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How Resources, Policies and Practices are Related to Education Outcomes

This chapter examines the relationships between education outcomes and various school and system characteristics, including the use of vertical and horizontal stratification, resource allocation, how the school system is organised and governed, and the learning environment in the school and classroom. Trends in these relationships up to 2012 are also discussed.

This volume focuses on how the organisation of learning environments relates to education outcomes in countries and economies that participated in PISA 2012. As in other organisations, decisions taken at one level in a school system are affected by the context and by decisions taken at other levels (see the *PISA 2012 Assessment and Analytical Framework* [OECD, 2013a]). For example, what happens in the classroom is influenced by the context and decisions made at the school level; and decisions made at the school level are affected by the context and decisions made at higher levels in school administrations (i.e. districts or national ministries) (Gamoran, Secada and Marrett, 2000). Thus, when analysing the organisational arrangement of school systems it is important to consider the organisation of learning environments at the school and school system levels together.

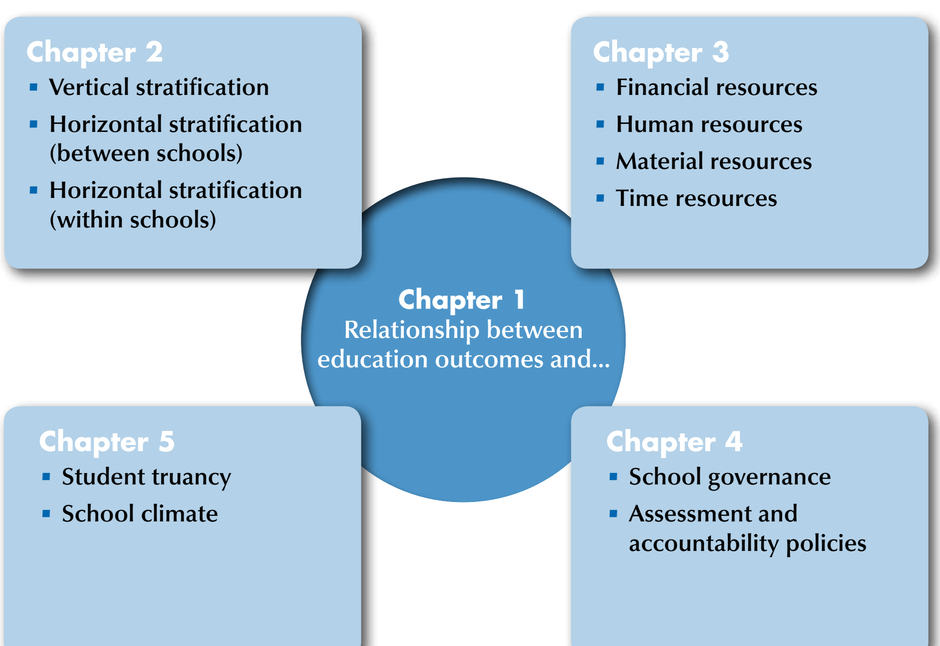
Data collected through the PISA 2012 student, parent and school questionnaires are used to describe how schools are organised. Some student-level data are aggregated at the school level to approximate school features, and some school-level data are aggregated at the system level to approximate system characteristics. School-level data from PISA are complemented by OECD system-level data.[1]

This volume also analyses how the organisation of schools and its relationships with education outcomes have changed over time. Comparisons are made between PISA 2012 and PISA 2003, the last time mathematics was assessed in depth. To account for the extent to which the observed relationships are influenced by the level of economic development of countries and economies, the comparison of school systems discussed in this chapter also considers national income per capita (per capita GDP).

The first chapter examines the relationships between education outcomes and various school and system characteristics. Chapters 2, 3, 4 and 5 then describe these school and system characteristics in detail: Chapter 2 describes how and when students are distributed across different grade levels, programmes and schools; Chapter 3 focuses on resources invested in education at the system level and examines how resources are allocated across schools within systems; Chapter 4 describes school-governance issues, including school autonomy, school choice, and assessment and accountability arrangements; and Chapter 5 focuses on learning environments at school, examining how these are related to other aspects of school organisation discussed in Chapters 2 through 4.

■ Figure IV.1.1 ■

Structure of Volume IV



What the data tell us

- Stratification in school systems, the result of policies like grade repetition and early selection, is negatively related to equity.
- Among countries and economies whose per capita GDP is more than USD 20 000, including most OECD countries, systems that pay teachers more (i.e. higher teachers' salaries relative to national income) tend to perform better in mathematics.
- High-performing countries and economies tend to allocate resources more equitably across socio-economically advantaged and disadvantaged schools.
- School autonomy has a positive relationship with student performance when accountability measures are in place and/or when school principals and teachers collaborate in school management.
- Systems with larger proportions of students who arrive late for school and skip classes tend to show lower overall performance in mathematics.

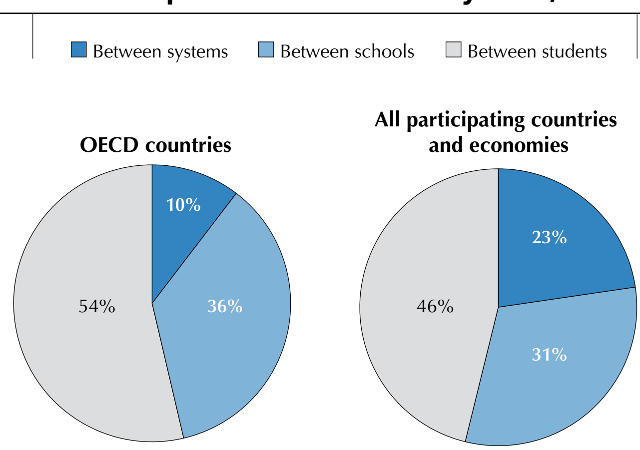
PERFORMANCE DIFFERENCES AMONG SCHOOL SYSTEMS, SCHOOLS AND STUDENTS

As discussed in Volume I, academic performance among 15-year-old students varies widely, and that variation is related both to individual student characteristics and to the characteristics of schools and school systems in which those students are enrolled.

In the PISA 2012 assessment of mathematics, about half of the variation in student performance is observed between schools and school systems. Figure IV.1.2 shows that among OECD countries, 10% of the variation in mathematics performance observed among students is attributable to differences in performance among school systems, 36% is attributable to differences in performance among schools within a country, and 54% is attributable to differences in performance among students in a school. Among all countries and economies that participated in PISA 2012, 23% of the performance variation among students is observed at the system level, 31% is observed at the school level, and 46% is observed at the student level.

■ Figure IV.1.2 ■

Variation in mathematics performance between systems, schools and students



Source: OECD, PISA 2012 Database.

This chapter relates features of school organisation and the learning environment to the performance of students within countries and economies and analyses how countries and economies differ in the relationships among these features, overall performance in mathematics, and the level of equity in school systems. The cross-national analyses provide an overview of how system-level attributes and major organisational arrangements relate to student performance and equity in school systems. As always, such relationships require further study in order to determine causality (Box IV.1.1).

Box IV.1.1. Interpreting the data from students, parents and schools

PISA 2012 asked students and school principals (and, in some countries, parents) to answer questions about the learning environment and organisation of schools, and the social and economic contexts in which learning takes place. Information based on reports from school principals or parents has been weighted so that it reflects the number of 15-year-olds enrolled in each school. These are self-reports rather than external observations and may be influenced by cultural differences in how individuals respond. For example, students' perceptions of classroom situations may reflect the actual classroom situation imperfectly, or students may choose to respond in a way that does not accurately reflect their genuine thoughts because certain responses may be more socially desirable/acceptable than others.

Several of the indices presented in this volume summarise the responses of students, parents or school principals to a series of related questions. The questions were selected from larger constructs on the basis of theoretical considerations and previous research. Structural equation modelling was used to confirm the theoretically expected dimensions of the indices and validate their comparability across countries. For this purpose, a model was estimated separately for each country or economy and collectively for all OECD countries. For detailed information on the construction of these indices, see Annex A1.

In addition to the general limitation of self-reported data, there are other limitations, particularly those concerning the information collected from principals, that should be taken into account when interpreting the data:

- An average of 346 principals was surveyed in each OECD country, but in 7 countries and economies, fewer than 150 principals were surveyed. In all of these countries and economies, the weighted school participation rate after all replacements is 95% or higher. In 6 of these 7 countries and economies, this was because fewer than 150 schools were attended by 15-year-old students.
- Although principals can provide information about their schools, generalising from a single source of information for each school and then matching that information with students' reports is not straightforward. Students' opinions and performance in each subject depend on many factors, including all the education that they have acquired in previous years and their experiences outside the school setting.
- Principals' perceptions may not be the most appropriate sources of some information related to teachers, such as teachers' morale and commitment.
- The learning environment examined by PISA may only partially reflect the learning environment that shaped students' experiences in education earlier in their school careers, particularly in school systems where students progress through different types of educational institutions at the pre-primary, primary, lower secondary and upper secondary levels. To the extent that students' current learning environment differs from that of their earlier school years, the contextual data collected by PISA are an imperfect proxy for students' cumulative learning environments, and the effects of those environments on learning outcomes is likely to be underestimated.
- In most cases, 15-year-old students have been in their current school for only two to three years. This means that much of their academic development took place earlier, in other schools, which may have little or no connection with the present school.
- In some countries and economies, the definition of the school in which students are taught is not straightforward because schools vary in the level and purpose of education. For example, in some countries and economies, sub-units within schools (e.g. study programmes, shifts and campuses) were sampled instead of schools as administrative units.

Despite these caveats, information from the school questionnaire provides unique insights into the ways in which national and sub-national authorities seek to realise their education objectives.

In using results from non-experimental data on school performance, such as the PISA Database, it is also important to bear in mind the distinction between school effects and the effects of schooling, particularly when interpreting

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the modest association between factors such as school resources, policies and institutional characteristics and student performance. The effect of schooling is the influence on performance of not being schooled compared with being schooled. As a set of well-controlled studies has shown, this can have a significant impact not only on knowledge but also on fundamental cognitive skills (e.g. Ceci, 1991; Blair et al., 2005). School effects are education researchers' shorthand for the effect on academic performance of attending one school or another, usually schools that differ in resources or policies and institutional characteristics. Where schools and school systems do not vary in fundamental ways, the school effect can be modest. Nevertheless, modest school effects should not be confused with a lack of an effect by schooling.

The analyses that relate the performance and equity levels of school systems to education policies and practices are carried out through a correlation analysis. A correlation is a simple statistic that measures the degree to which two variables are associated with each other, but does not prove causality between the two. Since the relationships are in general examined only after accounting for countries' per capita income, omitted variables could be related to these variables and their relationship in a significant way.

Given the nested nature of the PISA sample (students nested in schools that, in turn, are nested in countries), other statistical techniques, such as Hierarchical Linear Models or Structural Equation Modeling may seem more appropriate. Yet, even these sophisticated statistical techniques cannot adequately take into account the nature of the PISA sample for the system-level analyses because participating countries and economies are not randomly selected. The system-level correlations presented here are consistent with results from earlier PISA analyses, which used more sophisticated statistical techniques. Given that the limitations of a correlation analysis using PISA data are not completely overcome by using more sophisticated statistical tools, the simplest method was used. The robustness and sensitivity of the findings are checked against other specifications. Cautionary notes are provided to help the reader correctly interpret the results presented in this volume.

In contrast, the within-system analyses are based on multilevel regression models appropriate for the random sampling of schools and the random sampling of students within these schools.

Comparisons of results between resources, policies and practices and mathematics performance across time (trends analyses) should also be interpreted with caution. Changes in the strength of the relationship between policies and practices and mathematics performance cannot be considered causal because they can occur for two reasons. First, a particular set of resources, policies and practices might have been chosen by higher-performing students or higher-performing schools while lower-performing students/schools did not choose that set of resources, policies and practices. Under this interpretation, the relationship between mathematics performance and resources, policies and practices becomes stronger because higher-performing students and schools choose them. Second, a particular set of resources, policies and practices may have promoted student learning more in 2012 than in 2003. PISA trends data indicates where changes have taken place, but although they cannot provide precise explanations of the nature of the change, trends data shed light on the ways in which a school system is evolving. However, further analysis is needed to unveil the underlying processes (Box IV.1.3 provides more details on interpreting trends analysis results).

MEASURING THE SUCCESS OF SCHOOL SYSTEMS

"Successful" school systems are defined here as those that perform above the OECD average in mathematics (494 points) and in which students' socio-economic status has a weaker-than-average impact on mathematics performance (on average across OECD countries, 14.6% of the variation in mathematics scores is accounted for by the socio-economic status of students). As shown in Volume II, Australia, Canada, Estonia, Finland, Hong Kong-China, Japan, Korea, Liechtenstein and Macao-China perform at higher levels than the OECD average and also show a weaker relationship between socio-economic status and performance (Figure IV.1.3).

