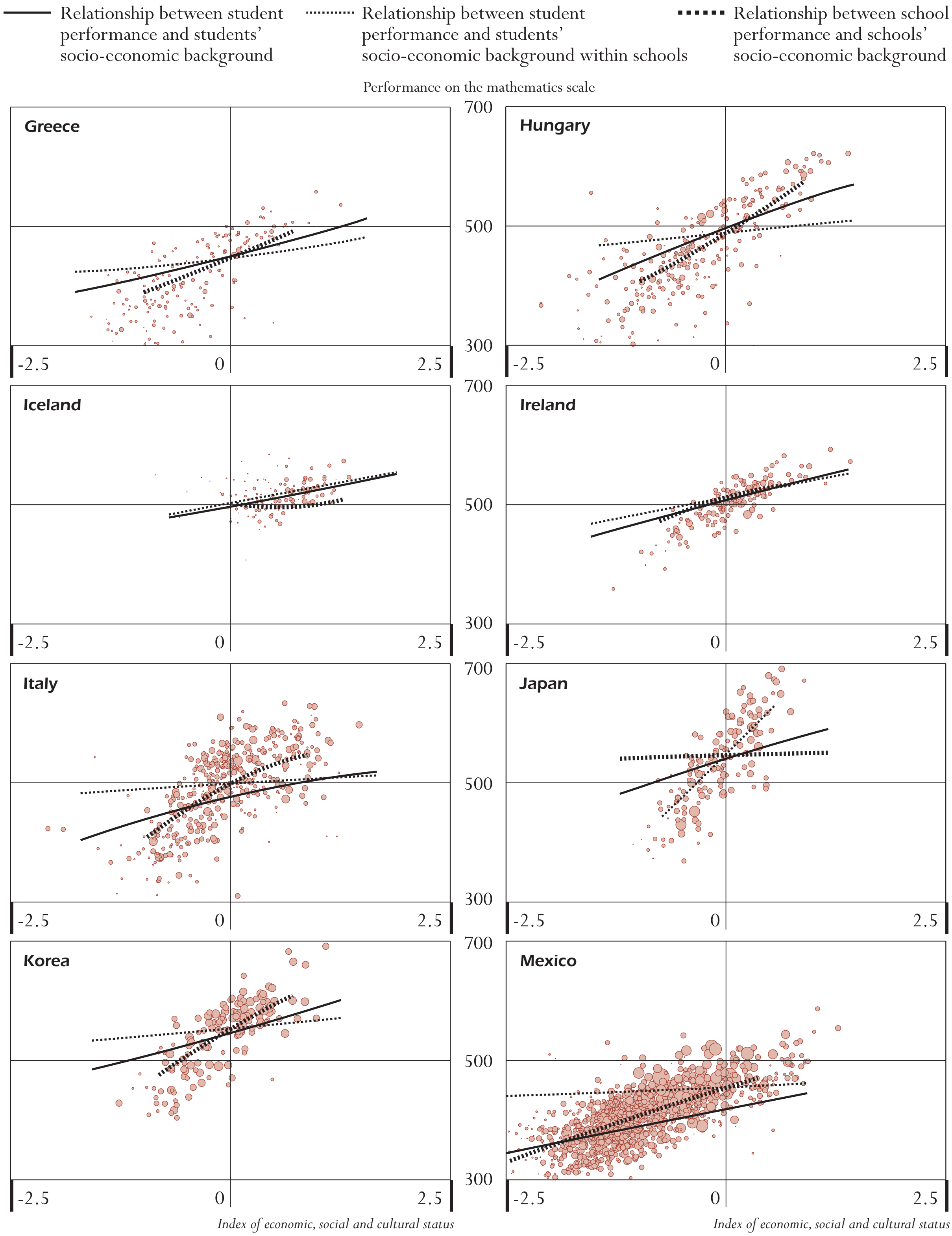
Improving quality and equity therefore require a long-term view and a broad perspective. For some countries, this may mean taking measures to safeguard the healthy development of young children, or improving early childhood education. For others, it may mean socio-economic reforms that enable families to provide better care for the children. But in many, it can mean efforts to increase socio-economic inclusion and improve school offerings.