The following sections analyse some of the features shared by these successful school systems that relate to their allocation of resources, policies and practices. The analysis is also extended to the school level within countries, before and after accounting for the socio-economic status of students and schools (Box IV.1.2).

■ Figure IV.1.3 ■

Student performance and equity

Source: OECD, PISA 2012 Database, Table II.2.1.
StatLink http://dx.doi.org/10.1787/888932957403

Box IV.1.2. **How PISA examines resources, policies, practices and education outcomes**

When examining the relationship between education outcomes and resources, policies and practices, this volume takes into account the socio-economic differences among students, schools and school systems. The advantage of doing this lies in comparing similar entities, namely school systems and schools with similar socio-economic profiles. At the same time, there is a risk that such adjusted comparisons underestimate the strength of the relationship between student performance and resources, policies and practices, since most of the differences in performance are often attributable to both policies and socio-economic status. For example, it may be that in better-performing schools, parents have high expectations for the school and exert pressure on the school to fulfil those expectations. After accounting for socio-economic factors, an existing relationship between parents' expectations of the school and student performance may no longer be apparent as an independent relationship because these

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schools often have an advantaged student population. Even though the relationship between parental expectations and student performance may exist, it is no longer observed, simply because it has been statistically accounted for by the socio-economic differences with which it overlaps.

Conversely, analyses that do not take socio-economic status into account can overstate the relationship between student performance and resources, policies and practices, as the level of resources and the kinds of policies adopted may also relate to the socio-economic profile of students, schools and countries and economies. At the same time, analyses without adjustments may paint a more realistic picture of the schools that parents choose for their children. They may also provide more information for other stakeholders who are interested in the overall performance of students, schools and systems, including any effects that may be related to the socio-economic profile of schools and systems. For example, parents may be primarily interested in a school's absolute performance standards, even if a school's higher achievement record stems partially from the fact that the school has a larger proportion of advantaged students.

The analyses in this volume present relationships both before and after accounting for socio-economic differences, and focus on differences among school systems and among schools within school systems. Unless otherwise noted, comparisons of student performance refer to the performance of students on the mathematics scale.

Relationships between the organisational characteristics of a school system and the school system's performance in PISA, as well as the impact of socio-economic status on performance, are established through a correlational analysis. The analysis is conducted both before and after accounting for the school systems' per capita income (i.e. per capita GDP). The analyses are undertaken first for OECD countries and then for all countries and economies that participated in PISA (Tables IV.1.1, IV.1.2, IV.1.3, IV.1.4 and IV.1.5).[2]

Within school systems, these relationships are established through multilevel regression analysis. In each of the following sections, a set of interrelated resources, policies and practices are considered jointly to establish their relationship with student performance. For the reasons explained above, two approaches are used: an unadjusted approach that examines the relationships as they present themselves to students, families and teachers in the schools, irrespective of the socio-economic context; and a "like-with-like" approach that examines the relationships after accounting for the socio-economic status and demographic background of students and schools.

HOW LEARNING OUTCOMES ARE RELATED TO THE WAYS IN WHICH SCHOOL SYSTEMS SELECT AND GROUP STUDENTS

Volume II highlights the challenges school systems face in addressing the needs of diverse student populations. To meet these challenges, some countries and economies have adopted non-selective and comprehensive school systems that seek to provide all students with similar opportunities, leaving it to each teacher and school to cater to the full range of student abilities, interests and backgrounds. Other countries and economies respond to diversity by grouping students, 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. Teaching in these schools or classes is adapted to students with different needs; class size and teacher assignments are determined accordingly. Often, the assumption underlying these stratification policies is that students' talents will develop best when students reinforce each other's interest in learning, and create an environment that is more conducive to effective teaching.

The analysis presented in this chapter covers not only curricular differentiation (i.e. tracking or streaming) and school selectivity, but also other forms of horizontal and vertical stratification. Vertical stratification refers to the ways in which students progress through school as they become older. Even though the student population is differentiated into grade levels in practically all schools that participate in PISA, in some countries, all 15-year-old students attend the same grade level, while in other systems they are dispersed throughout various grade levels as a result of policies governing the age of entrance into the school system and/or grade repetition.

Horizontal stratification refers to differences in instruction within a grade or education level. Horizontal stratification, which can be adopted by the school system or by individual schools, groups students according to their interests and/or performance. School systems make decisions on offering specific programmes (vocational or academic, for example),

setting the age at which students are admitted into these programmes, and determining the extent to which students' academic records are used to select students for their schools. Individual schools make decisions about whether to transfer students out of the school because of poor performance, behavioural problems or special needs, and whether to group students in classes according to ability. Chapter 2 complements this analysis with a detailed description of how different school systems implement these policies and practices and how various forms of stratification are interrelated.

Policies that regulate the selection and sorting of students into schools and classrooms can be related to performance in various ways. On the one hand, creating homogeneous student populations may allow teachers to direct classroom instruction to the specific needs of each group, maximising the learning potential of each group. On the other hand, selecting and sorting students may segregate students according to socio-economic status and result in differences in opportunities to learn. Grouping higher-achieving students together limits the opportunity for under-achieving students to benefit by learning from their higher-achieving peers. In addition, if student sorting is related to teacher sorting, such that high-achieving students are matched to the most talented teachers, under-achieving students may be relegated to lower-quality instruction. Student selection and sorting may also create stereotypes and stigmas that could eventually affect student engagement and learning.

Vertical stratification

PISA shows that the degree of school systems' vertical stratification tends to be negatively related to the equity aspect of education outcomes. In systems where 15-year-old students are found in different grade levels, the impact of students' socio-economic status on their academic performance is stronger than in systems with less vertical stratification. Across OECD countries, 32% of the variation in the impact of students' socio-economic status on their mathematics performance can be explained by differences in the degree of vertical stratification within the system, after accounting for per capita GDP (Table IV.1.1).[3] In contrast, the relationship between vertical stratification and average performance differs between OECD countries on the one hand and across all participating countries and economies on the other. School systems where 15-year-old students attend a wider range of grade levels tend to have lower overall performance in mathematics, across all participating countries and economies, even after accounting for per capita GDP,[4] while no clear relationship is observed across OECD countries, where the dispersion of 15-year-olds across grades is generally less pronounced. To some extent, this is the expected result of a deliberate effort by some countries and economies to make education more inclusive by accommodating students who started school at relatively late ages or who are at greater risk of dropping out.

How is grade repetition related to student performance? The literature suggests that the effect of grade repetition varies, depending on when during their school careers students are retained (Schwerdt and West, 2012). Although some research suggests that grade repetition does not benefit learning (Hauser, 2004; Alexander, Entwisle and Dauber, 2003; Jacob and Lefgren, 2009; Manacorda, 2012), and there is a general understanding that grade repetition is costly for a system (West, 2012; OECD, 2011a), grade repetition is still used in many countries (Goos et al., 2013). Sometimes the prospect of grade repetition, itself, is seen as a source of motivation towards better engagement with school, and is accompanied by other interventions to help a student succeed.

PISA examines the issue of grade repetition not at the individual student level but at the system level in order to avoid selection bias (Heckman and Li, 2003).[5] Grade repetition tends to be negatively related to equity, and this is especially obvious when the relationship is examined across OECD countries, as shown in Figure IV.1.4. Across OECD countries, 20% of the variation in the impact of students' socio-economic status on their mathematics performance can be explained by differences in the proportion of students who repeated a grade, even after accounting for per capita GDP. Across OECD countries, grade repetition is unrelated to the system's overall performance; but across all PISA participating countries and economies, systems in which more students have repeated a grade tend to be those that have lower overall performance in mathematics (Table IV.1.1).[6]

Requiring that students repeat grades implies some cost, not only the expense of providing an additional year of education (i.e. direct costs), but also the cost to society in delaying that student's entry into the labour market by at least one year (i.e. opportunity costs) (OECD, 2011a). Among the countries that practice grade repetition and that have relevant data available, in Estonia, Iceland, Ireland and Israel, the direct and opportunity costs of using grade repetition for one age group can be as low as 0.5% or less of the annual national expenditure on primary- and secondary-school education – or between USD 9 300 and USD 35 100 per repeater (Figure IV.1.5 and Table IV.1.6). In Belgium and the Netherlands, the cost is equivalent to 10% or more of the annual national expenditure on primary- and secondary-school education – or as high as USD 48 900 per repeater or more. These estimates are based on the assumption that students who repeat grades attain lower secondary education, at most. If they were to attain higher levels of education, the costs would be even greater.[7]

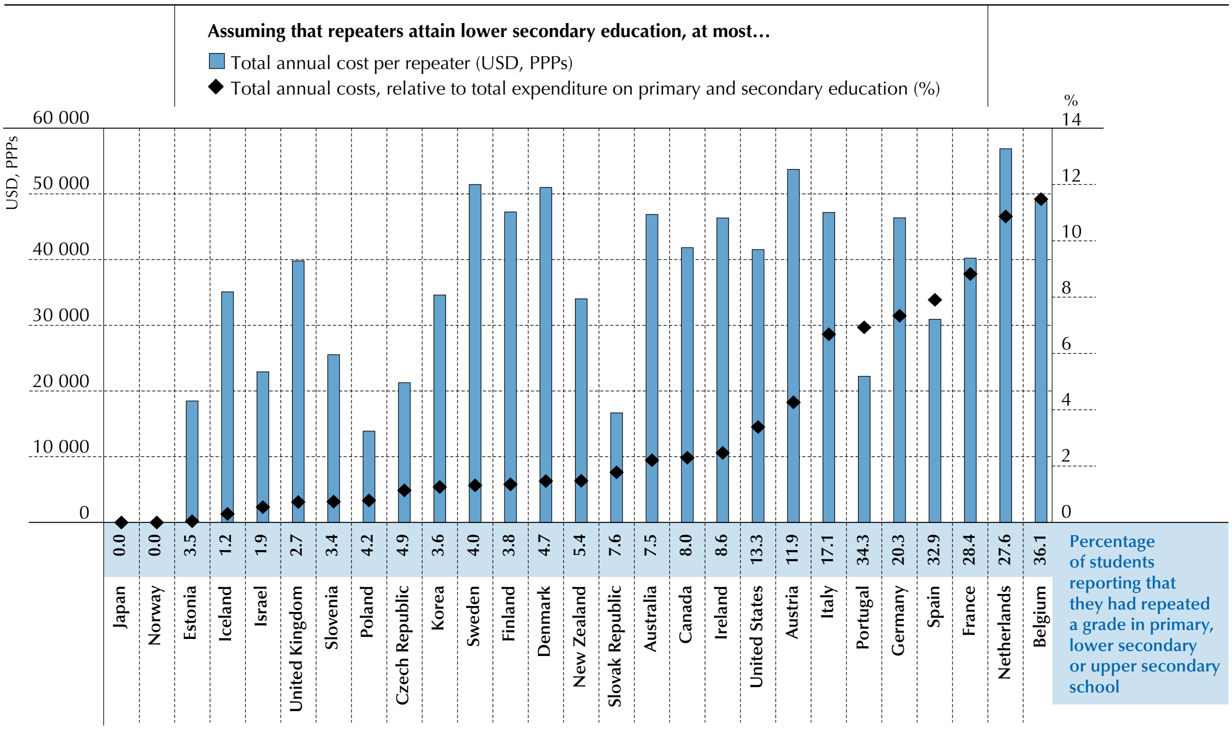
■ Figure IV.1.4 ■

Grade repetition and equity

Note: Grade repetition refers to the percentage of students who have repeated a grade at least once in primary or secondary school.
1. A significant relationship (p < 0.10) is shown by the solid line.
Source: OECD, PISA 2012 Database, Table IV.1.1.
StatLink http://dx.doi.org/10.1787/888932957403

■ Figure IV.1.5 ■

Cost of grade repetition



Note: Only countries and economies with available data are shown.
Countries and economies are ranked in ascending order of the total annual cost, relative to total expenditure on primary and secondary education.
Source: OECD, PISA 2012 Database, Tables IV.1.6 and IV.2.2.
StatLink http://dx.doi.org/10.1787/888932957403