Figure 4.13 ■ **Relationship between school performance and schools' socio-economic background**



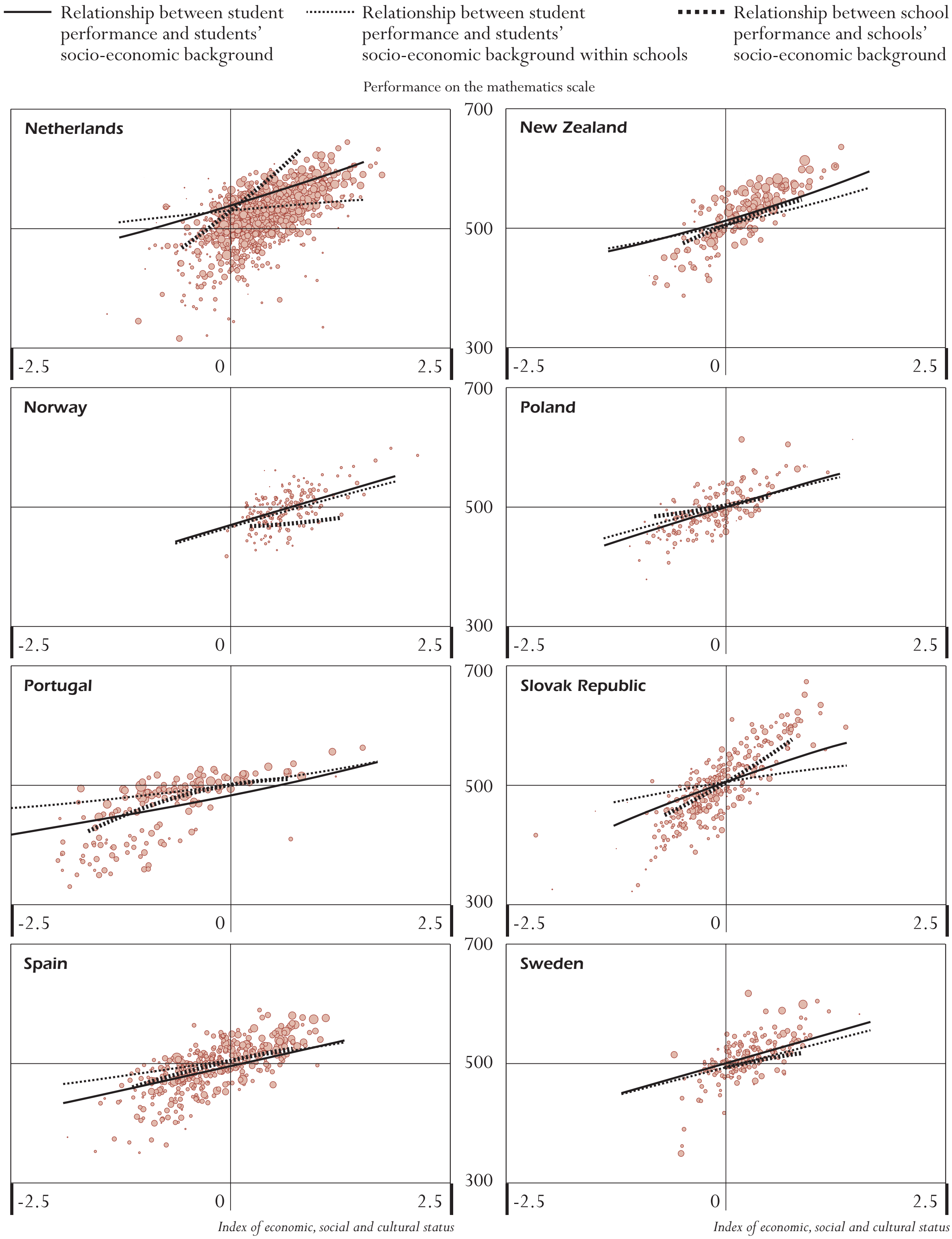
Note: Each symbol represents one school in the PISA sample, with the size of the symbols proportional to the number of 15-year-olds enrolled.
Source: OECD PISA 2003 database.

Figure 4.13 (continued-1) ■ **Relationship between school performance and schools' socio-economic background**



Note: Each symbol represents one school in the PISA sample, with the size of the symbols proportional to the number of 15-year-olds enrolled.
Source: OECD PISA 2003 database.

Figure 4.13 (continued-2) ■ **The relationship between school performance and schools' socio-economic background**



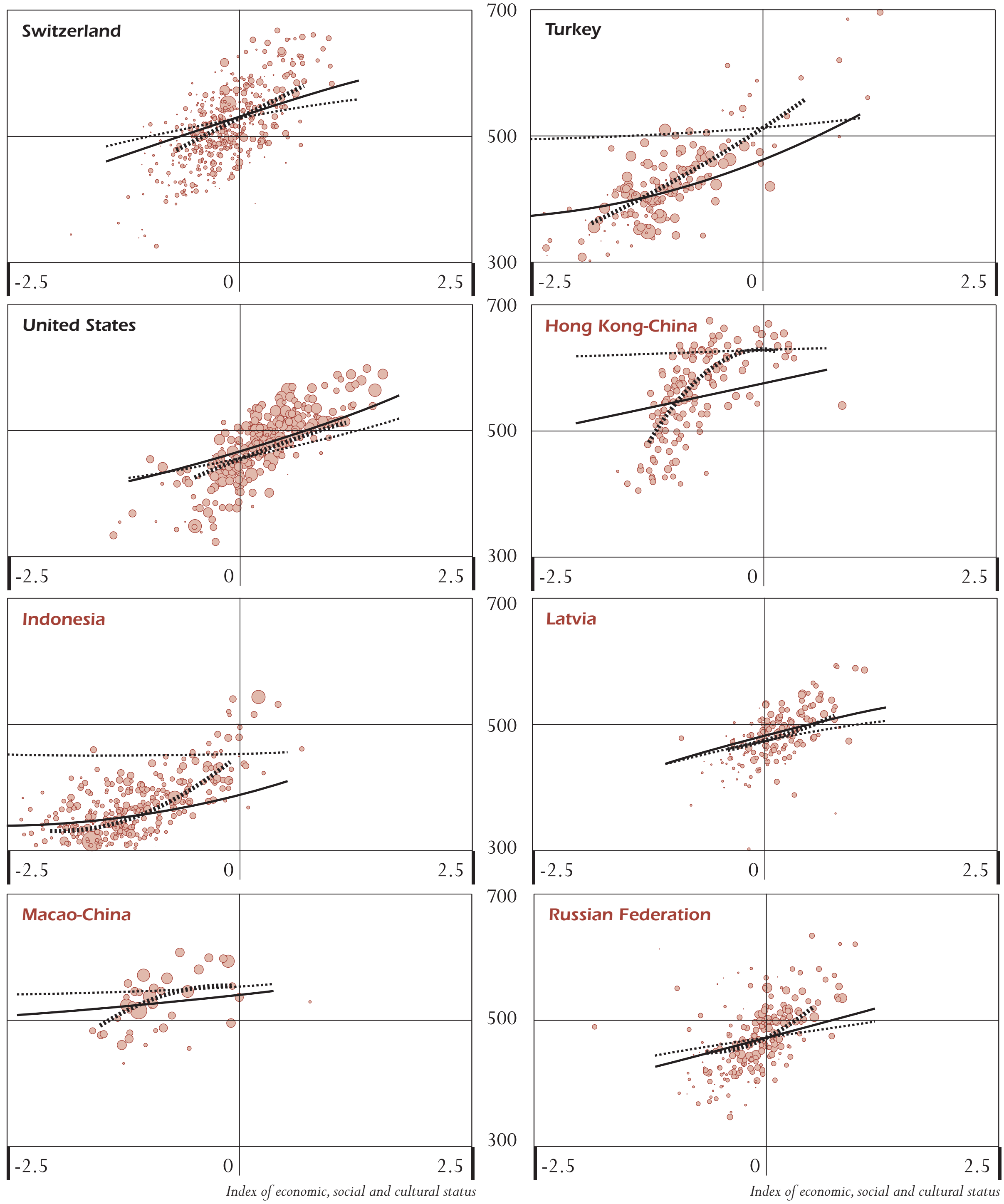
Note: Each symbol represents one school in the PISA sample, with the size of the symbols proportional to the number of 15-year-olds enrolled.
Source: OECD PISA 2003 database.