Horizontal stratification

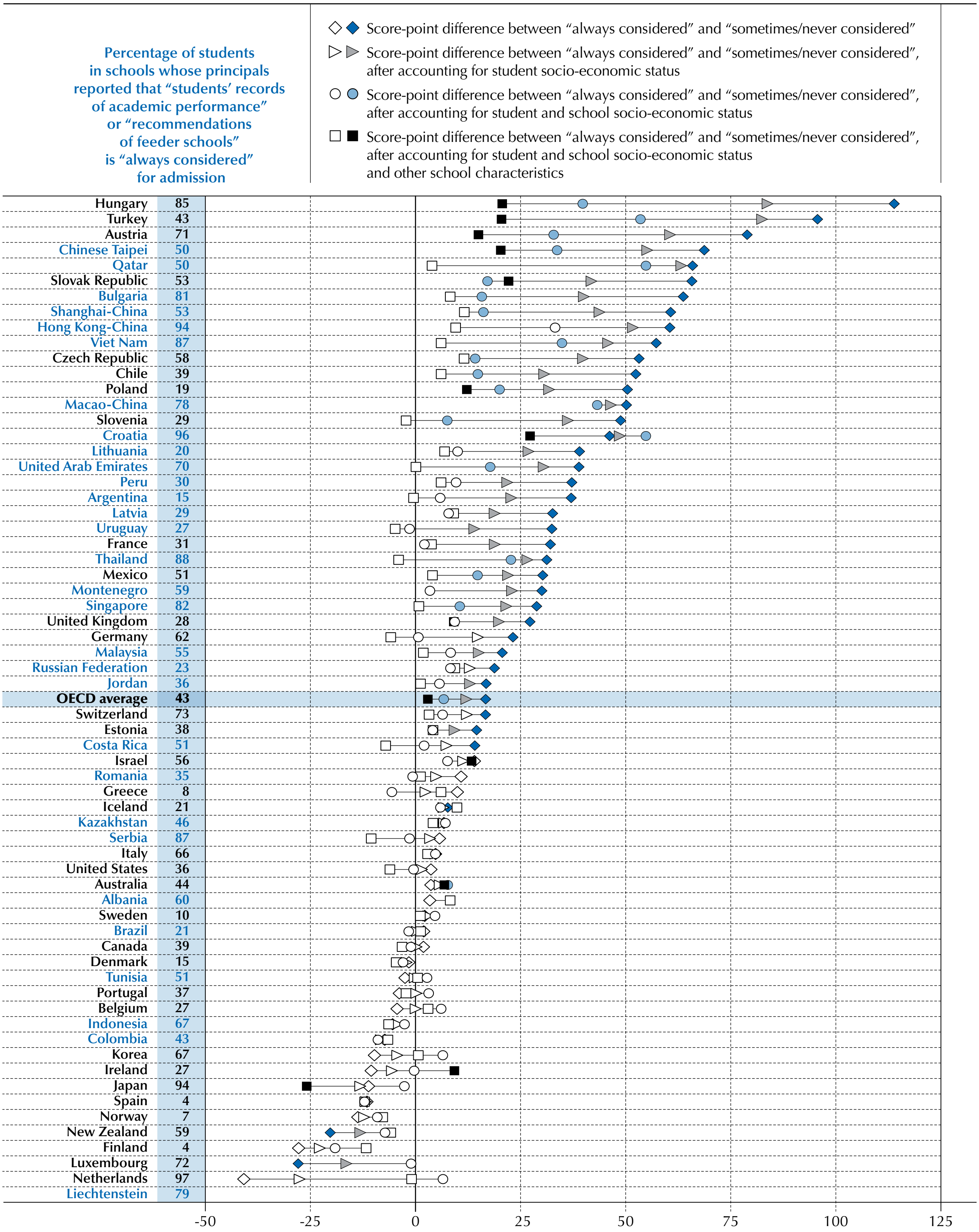
In general, horizontal stratification is unrelated to a system's average performance. The exception is that systems that group students, within schools, for all classes based on their ability tend to have lower performance across all participating countries and economies, after accounting for per capita GDP (partial correlation coefficient=-0.25). However, between-school horizontal stratification is negatively related to equity in education opportunities. The impact of the socio-economic status of students and/or schools on performance is stronger in school systems that sort students into different tracks, where students are grouped into different tracks at an early age, where more students attend vocational programmes, where more students attend academically selective schools, or where more students attend schools that transfer low-performing students or students with behaviour problems to another school. Across OECD countries, 39% of the variation in the impact of socio-economic status of students and schools on students' mathematics performance can be explained by differences in the ages at which students are selected into different programmes, even after accounting for per capita GDP (Table IV.1.1).

The reason why the age at which stratification begins is closely associated with the impact of socio-economic status on performance may be because the frequency and the nature of student selections/transitions differ between early- and late-stratified systems. In systems that stratify students early, students might be selected more than once before the age of 15. When students are older, more information on individual students is available, and decisions on selecting and sorting students into certain tracks are thus better informed. In addition, students are more dependent upon their parents and their parents' resources when they are younger. In systems that stratify students early, parents with more advantaged socio-economic status may be in a better position to promote their children's chances than disadvantaged parents. In systems where these decisions are taken at a later age, students play a larger role in deciding their own education pathways, and teachers and parents have enough information to make more objective judgements.

As expected, schools that select students for admittance based on students' academic performance tend to show better school average performance, even after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics, on average across OECD countries (Table IV.1.12c).

■ Figure IV.1.6 ■

School admissions policies and mathematics performance



Note: White symbols represent differences that are not statistically significant.

Countries and economies are ranked in descending order of the score-point difference in mathematics between students in schools whose principals reported that "students' records of academic performance" or "recommendations of feeder schools" are "always considered" for admission and students in schools where these two factors are "sometimes" or "never considered" for admission.

Source: OECD, PISA 2012 Database, Tables IV.1.12c, IV.1.31 and IV.2.7.

StatLink http://dx.doi.org/10.1787/888932957403

However, a school system's performance overall is not better if it has a greater proportion of academically selective schools. In fact, in systems with more academically selective schools, the impact of the socio-economic status of students and schools on student performance is stronger (Table IV.1.1).

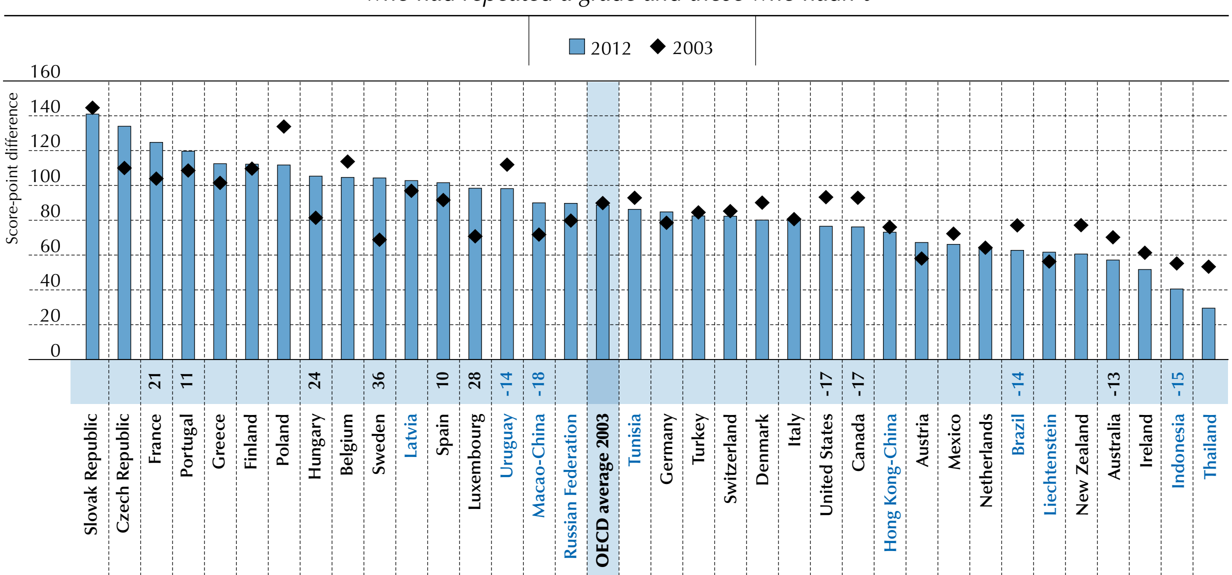
Trends in the relationship between mathematics performance and stratification

With the exception of Brazil and Turkey, in all countries and economies, students who entered primary school at age 5 or younger, or at age 6, 7 or 8 or older improved their performance between PISA 2003 and PISA 2012 to a similar degree. By contrast, in Brazil and Turkey, performance among students who had started primary school at age 8 or older improved to a greater degree between 2003 and 2012 than that of students who had started school at younger ages (Table IV.1.21). In Brazil, and as shown in Table IV.2.17 (see Chapter 2), more students in 2012 than in 2003 had started school at age 8 or older. Combining these two results suggests that students who would have started school at age 7 in 2003 but did so at age 8 in 2012 were more likely to perform better than students who entered school at age 8 in 2003. It may also be the case that in Turkey students who started school later were more likely to come from socio-economically disadvantaged backgrounds and, as discussed in Volumes I and II, the greatest improvements in performance over the period were observed among low-achieving and disadvantaged students, who are more likely to be those who entered school at a later age in 2012 compared with their counterparts in 2003.

■ Figure IV.1.7 ■

Change between PISA 2003 and PISA 2012 in the relationship between grade repetition and mathematics performance

Score-point difference in mathematics performance between students who had repeated a grade and those who hadn't



Notes: The change in the score-point difference in mathematics performance between 2003 and 2012 (2012 - 2003) is shown above the country/economy name. Only statistically significant differences are shown.
OECD average 2003 compares only OECD countries with comparable mathematics scores since 2003.
Only countries and economies with comparable data from PISA 2003 and PISA 2012 are shown.
Countries and economies are ranked in descending order of the score-point difference in mathematics performance between students who reported in 2012 that they had repeated a grade and those who hadn't.
Source: OECD, PISA 2012 Database, Table IV.1.22.
StatLink http://dx.doi.org/10.1787/888932957403

In PISA 2012, more than 20% of students in 16 countries and economies reported that they had repeated a grade; 11 of these countries and economies have comparable data for PISA 2003. On average across these 11 countries and economies (Macao-China, Tunisia, Uruguay, Brazil, Belgium, Luxembourg, Portugal, Spain, France, the Netherlands and Germany), in 2003, the difference in mathematics performance between students who had repeated a grade and those who hadn't was 90 score points; by 2012, that difference had increased slightly, to 94 score points. This performance advantage among those who had not repeated a grade increased in Macao-China, Luxembourg, Portugal, Spain and France (and also in Sweden and Hungary, two countries with lower grade repetition rates). In this group of

countries and economies, either the penalty in performance for repeating a grade became larger during the period, or low-achieving students were more likely to have been required to repeat a grade. The performance advantage of non-repeaters decreased in Brazil and Uruguay, where either the adverse effects on performance of repeating a grade weakened during the period, or these school systems held back more students with relatively higher scores in mathematics in 2012 than they did in 2003. Among countries that rely less on grade repetition, the performance advantage increased in Sweden and Hungary and narrowed by more than 10 points in Canada, the United States, Indonesia and Australia (Figure IV.1.7; see also Table IV.2.18 in Chapter 2 for repetition rates).

Trends at different levels of the school system (grade levels or lower/upper secondary, for example) shed light on the extent to which students are more – or less – prepared to enter the next level. Declining trends among 15-year-old students in the 9th grade, for example, may signal an increasing challenge for 10th-grade teachers, as the students they teach now are not as well prepared for 10th-grade coursework as students were a decade ago. Similarly, declining trends in performance among upper secondary students indicate that it is becoming more difficult for school systems to ensure that their students are ready to make the transition into tertiary education or the labour market. On average across OECD countries[8] and in most other countries and economies, the overall trends in mathematics performance discussed in Volume I are seen in both lower and upper secondary education. In 2012, lower secondary students in Turkey, Brazil, the Russian Federation, Portugal, Mexico, Poland, Thailand, Belgium, Indonesia, Tunisia, Germany and Latvia scored higher in mathematics than did their counterparts in 2003, signalling that lower secondary 15-year-old students were better prepared to enter upper secondary education in 2012 than in 2003. In Portugal, the Russian Federation, Turkey, Italy, Korea and Mexico, 15-year-olds in upper secondary students in 2012 were better prepared to make the transition into tertiary education or the labour market than their counterparts were in 2003 (Table IV.1.23).

Box IV.1.3. **Trends in the relationship between resources, policies and practices and mathematics performance**

Educational resources, policies and practices interact in different ways with students' mathematics performance. The relationship between education policies and practices and students' mathematics performance varies across school systems; it may also vary across time with certain resources, policies or practices becoming more strongly related to mathematics over time. The sections on trends discuss how certain resources, policies and practices have become more strongly – or weakly – related to students' mathematics performance. They compare the strength of the relationship observed in PISA 2003 to that observed in PISA 2012, taking advantage of the fact that many of the resources, policies and practices measured in PISA 2012 were also measured in PISA 2003. These factors include vertical and horizontal stratification practices, learning time and assessment practices. The trends sections in the following chapters describe the ways in which countries and economies have changed their stratification practices (Chapter 2), their level of resources (Chapter 3), their autonomy and assessment/accountability policies (Chapter 4), and their learning environments (Chapter 5).[9]

Changes in the relationship between resources, policies and practices described in this section should be interpreted with caution as they may arise for a variety of reasons. One possible interpretation of the fact that a particular policy or practice has become more strongly related to students' mathematics performance is that it has promoted student learning better in 2012 than in 2003. Alternative explanations are also possible, such as the fact that better-performing students (or schools) may have chosen to adopt this policy during the period, or that lower-performing students (or schools) chose not to. Changes in the relationship between resources, policies and practices and mathematics performance between PISA 2003 and PISA 2012 cannot be considered causal. They shed light on ways in which a school system is evolving and need further analysis to reveal the processes and nature of the change. Moreover, because PISA can only show whether the policy or practice has become more – or less – strongly related to students' mathematics performance among the particular students, schools and school systems that adopted it, it is not possible to know whether the observed changes can be generalised to include other school systems, schools and students (see endnote 10 for further details on interpreting trends results).

Nonetheless, these changes over time show where certain policies may have become more closely related to student learning. They also highlight where certain challenges to excellence in performance remain or have become more apparent, as in the case of those policies and practices that continue to be related to lower performance or that have become even more strongly associated with poorer mathematics performance.

On average across OECD countries, there was no change in the performance advantage among students in higher grades. In Luxembourg, however, the difference became more pronounced by PISA 2012: in 2003, students in the modal grade outperformed those in the grades below (by an average of 30 score points) and scored lower than those in the grades above (by an average of 80 points); by 2012 these differences had widened significantly to 46 and 89 points, respectively. By contrast, in Belgium, Ireland, Thailand and Australia, these performance differences across grade levels were smaller in 2012 than in 2003 (Table IV.1.23).

On average across OECD countries, the advantage in mathematics performance increased for students in schools that do not use ability grouping compared with students in schools where ability grouping is practiced in some or all classes. Students in schools where no ability grouping is practiced scored eight points higher in mathematics in 2012 compared to their counterparts in 2003, while students in schools where ability grouping is practiced in some or all classes scored lower in PISA 2012 than their counterparts in PISA 2003 did. This could mean that schools that do not group students by ability became more effective than schools that use ability grouping. Alternatively, it could mean that schools that do not group students by ability are increasingly those that select higher-performing students and so appear to have higher average performance than schools that do practice ability grouping. The advantage of schools that do not use ability grouping narrowed in Uruguay and Brazil, where, by 2012, it was no longer statistically significant, and in Luxembourg. The performance advantage among students in schools that do not use ability grouping was observed in PISA 2012, but not in PISA 2003, in Macao-China and Iceland, while the performance disadvantage observed among students who attend schools that do not group students by ability disappeared by 2012 in Turkey and Belgium (Table IV.1.24).[11]

HOW LEARNING OUTCOMES ARE RELATED TO SYSTEMS' RESOURCE ALLOCATION

Adequate resources are crucial for providing students with high-quality opportunities to learn. At the same time, those resources translate into better learning outcomes only if they are used efficiently. As Chapter 3 shows, school systems in the countries and economies that participated in PISA vary in the amount of resources – including financial, human and material resources and students' learning time – that they invest in education. Research is inconclusive on the subject, but usually shows a weak relationship between the quantity of educational resources and student performance, since more of the variation in performance can be explained by the quality of resources and how these resources are used, particularly among the industrialised countries (Fuller, 1987; Greenwald, Hedges and Laine, 1996; Buchmann and Hannum, 2001; Rivkin, Hanushek and Kain, 2005; Murillo and Román, 2011; Hægeland, Raaum and Salvanes, 2012; Nicoletti and Rabe, 2012).

Financial resources

A first glance at PISA results gives the impression that high-income countries and economies – and those that are able to and spend more on education – have better student performance. High-income countries and economies (defined here as those with a per capita GDP above USD 20 000) have more resources to spend on education: high-income countries and economies cumulatively spend, on average, USD 89 702 on each student from age 6 to 15, while countries that are not considered to be in that group spend, on average, USD 25 286 (Tables IV.3.1 and IV.3.2 discussed in Chapter 3). Moreover, high-income countries and economies have an average mathematics performance almost 70 score points higher than that of countries whose per capita GDP is below the USD 20 000 threshold.

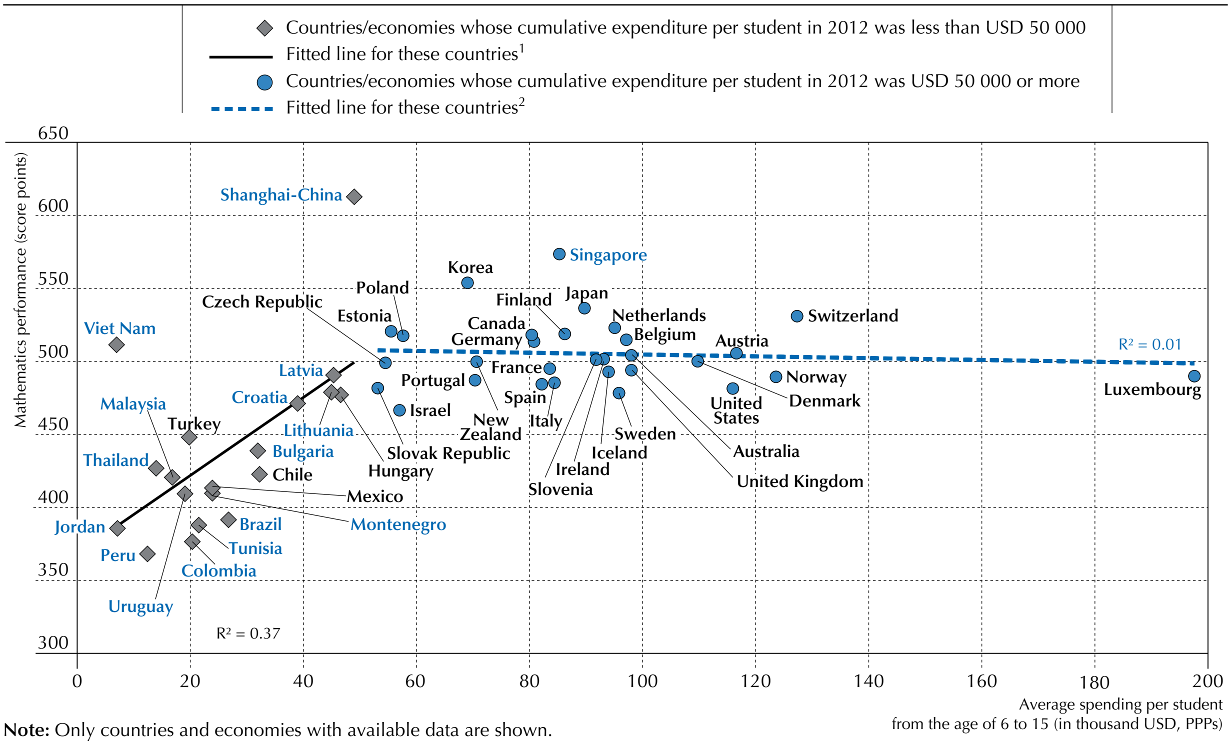
Yet the relationship among a country's/economy's income per capita, its level of expenditure on education per student, and its PISA score is far more complex (Baker, Goesling and LeTendre 2002; OECD, 2012). While among countries and economies whose cumulative expenditure per student is below USD 50 000 (the level of spending in the Czech Republic, the Slovak Republic and Hungary), higher expenditure on education is predictive of higher PISA mathematics scores; however, this is not the case among high-income countries and economies, which include most OECD countries. It seems that for this latter group of countries and economies, factors other than wealth are better predictors of student performance.

Among the former group of countries and economies, systems with a cumulative expenditure of USD 10 000 higher than other systems score an average of 27 points higher in the PISA mathematics assessment. For example, Jordan, with a cumulative expenditure per student of USD 7 125, has an average PISA mathematics score of 386 points – 35 points lower than Malaysia, which has a cumulative expenditure per student that is roughly USD 10 000 higher than that of Jordan.

However, among those countries and economies whose cumulative expenditure per student is more than USD 50 000, the relationship between spending per student and performance is no longer apparent, even after accounting for differences in purchasing power. Thus, among these countries and economies, it is common to find some with substantially different levels of spending per student yet similar mathematics performance. For example, the United States and the Slovak Republic score at 481 points in mathematics, but the United States' cumulative expenditure per student is more than double that of the Slovak Republic. Also, countries and economies with similar levels of expenditure can perform very differently.

■ Figure IV.1.8 ■

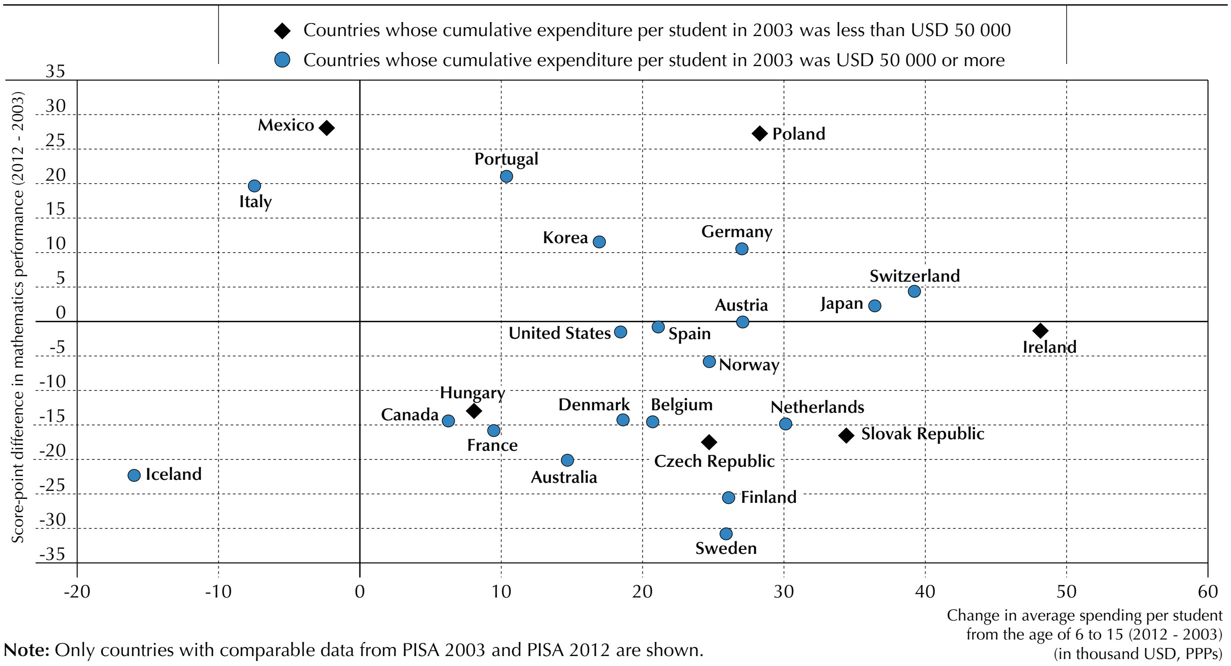
Spending per student from the age of 6 to 15 and mathematics performance in PISA 2012



Note: Only countries and economies with available data are shown.
1. A significant relationship ($p < 0.10$) is shown by the solid line.
2. A non-significant relationship ($p > 0.10$) is shown by the dotted line.
Source: OECD, PISA 2012 Database, Tables I.2.3a and IV.3.1.
StatLink http://dx.doi.org/10.1787/888932957403

■ Figure IV.1.9 ■

Change between 2003 and 2012 in average spending per student from the age of 6 to 15 and change in mathematics performance



Note: Only countries with comparable data from PISA 2003 and PISA 2012 are shown.
Source: OECD, PISA 2012 Database, Tables I.2.3b and IV.3.1.
StatLink http://dx.doi.org/10.1787/888932957403