Figure 4.13 (continued-3) ■ **Relationship between school performance and schools' socio-economic background**

Relationship between student performance and students' socio-economic background

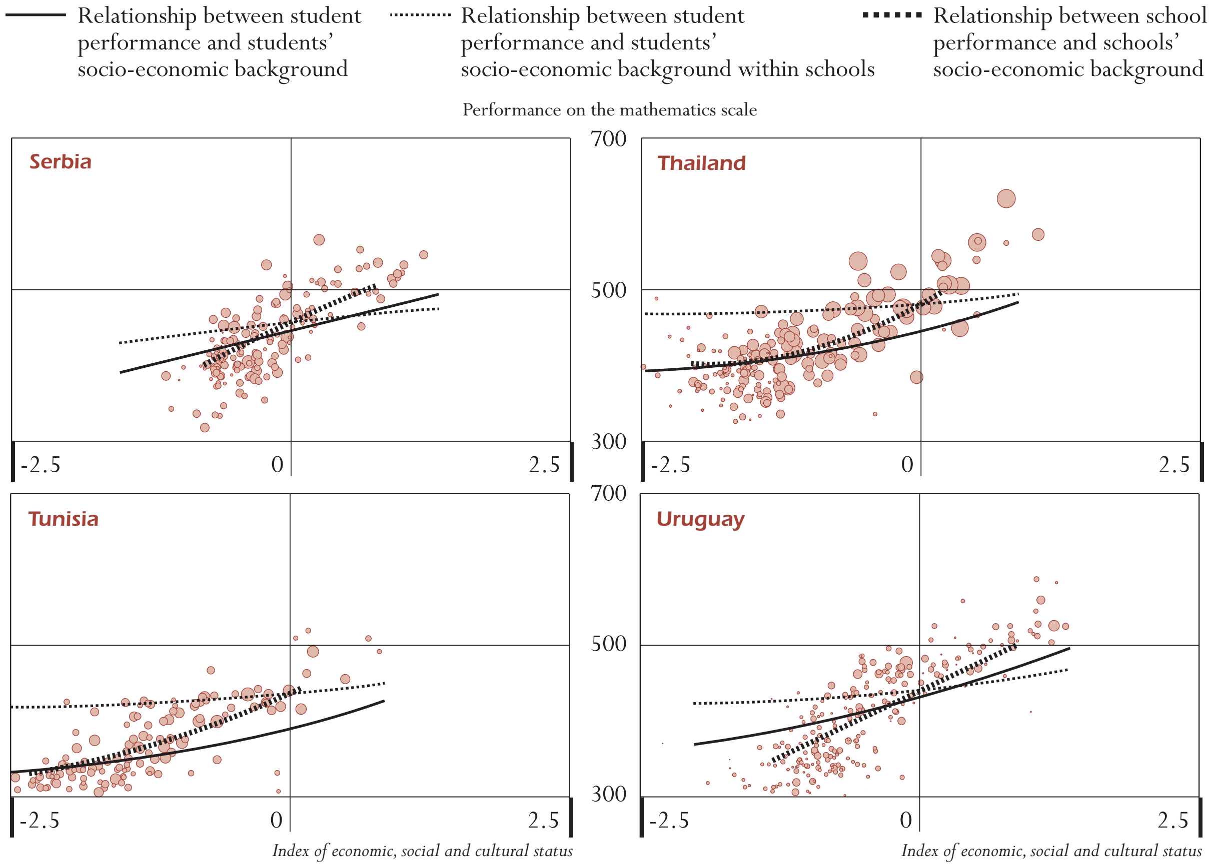
Relationship between student performance and students' socio-economic background within schools