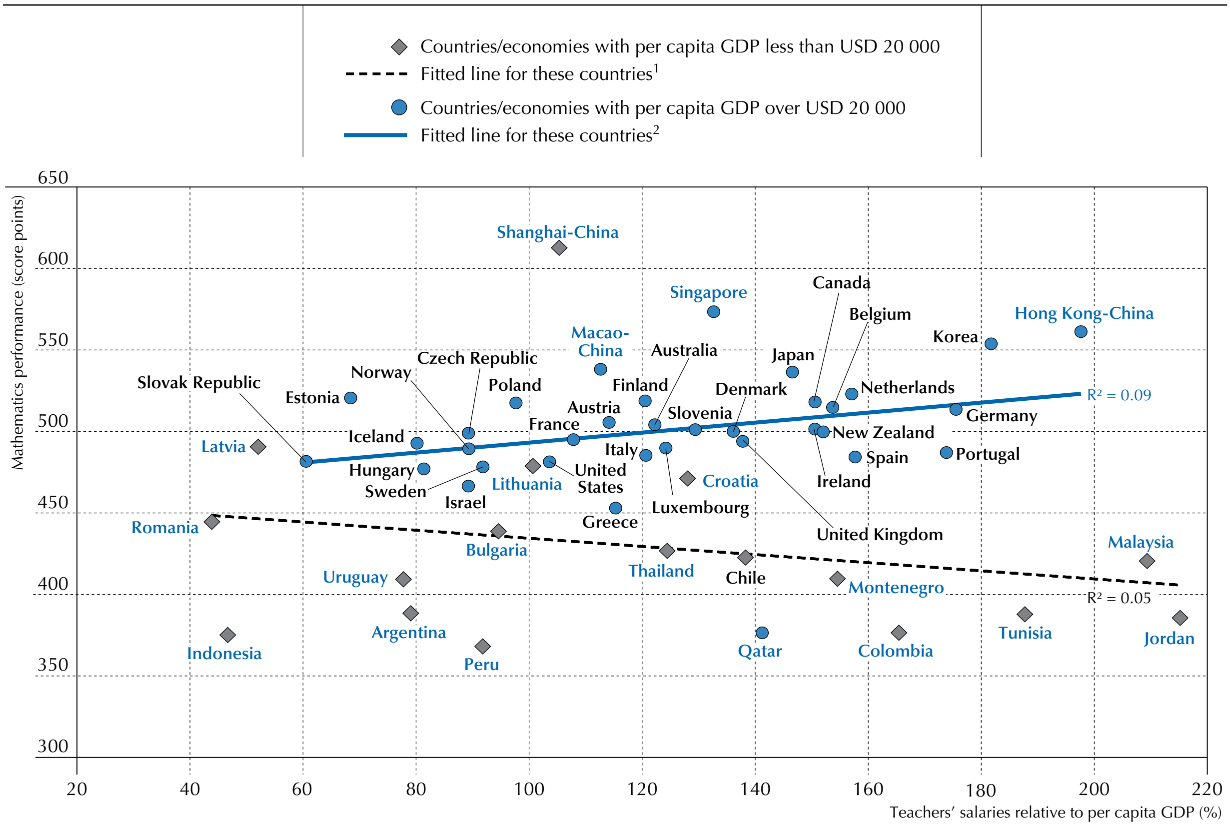
For example, Italy and Singapore both have a cumulative expenditure per student of roughly USD 85 000, but while Italy scored 485 points in mathematics in PISA 2012, Singapore scored 573 points (Figure IV.1.8).

Trend data between PISA 2003 and PISA 2012 shed light on how changes in spending per student relate to changes in performance.[12] As shown in Figure IV.1.9, the PISA data show no relationship between increases in expenditure and changes in performance, not even for the countries where cumulative expenditure per student was less than USD 50 000 in 2003. Mexico, for example, is among the countries and economies with the greatest improvement in average mathematics performance between 2003 and 2012, but its levels of expenditure remained relatively stable between 2001 and 2011. Similar improvements in average mathematics performance were observed in Poland, where per-student cumulative expenditure nearly doubled during the period (Figure IV.1.9). Caution is required when interpreting the change in per-student expenditure: if the spending is related to capital investment or other purposes that did not change the instructional environment of the 15-year-olds assessed by PISA, then it would not be expected that the returns to these investments accrue to the students whose performance is measured by PISA. Also, in some countries, an increase in per-student expenditure might be a consequence of a decreasing student population rather than a real increase in investment in education.

Whatever the reason for the lack of a relationship between spending per student and learning outcomes, at least in the countries and economies with larger education budgets, excellence in education requires more than money. How resources are allocated is just as important as the amount of resources available to be allocated. One finding from PISA is that high-performing systems tend to prioritise higher salaries for teachers, especially in high-income countries (Figure IV.1.10).

■ Figure IV.1.10 ■

Teachers' salaries and mathematics performance



Notes: Teachers' salaries relative to per capita GDP refers to the weighted average of upper and lower secondary school teachers. The average is computed by weighting teachers' salaries for upper and lower secondary school according to the respective 15-year-old students' enrolment (for countries and economies with available information on both the upper and lower secondary levels).

Only countries and economies with available data are shown.

1. A non-significant relationship ($p > 0.10$) is shown by the dotted line.

2. A significant relationship ($p < 0.10$) is shown by the solid line.

Source: OECD, PISA 2012 Database, Tables I.2.3a and IV.3.3.

StatLink http://dx.doi.org/10.1787/888932957403

Among countries and economies whose per capita GDP is more than USD 20 000, including most OECD countries, systems that pay teachers more (i.e. higher teachers' salaries relative to national income per capita) tend to perform better in mathematics. The correlation between these two factors across 33 high-income countries and economies is 0.30, and the correlation is 0.40 across 32 high-income countries and economies excluding Qatar.[13] In contrast, across countries and economies and economies whose per capita GDP is under USD 20 000, a system's overall academic performance is unrelated to its teachers' salaries, possibly signalling that a host of resources (material infrastructure, instructional materials, transportation, etc.) also need to be improved until they reach a certain threshold, after which improvements in material resources no longer benefit student performance, but improvements in human resources (through higher teachers' salaries, for example) do.[14]

Human resources

As with spending per student, the mere volume of human resources tends to be unrelated to the academic performance or equity of school systems, after accounting for the level of national income.[15] Of course, a school system that lacks quality teachers, infrastructure and textbooks will almost certainly perform at lower levels than other systems. In fact, at the school level, teacher shortage appears to be related to poorer performance in most countries. In 33 countries and economies, schools where a higher share of principals reported that teacher shortages hinder learning tend to show lower performance (see Table IV.3.10, in Chapter 3). However, the degree of teacher shortage is related to the amount of other resources allocated to schools and to schools' socio-economic intake. But even after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics, in the Czech Republic, Slovenia and Switzerland schools whose principals reported that teacher shortages hinder learning tend to show lower average performance (Table IV.1.12c). On average across OECD countries, almost half of the performance differences between schools are accounted for jointly by school resources and students' and schools' socio-economic status and demographic profile (Table IV.1.8a).[16] This suggests that much of the impact of socio-economic status on performance is mediated by the resources invested in schools.

Material resources

The educational resources available in a school tend to be related to the system's overall performance, while the adequacy of the physical infrastructure appears to be unrelated. After accounting for per capita GDP, 33% of the variation in mathematics performance across OECD countries can be explained by differences in principals' responses to questions about the adequacy of science laboratory equipment, instructional materials (e.g. textbooks), computers for instruction, Internet connectivity, computer software for instruction, and library materials (Table IV.1.2).

How resources are allocated to disadvantaged and advantaged schools is also related to systems' levels of performance. In higher performing systems, principals in socio-economically advantaged and disadvantaged schools reported similar levels of quality of physical infrastructure and schools' educational resources, both across OECD countries and across all countries and economies participated in PISA 2012 (Table IV.1.3). As shown in Figure IV.1.11, even after accounting for per capita GDP, 30% of the variation in mathematics performance across OECD countries can be explained by the level of similarities in principals' report on school s' educational resources between socio-economically advantaged and disadvantaged schools.

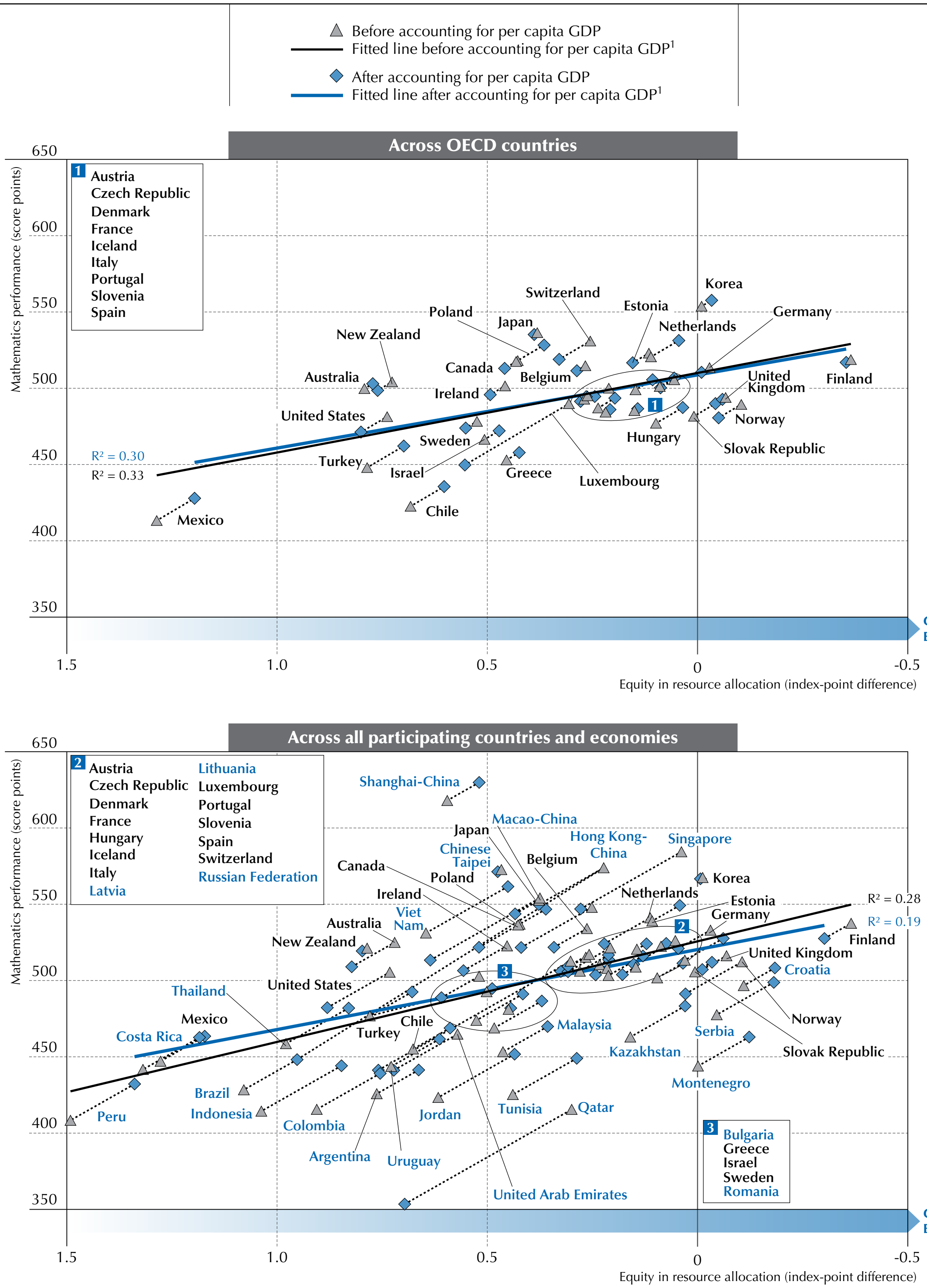
At the school level, in 32 countries and economies, principals' perceptions about the adequacy of the educational resources in their school are positively related to the school's average performance (Table IV.3.16, which is discussed in Chapter 3). However, schools with more adequate educational resources are also those that have other characteristics closely related to higher performance. But, even after accounting for the socio-economic status and demographic profile of students and schools and various other school characteristics, in Qatar, Romania and Costa Rica schools with more adequate resources tend to perform better (Table IV.1.12c). This suggests that much of the impact of socio-economic status on performance is mediated by the resources invested in schools (Table IV.1.8a).

Time resources

The average learning time in regular mathematics lessons is positively related to student performance at the school level. Even after accounting for the socio-economic status and demographic profile of students and schools and various other school characteristics, in 15 countries and economies, schools with longer learning time in mathematics classes tend to perform better in mathematics (Table IV.1.12c). However, at the system level, across all OECD countries and all countries and economies that participated in PISA 2012 there is no clear pattern between a system's overall mathematics performance and whether students in that system spend more time in regular mathematics classes or not (Table IV.1.2).[17] Since learning outcomes are the product of both the quantity and the quality of instruction time, this suggests that cross-system differences in the quality of instruction time blur the relationship between the quantity of instruction time and student performance.

■ Figure IV.1.11 ■

Systems' allocation of educational resources and mathematics performance



Note: Equity in resource allocation refers to the difference in the *index of quality of schools' educational resources* between socio-economically advantaged and disadvantaged school.

1. A significant relationship ($p < 0.10$) is shown by the solid line.

Source: OECD, PISA 2012 Database, Table IV.1.3.

StatLink http://dx.doi.org/10.1787/888932957403

Some schools offer supplementary mathematics lessons in addition to those provided during regular school hours. Schools often decide to offer these after-school lessons because their students need more time to learn mathematics. Not surprisingly then, the schools that offer after-school mathematics lessons are often those with lower average performance in mathematics (Tables IV.1.8b, IV.1.8c, IV.1.12b and IV.1.12c). However, at the system level and across all OECD countries and also across all participating countries and economies, the proportion of students in schools with after-school mathematic lessons tends to be unrelated to the system's overall performance level (Table IV.1.2).

Schools whose students spend more hours on homework or other study set by teachers tend, on average, to perform better, even after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics (Tables IV.1.8b, IV.1.8c, IV.1.12b and IV.1.12c). This is not an obvious finding, since one could expect that lower-performing students spend more time doing homework. However, there may be other factors, such as higher-performing schools requiring more homework from their students. At the system level, the average number of hours that students spend on homework or other study set by their teachers tends to be unrelated to systems' overall performance level (Table IV.1.2).

In summary, at the school level, there is some relationship between the time students spend learning in and after school and their performance, but no clear pattern of this relationship is observed at the system level. This might be because of differences across systems in how the time is spent and how much students learn within a given amount of time. In addition, the nature and purpose of after-school lessons are not always the same. In some schools and school systems, after-school lessons are provided mainly to support struggling students, while in others they are mainly for enrichment.

Across all countries and economies, school systems where schools tend to offer more creative extracurricular activities (i.e. band, orchestra or choir; school plays or musicals; and art clubs or art activities) tend to show better overall performance in mathematics, even after accounting for per capita GDP; but this relationship is not observed across OECD countries (Table IV.1.2). In 47 countries and economies, schools that offer more creative extracurricular activities tend to perform better in mathematics (see Table IV.3.31, discussed in Chapter 3). However, the extent to which schools offer these activities is also related to schools' socio-economic profile and other characteristics. But, even after accounting for the socio-economic status and demographic profile of students and schools and various other school characteristics, in Qatar, Viet Nam, Israel, the United Arab Emirates, Jordan, Estonia and Uruguay schools that offer more of these activities tend to perform better in mathematics (Table IV.1.12c) (Box IV.1.4 offers more details on the policies and programmes implemented recently by Israel[18]).

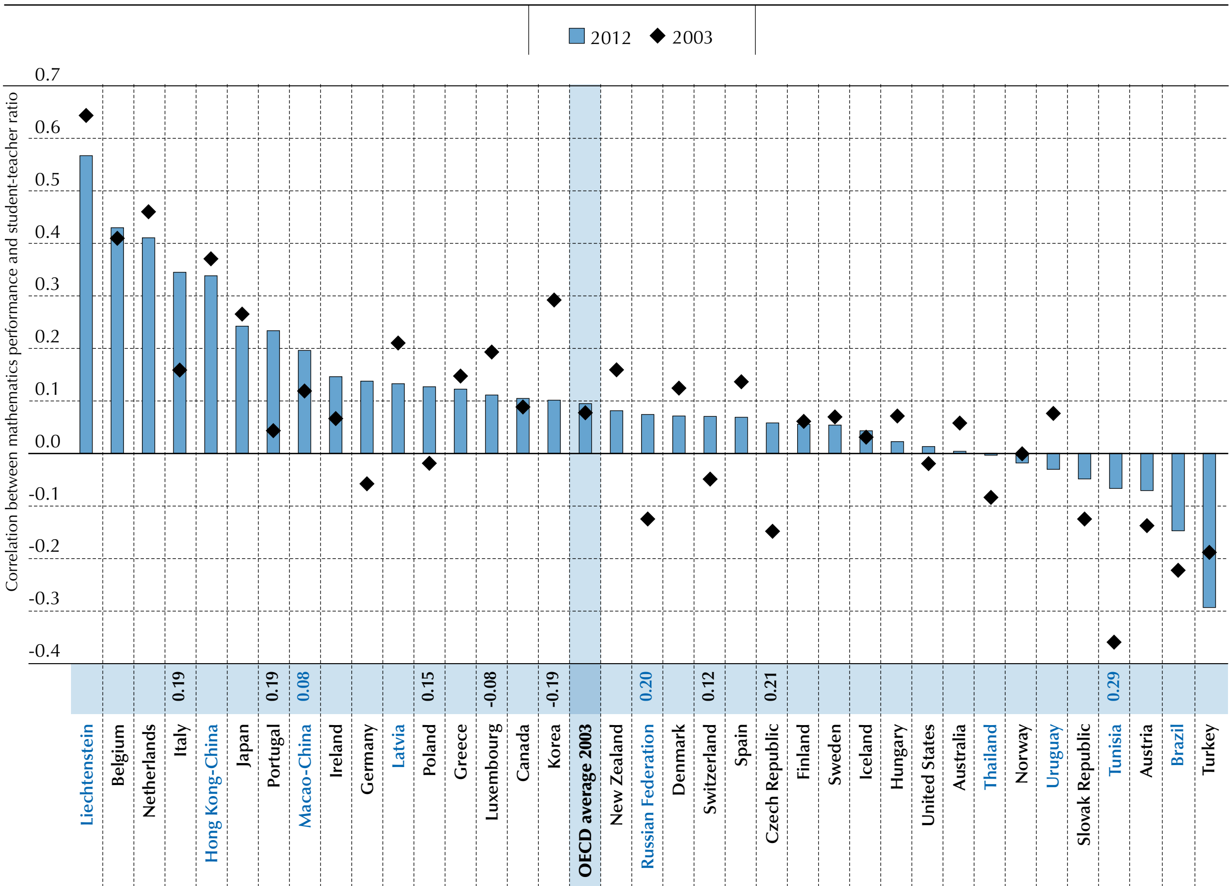
As shown in Volume II, students who attended pre-primary education tend to perform better at the age of 15 than those who did not attend pre-primary education. This relationship is also apparent at the school level. In 17 countries and economies, schools with more students who had attended pre-primary education for more than one year tend to show better average performance (Table IV.1.12c). At the system level, across all PISA participating countries and economies, there is also a relationship between the proportion of students who had attended pre-primary education for more than one year and systems' overall performance in mathematics. Some 32% of the variation in mathematics performance across all countries and economies can be explained by the difference in the percentage of students who attended pre-primary education for more than one year, after accounting for per capita GDP (Table IV.1.2). However, across OECD countries, there is no clear relationship.

Trends in the relationship between mathematics performance and educational resources

As discussed in Chapter 3, all but 11 countries reduced their student-teacher ratios between 2003 and 2012 (Table IV.3.35). The relationship between the student-teacher ratio and the mathematics performance of schools was weak in 2003 and remained so in 2012. In Tunisia, the negative relationship between student-teacher ratios and performance observed in 2003 – whereby students who attend schools with smaller student-teacher ratios perform better – weakened by 2012. Conversely, the positive relationship between student-teacher ratios and students' mathematics performance – whereby students in schools with more favourable student-teacher ratios actually score lower - strengthened in Italy during the period and remained positive and moderately strong in Liechtenstein, Belgium, the Netherlands and Hong Kong-China. In all other countries and economies, the relationship between the student-teacher ratio and student performance in mathematics was weak in both 2003 and 2012 (Figure IV.1.12).

■ Figure IV.1.12 ■

Change between 2003 and 2012 in the relationship between students' mathematics performance and student-teacher ratios in their schools



Notes: The change in the correlation between mathematics performance and schools' student-teacher ratios between 2003 and 2012 (2012 - 2003) is shown above the country/economy name. Only statistically significant differences are shown.
OECD average 2003 compares only OECD countries with comparable mathematics scores and student-teacher ratios since 2003.
Only countries and economies with comparable data from PISA 2003 and PISA 2012 are shown.
Countries and economies are ranked in descending order of the correlation between students' mathematics performance and the student-teacher ratio in their schools in 2012.
Source: OECD, PISA 2012 Database, Table IV.1.25.
StatLink http://dx.doi.org/10.1787/888932957403

Between 2003 and 2012, there was an increase in the amount of time students spend in mathematics classes (see Table IV.3.46 in Chapter 3); yet the relationship between learning time and mathematics performance was weak in both PISA 2003 and PISA 2012: in both PISA assessments, students exposed to more mathematics instruction did not perform better than students exposed to less mathematics instruction. This could be because, in some countries and economies, low-performing students tend to spend more time in mathematics classes to catch up with their peers; in others, higher-performing students may spend more time in mathematics lessons because they enjoy the subject more. In both cases, students may benefit from more time spent in the classroom, but the average relationship is negligible. The relationship was weak and positive in PISA 2003 and became stronger in PISA 2012 in Thailand, Japan and Turkey, meaning that students in these countries who spent more time in mathematics classes performed even better in mathematics in 2012 than their peers did in 2003. This relationship was also positive, but weakened during the period, in Greece and Belgium (Table IV.1.26).

One notable trend concerning educational resources was the widening of the performance gap between students who had attended pre-primary school and those who had not. In 2003, the average advantage in mathematics performance among students who had attended pre-primary education compared to those 15-year-olds who had not was 40 points; by 2012 the difference had grown to 51 score points. Students who had not attended pre-primary education are at an

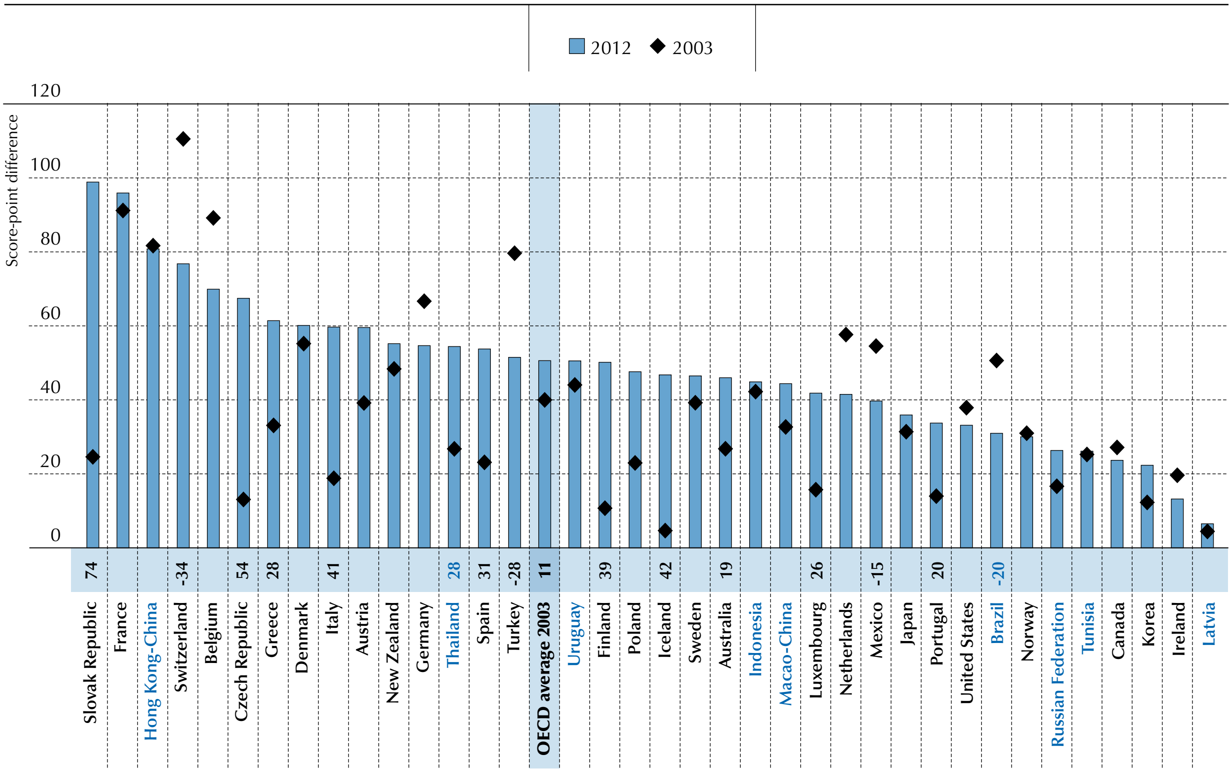
increasing disadvantage compared to their peers who had, and this disadvantage widened by more than 25 points in the Slovak Republic, the Czech Republic, Iceland, Italy, Finland, Spain, Greece, Thailand and Luxembourg. Participation in pre-primary education increased significantly in all of these countries and economies, and by more than five percentage points in Finland, Luxembourg and Portugal (see Table IV.3.50 in Chapter 3), signalling not only that enrolments grew, but that the relationship between attendance and later performance strengthened. In these countries and economies, where the relationship between attendance in pre-primary school and students' mathematics performance grew stronger, attendance in pre-primary school may have improved students' readiness for school or determined students' paths through education to a greater degree in 2012 than it did in 2003.