Relationship between school performance and schools' socio-economic background



Note: Each symbol represents one school in the PISA sample, with the size of the symbols proportional to the number of 15-year-olds enrolled.
Source: OECD PISA 2003 database.

Figure 4.13 (continued-4) ■ **Relationship between school performance and schools' socio-economic background**



Note: Each symbol represents one school in the PISA sample, with the size of the symbols proportional to the number of 15-year-olds enrolled.
Source: OECD PISA 2003 database.

Notes

1. Performance differences between countries account for 10 per cent of the overall observed variance of student performance in mathematics, while performance differences between schools within countries account for 28 per cent and performance differences between students within schools account for 61 per cent of the overall variance (Table 5.21a)

2. While the overall relationship between socio-economic background and student performance tends to be similar across the areas of mathematics, science and reading, it varies for some countries. For example, for the Czech Republic, Hungary, Korea and the partner countries Brazil, Tunisia and Uruguay, the proportion of science performance variation that is explained by the PISA index of economic, social and cultural status lies between 3.0 and 5.8 percentage points lower than for mathematics while in Germany it lies 3.2 percentage points higher in science. Similarly, for the Czech Republic, Greece, Hungary, Korea, the Netherlands, Portugal and Spain and for the partner countries Brazil, Tunisia and Uruguay the proportion of reading performance that is explained by the PISA index of economic, social and cultural status lies between 3.1 and 6.7 percentage points lower than for mathematics while in Austria it is 5.0 percentage points higher in reading (see *www.pisa.oecd.org*).

3. Variation is expressed by statistical variance. This is obtained by squaring the standard deviation referred to in Chapter 2. The statistical variance rather than the standard deviation is used for this comparison to allow for the decomposition of the components of variation in student performance. For reasons explained in the *PISA 2003 Technical Report*, and most importantly because the data in this table only account for students with valid data on their socio-economic background, the variance may differ from the square of the standard deviation shown in Chapter 2. The *PISA 2003 Technical Report* also explains why, for some countries, the sum of the between-school and within-school variance components differs slightly from the total variance. The average is calculated over the OECD countries included in the table.

4. For the country Serbia and Montenegro, data for Montenegro are not available. The latter accounts for 7.9 per cent of the national population. The name "Serbia" is used as a shorthand for the Serbian part of Serbia and Montenegro.

5. The OECD average level is calculated simply as the arithmetic mean of the respective country values. This average differs from the square of the OECD average standard deviation shown in Chapter 2, since the latter includes the performance variation among countries whereas the former simply averages the within-country performance variation across countries.

6. Note that these results are also influenced by differences in how schools are defined and organised within countries and by the units that were chosen for sampling purposes. For example, in some countries some of the schools in the PISA sample were defined as administrative units (even if they spanned several geographically separate institutions, as in Italy; in others they were defined as those parts of larger educational institutions that serve 15-year-olds; in others they were defined as physical school buildings; and in yet others they were defined from a management perspective (*e.g.*, entities having a principal). The *PISA 2003 Technical Report* (OECD, forthcoming) provides an overview of how schools were defined. Note also that, because of the manner in which students were sampled, the within-school variation includes variation between classes as well as between students.