However, this trend can also signal that, despite an expansion in enrolments in pre-primary programmes, the group of students who do not attend pre-primary schools are increasingly from socio-economically and academically disadvantaged backgrounds. In fact, from 2003 to 2012 there was an increase in the socio-economic disparity between students who had attended pre-primary education and those who had not. This means that the students who could benefit the most from these programmes, those from disadvantaged backgrounds, are those less likely to participate in them. This growing socio-economic divide between students who had attended pre-primary education and those who hadn't is wide in the Slovak Republic and is also observed in Greece, Luxembourg, Poland, Finland, the Russian Federation and Latvia; it narrowed, however, in Macao-China, Germany, Korea, Uruguay and Portugal during the period (Figures IV.1.13 and IV.1.14).

■ Figure IV.1.13 ■

Change between 2003 and 2012 in the relationship between students' mathematics performance and their attendance in pre-primary school

Score-point difference in mathematics performance between students who reported that they had attended pre-primary education (ISCED 0) for more than one year and those who hadn't

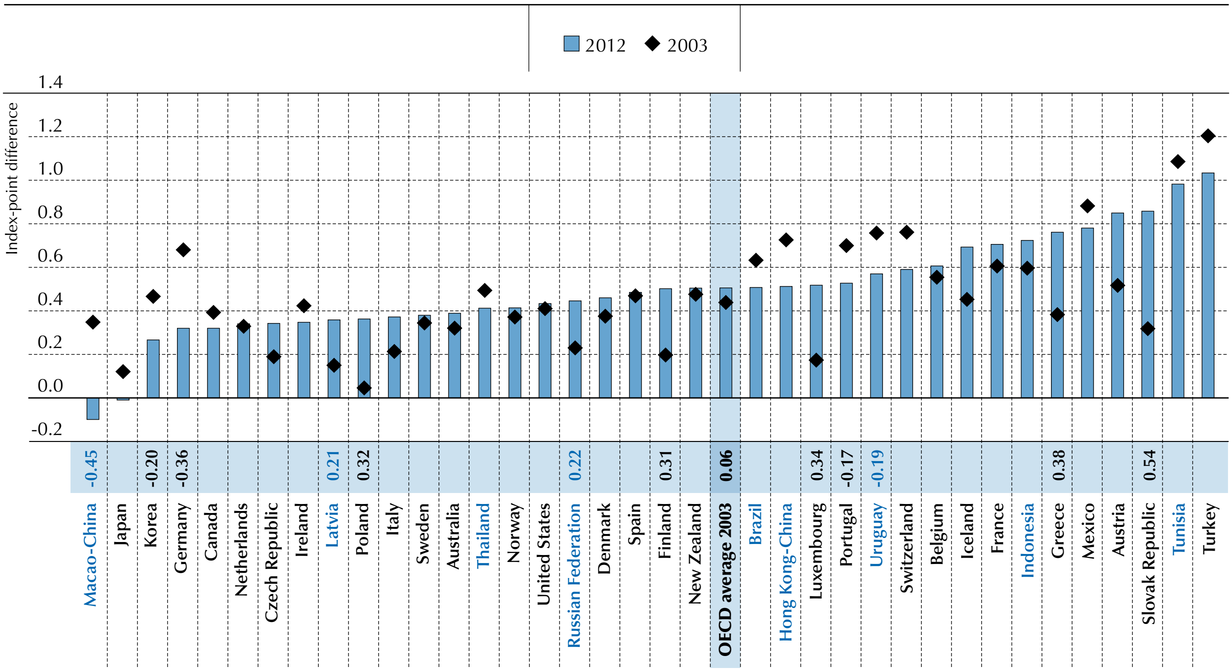


Notes: The change in the score-point difference in mathematics performance between 2003 and 2012 (2012 - 2003) is shown above the country/economy name. Only statistically significant differences are shown.
OECD average 2003 compares only OECD countries with comparable mathematics scores since 2003.
Only countries and economies with comparable data from PISA 2003 and PISA 2012 are shown.
Countries and economies are ranked in descending order of the score-point difference in mathematics performance between students who reported in 2012 that they had attended pre-primary education (ISCED 0) for more than one year and those who hadn't.
Source: OECD, PISA 2012 Database, Table IV.1.27.
StatLink http://dx.doi.org/10.1787/888932957403

■ Figure IV.1.14 ■

Change between 2003 and 2012 in the relationship between students' socio-economic status and their attendance at pre-primary school

Index-point difference in the PISA index of economic, social and cultural status *between students who reported that they had attended pre-primary education (ISCED 0) for more than one year and those who hadn't*



Notes: The change in the index-point difference in the *PISA index of economic, social and cultural status* performance between 2003 and 2012 (2012 - 2003) is shown above the country/economy name. Only statistically significant differences are shown.
OECD average 2003 compares only OECD countries with comparable values on the *PISA index of economic, social and cultural status* since 2003.
Only countries and economies with comparable data from PISA 2003 and PISA 2012 are shown.
Countries and economies are ranked in ascending order of the index-point difference in the PISA index of economic, social and cultural status *between students who reported in 2012 that they had attended pre-primary education (ISCED 0) for more than one year and those who hadn't.*
Source: OECD, PISA 2012 Database, Table IV.1.27.
StatLink http://dx.doi.org/10.1787/888932957403

Box IV.1.4. Improving in PISA: Israel

Israel's performance in PISA has improved in all subject matters. Since PISA 2006, for example, it has improved by an average of 4.2 points per year in mathematics and 2.8 points per year in science; since 2000, the country's score in reading has improved by an average of 3.7 points per year. Average performance in mathematics improved from 442 points in PISA 2006 to 466 points in PISA 2012 and reading performance improved from 452 points in 2000 to 486 points in 2012. At the same time, the proportion of students who score below proficiency Level 2 shrank considerably and the proportion of those who score at or above proficiency Level 5 increased. In 2006, for example, 42% of students did not attain proficiency Level 2 in mathematics; by 2012, that proportion had decreased to 34%. The share of top performers in mathematics grew from 6% to 9% over the same period.

Israel's school system is arranged along six different education streams, reflecting the cultural diversity of the country. Three of these streams cater to the Hebrew-speaking community (secular schools, religious schools and ultra-orthodox schools), and three cater to the Arab-speaking community (schools for the Arab, Druze and Bedouin minorities). For most streams (all but the ultra-orthodox), the Ministry of Education has high capacity to influence and monitor the type and quality of teaching and learning through resource allocation, regulations and guidelines. Only ultra-orthodox schools, which are only partially funded by the state, often do not follow the programmes and policies established by the Ministry.

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The *Meitzav* and the *Bagrut* are two external evaluations that characterise Israel's education system. The *Meitzav* assessments are conducted in the second year of primary school (Grade 2), the fifth year of primary school (Grade 5), and the second year of lower-secondary school (Grade 8). The *Meitzav* assessment is used for system-level evaluation and assesses a quarter of Israel's schools each year in Hebrew or Arabic skills in Grade 2, depending on the language spoken by the child; and also in mathematics, English and science and technology in the Grade 5 and Grade 8 assessments. The *Bagrut* is the upper secondary exit-level examination, which is also used for university-level admissions, thus having direct consequences for students and a strong influence on what students learn and how they are taught. Students who graduate but do not pass the *Bagrut* are awarded a certificate of completion of upper-secondary education; those who pass obtain a diploma that allows students to apply to university.

Israel's school system has expanded dramatically in the past 20 years. As a result of a 40% increase in the 5-24 year-old population between 1990 and 2010, and a change in the composition of the student population (much of the increase in the number of primary and secondary school students has been in the Arab-speaking and ultra-orthodox streams), the Israeli school system has been in constant change.

Reforms prompted by assessment results

Education policy discussions flourished after participation in international assessments revealed Israel's relatively poor performance and inequitable school system. In PISA 2000, which Israel implemented in 2002 as part of PISA+, for example, Israel performed well below the OECD average in reading, mathematics and science. These policy discussions led to the formation of the *Dovrat Committee* in 2003 whose aim was to propose reforms and policies to the government to improve both the performance and equity of the school system. Although only some of the recommendations, delivered in 2004, were ultimately implemented, many of the current policies and reforms follow the committee's strategic recommendations. The recommendations included providing universal pre-school from age three, improving the links between pre-primary and primary schools by either organising pre-schools into clusters or adding pre-school classes to primary schools, lengthening the school day for all students, and re-defining the role of school principals by giving them more responsibilities and higher pay. Following the *Dovrat Committee*'s recommendations, in 2005, the National Authority for Measurement and Evaluation (RAMA) was established to conduct periodic evaluations of the education system and schools, contributing to the process of results-based management at all levels.

Current education policy follows the framework outlined by *New Horizons*, a programme launched in 2007 that advances reform for pre-primary, primary and lower secondary schools on several fronts and follows an agreement between education authorities and the primary and lower-secondary teachers' union. Initially, it was implemented on a voluntary basis, in schools were a majority of teachers agreed, then became compulsory in the 2009-10 school year. School principals' careers were distinguished from that of teachers. Following the reforms on principals' careers originally laid out by the *Dovrat Committee,* principals must now have earned a special tertiary-level degree and have been granted more responsibility and autonomy in evaluating teachers. Each school is given a monthly in-service training opportunity; the principal and managerial staff decide how to make the best use of it. Teachers' working hours were increased from 30 to 36 hours per week. In parallel, government policies expanded the duration of compulsory education to Grade 12 and set a maximum class size of 32 students which has been partially implemented, mainly among socio-economically disadvantaged schools. In addition, extra funding was given to primary schools to teach reading, writing and mathematics at the first two years in small groups of 20 students.

Changes in teachers' pay and working conditions, school support and assessments

In addition, teachers' pay scales were increased and flattened (salaries for junior teachers were doubled, while those for veteran teachers increased by 25%) and promotion was made contingent on triennial evaluations and fulfilling the requirement of 60 hours of in-service training per year. These changes to teachers' working conditions sought to improve teacher morale and reduce retention and recruitment problems that stem from the growing student population, the caps on class size, and the expansion of compulsory schooling.

New Horizons also mandates that the increased number of working hours for teachers be focused on small-group teaching for under-performing students. Small-group teaching programmes were piloted in the early 2000s together with cash-reward programmes (although cash-reward programmes for students proved more cost-effective, they did not have broad public support). Other programmes to promote equity focus on the Arab-speaking minorities,

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particularly the Bedouin minority. The most recent of these five-year programmes began in 2008 and supports extra hours of study, provides rent assistance for teachers, improves the quality of educational facilities, offers support teams to assist low-performing schools, and strengthens Arabic-language skills. To advance towards greater equity, other policies introduced a socio-economic component in the allocation of resources in primary schools and lower secondary; but only 5% of the school budget is devoted to this compensatory mechanism.

More recently, *Courage to Change* policies outlines the framework for reform in upper secondary schools. In conjunction with *New Horizons, Courage to Change* allows schools that offer lower and upper secondary education to take part in the reforms. *Courage to Change* was signed in 2012 and the policies are set to be implemented gradually so that full implementation is expected by 2015.

Other programmes have sought to attract university-level graduates into the teaching profession in general and to science areas in particular. In *Academics for Teaching*, participants undergo an intensive teacher-training programme (no tuition fees and a monthly allowance), and teach full time with a commitment to teach for three years. They receive a normal teachers' salary in addition to a supplement, and after the three years they can enrol, for free, in a master's degree in return for an additional two years' commitment. Other programmes to attract individuals to the teaching profession are *Outstanding Achievers for Education* (to attract students with good performance at the tertiary level), *Teach First* (to promote teaching as an interim career move following graduation from university), *Educational Pioneer* (to encourage those already working with youth in other contexts to become teachers), and the *Atidim* programme (to encourage English and science teachers to work in remote and disadvantaged areas).

In 2007, the schedule of the *Meitzav* assessment was converted to a new biennial-rotating, so that individual schools are assessed every two years and on a particular subject every four years with system-level results available annually based on a quarter of the country's schools. In the years where a particular subject is not assessed in a particular school, individual schools implement, internally, a version of the *Meitzav* which come with supporting pedagogical material. The internal *Meitzav* is graded internally by the teachers and results are not reported to an external entity. Changes to the *Bagrut* examination have shifted the weight given to questions that can be answered by rote learning so that more space is given to projects that require students' individual inquiry, sending a strong signal to secondary schools about the competencies that students should have acquired by the end of compulsory education.