7. In all countries, the changes between 2000 and 2003 are very similar for both mathematics scales for which trend data can be estimated. For the purpose of this comparison, results are only shown for the overall mathematics scale, even though the PISA 2000 data did not include two of the four mathematical content areas.

8. In Belgium, some of this difference may be attributable to changes in the ways in which schools were defined for the purposes of sampling in PISA.

9. Father's or mother's occupation was used for this comparison, whichever was higher on the PISA socio-economic index of occupational status.

10. Mother's level of education was used for this comparison because the literature shows it to have the strongest relationship with student performance. However, the relationship tends to be similar when fathers' education is considered, with an OECD average performance gap of 40 score points between students whose fathers completed secondary education from students whose fathers did not (Table 4.2c).

11. For this comparison, the education levels of mothers and fathers were jointly examined and whichever was higher was then related to student performance. In order to obtain a continuous metric that can be used in a regression, levels of education were converted into years of schooling, using the conversion table shown in Table A1.1.

12. In this analysis, immigrant families' current educational and socioeconomic status is used as a proxy for their qualifications at the time they moved to their country of adoption. It should be noted that the families' current situation will have also been shaped by countries' integration policies and practices. Therefore, the results will most likely overestimate the role of the composition of immigrant populations and underestimate the role of countries' approaches to integration as potential determinants of between-country differences in the performance gap between students with and without migration backgrounds.

13. For the methodology used for the conversion see Annex A1.1.

14. The measure of home educational resources is constructed based on students' reports on having at their home a desk to study at, a room of their own, a quiet place to study, a computer they can use for school work, educational software, a link to the Internet, their own calculator, classic literature, books of poetry; works of art (*e.g.*, paintings); books to help with their school work, and a dictionary.

15. These results were based on dividing the distribution of the index of economic, social and cultural status into quartiles and examining the correlation in each quartile with mathematics performance. The following results were obtained: *i)* for the lowest quartile: 0.336 (0.014) for the OECD total and 0.297 (0.009) for the OECD average, and *ii)* for the highest quartile: 0.179 (0.012) for the OECD total and 0.147 (0.007) for the OECD average.

16. The percentage of variance explained on average across OECD countries and the average slope across countries are different from the OECD average and total shown in Table 4.3a since the latter also reflect the between-country differences.

17. In PISA 2000, the index of economic, social and cultural status included a component on family wealth. Since analyses of the PISA 2003 data suggest that the data on family wealth is difficult to compare across countries and cultures due to the nature of the underlying questions, the family-wealth component was excluded from the index. Even though the influence of the family-wealth component on the index was small, for the purpose of the comparison over time the PISA 2000 index was re-calculated with the family-wealth component excluded as well. For this reason, the results for 2000 published in this report differ slightly from those published in 2001.

18. The decomposition is a function of the between-school slope, the average within-school slope, and η^2, which is the proportion of variation in socio-economic background that is between schools. The statistic η^2 can be considered a measure of segregation by socio-economic background (Willms & Paterson, 1995), which theoretically can range from zero for a completely desegregated system in which the distribution of socio-economic background is the same in every school, to one for a system in which students within schools have the same level of socio-economic background, but the schools vary in their average socio-economic background. One can also think of the term, $1 - \eta^2$, as an index of socio-economic inclusion, which would range from zero for a segregated schooling system to one for a fully desegregated schooling system. The overall gradient is related to the within- and between-school gradients through the segregation and inclusion indices: $\beta_t = \eta^2 \times \beta_b + (1- \eta^2) \times \beta_w$, where β_t is the overall gradient, β_b is the between-school gradient, and β_w is the average within-school gradient.

19. More specifically, the index is defined as one minus the proportion of variation in the PISA index of economic, social and cultural status that lies between schools, as explained in note 18.