Note: The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Sources:

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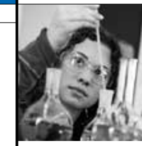
HOW LEARNING OUTCOMES ARE RELATED TO THE GOVERNANCE OF EDUCATION SYSTEMS

School autonomy

Since the early 1980s, school reforms have focused on giving schools greater autonomy over a wide range of institutional operations in an effort to raise performance levels (Whitty, 1997; Carnoy, 2000; Clark, 2009; Machin and Vernoit, 2011). More decision-making responsibility and accountability has devolved to school principals, and, in some cases, management responsibilities have devolved to teachers or department heads. Schools have become increasingly responsible for curricular and instructional decisions as well as for managing financial and material resources and personnel. These reforms are adopted on the premise that schools themselves are more knowledgeable about their own needs and the most effective ways to allocate resources and design the curriculum so that they can better meet the needs of their students.



■ Figure IV.1.15 ■

School autonomy over curriculum and assessment and mathematics performance

1. A significant relationship ($p < 0.10$) is shown by the solid line.
Source: OECD, PISA 2012 Database, Table IV.1.4.

StatLink http://dx.doi.org/10.1787/888932957403

PISA shows that school systems that grant more autonomy to schools to define and elaborate their curricula and assessments tend to perform better than systems that don't grant such autonomy, even after accounting for countries' national income (Figure IV.1.15). School systems that provide schools with greater discretion in deciding student-assessment policies, the courses offered, the content of those courses and the textbooks used are also school systems that perform at higher levels in mathematics. In contrast, greater responsibility in managing resources appears to be unrelated to a school system's overall performance (Table IV.1.4).

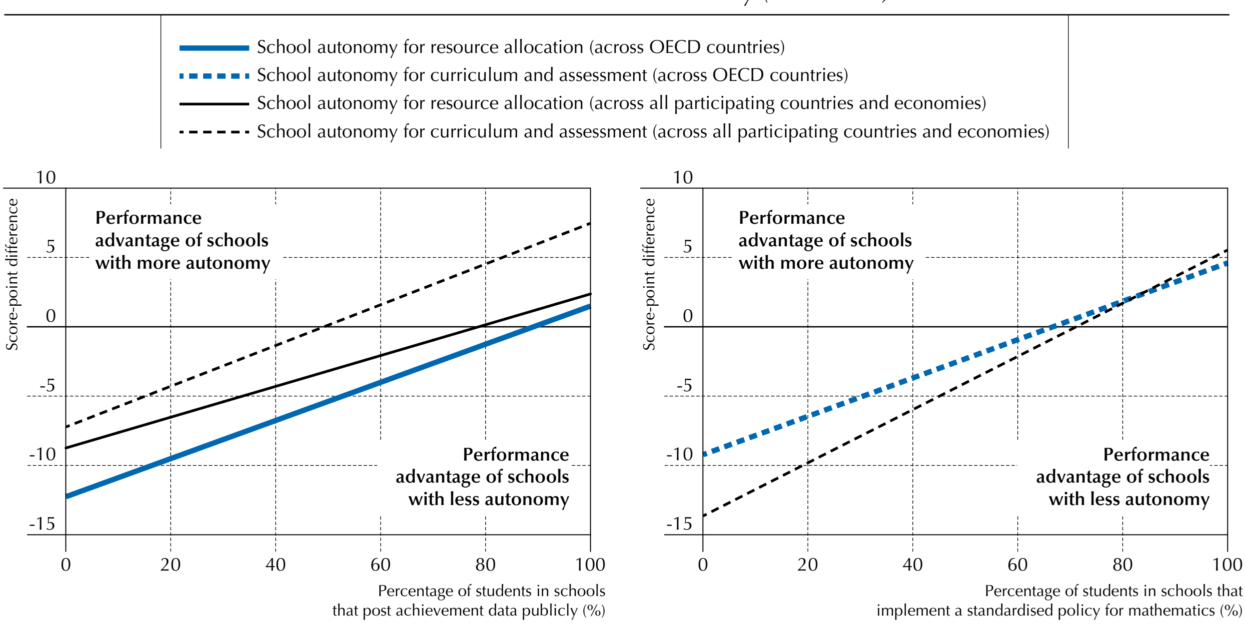
The positive relationship between schools' autonomy in defining and elaborating curricula and assessment policies and student performance that is observed at the level of the school system can play out differently within countries and economies. In 17 countries and economies, schools that have more autonomy in this area tend to perform better, while the opposite is observed in seven countries and economies (Table IV.4.3, discussed in Chapter 4). The degree of school autonomy is also related to the socio-economic status and demographic background of students and schools and various other school characteristics, such as whether the school is public or private. But even after accounting for all of these aspects, a positive relationship is observed in Costa Rica, Thailand, Latvia and Finland (Table IV.1.12c).

Within systems too, there is a relationship between school autonomy and learning outcomes, but this relationship interacts with the accountability arrangements of school systems. For example, information on the results of external examinations and assessments often provide a basis on which schools and parents can make informed and appropriate decisions for students (Fuchs and Woessmann, 2007). Data from PISA 2012 show that in systems where a greater share of schools post achievement data publicly, considered here as one form of accountability, there is a positive relationship between school autonomy in resource allocation and student performance. The first panel in Figure IV.1.16 shows that, in the participating countries and economies where schools do not post achievement data publicly, after students' and schools' socio-economic status and demographic profile are taken into account, a student who attends a school with greater autonomy in defining and elaborating curricula and assessment policies tends to perform seven points lower in mathematics than a student who attends a school with less autonomy in these areas.

■ Figure IV.1.16 ■

School autonomy and mathematics performance, by system-level accountability features

Predicted score-point difference in mathematics performance between students in schools with more autonomy and those in schools with less autonomy (more - less)



Notes: Schools with more autonomy are those with 1.0 point on the autonomy index and schools with less autonomy are those with -1.0 point on the autonomy index.
These predicted relationships are based on a net model after accounting for socio-economic status of students and schools, demographic backgrounds and school type.
Source: OECD, PISA 2012 Database, Tables IV.1.13 and IV.1.14.
StatLink http://dx.doi.org/10.1787/888932957403

In contrast, in a school system where all schools post achievement data publicly, a student who attends a school with greater autonomy scores seven points higher in mathematics than a student who attends a school with less autonomy. A similar interaction between school autonomy in resource allocation and a system's accountability arrangements, particularly those of posting achievement data publicly, is observed; however the performance advantage for schools with greater autonomy in this regard is relatively small (Table IV.1.13).

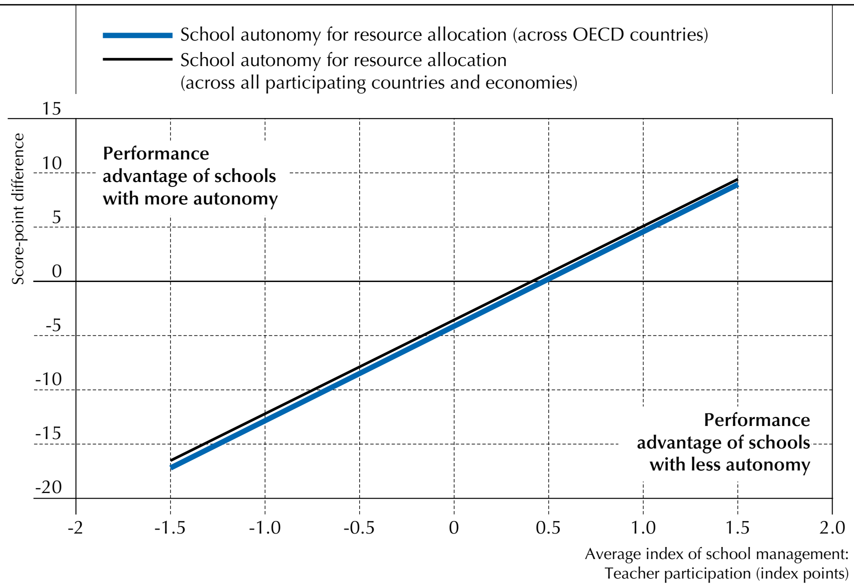
Similar interactions between school autonomy and system-level accountability are observed when system accountability takes the form of a standardised policy for mathematics, such as a school curriculum with shared instructional materials accompanied by staff development and training. The right panel of Figure IV.1.16 shows that the relationship between school autonomy in defining and elaborating curricula and assessment policies and school average performance in mathematics is influenced by the extent to which systems have a standardised policy for mathematics. In OECD countries where no school implements a standardised policy for mathematics, a student who attends a school with greater autonomy in curricula and assessments tends to score nine points lower in mathematics than a student who attends a school with less autonomy. In contrast, in a school system where all students are in schools that implement such a standardised policy, a student who attends a school with greater autonomy scores five points higher in mathematics than a student who attends a school with less autonomy (Table IV.1.14).

The relationship between school autonomy and performance also appears to be affected by whether there is a culture of collaboration between teachers and principals in managing a school. Figure IV.1.17 shows that, in school systems where principals reported less teacher participation in school management (i.e. 1.5 index points lower than the OECD average), even after students' and schools' socio-economic status and demographic profile are taken into account, a student who attends a school with greater autonomy in allocating resources tends to score 17 points lower in mathematics than a student who attends a school with less autonomy. In contrast, in a school system where principals reported more teacher participation in school management (i.e. 1.5 index points higher than the OECD average), a student who attends a school with greater autonomy scores 9 points higher in mathematics than a student who attends a school with less autonomy (Table IV.1.15).

■ Figure IV.1.17 ■

School autonomy and mathematics performance, by system-level teacher participation in school management

Predicted score-point difference in mathematics performance between students in schools with more autonomy and those in schools with less autonomy (more - less)



Notes: Schools with more autonomy are those with 1.0 point on the autonomy index and schools with less autonomy are those with -1.0 point on the autonomy index.
These predicted relationships are based on a net model after accounting for socio-economic status of students and schools, demographic backgrounds and school type.
Source: OECD, PISA 2012 Database, Table IV.1.15.
StatLink http://dx.doi.org/10.1787/888932957403

School competition

Since the early 1980s, reforms in many countries have also granted parents and students greater choice in the school the students will attend. Students and their families are granted the freedom to seek and attend the school that best serves students' education needs; that, in turn, introduces a level of competition among schools to attract students. Assuming that students and parents have all the required information about schools and choose schools based on academic criteria, the competition creates incentives for institutions to organise programmes and teaching in ways that better meet diverse student requirements and interests, reducing the costs of failure and mismatches.

Yet some of the assumptions underlying such reforms have been called into question (Schneider, Teske and Marshall, 2002; Hess and Loveless, 2005; Berends and Zottola, 2009). It is unclear, for example, whether parents have the necessary information to choose the best schools for their children. It is also unclear whether parents always give sufficient priority to high achievement, at the school level, when making these choices (see Chapter 4). School choice may also lead to the unintended racial/ethnic or socio-economic segregation of schools (Gewirtz, Ball and Rowe, 1995; Whitty, 1998; Karsten, 1999; Viteritti, 1999; Schneider and Buckley, 2002; Plank and Sykes, 2003; Hsieh, 2006; Heyneman, 2009; Bunar, 2010a; Bunar, 2010b; Söderström and Uusitalo, 2010). Recently, in some school systems greater responsibility for assigning students to schools is given to the education authority (see Box IV.4.2 as an example in Belgium [French community]).

The degree of competition among schools is one way to measure school choice. Competition among schools is intended to provide incentives for schools to innovate and create more effective learning environments. System-level correlations in PISA do not show a relationship between the degree of competition and student performance (Table IV.1.4). At the school level, in 28 countries and economies, schools that compete for student enrolment with other schools tend to show better performance, before accounting for schools' socio-economic intake. In seven countries and economies, schools whose socio-economic intake is more advantaged are also more likely to compete with other schools for students (Table IV.1.16). Only in the Czech Republic and Estonia do schools that compete with other schools for students in the same area tend to perform better, on average, than schools that do not compete, after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics (Table IV.1.12c).

On the other hand, the results indicate a weak and negative relationship between the degree of competition and equity. Among OECD countries, systems with more competition among schools tend to show a stronger impact of students' socio-economic status on their performance in mathematics. Caution is advised when interpreting this result, as the observed relationship could be affected by a few outliers.[19] But, this finding is consistent with research showing that school choice – and, by extension, school competition – is related to greater levels of segregation in the school system, which may have adverse consequences for equity in learning opportunities and outcomes.

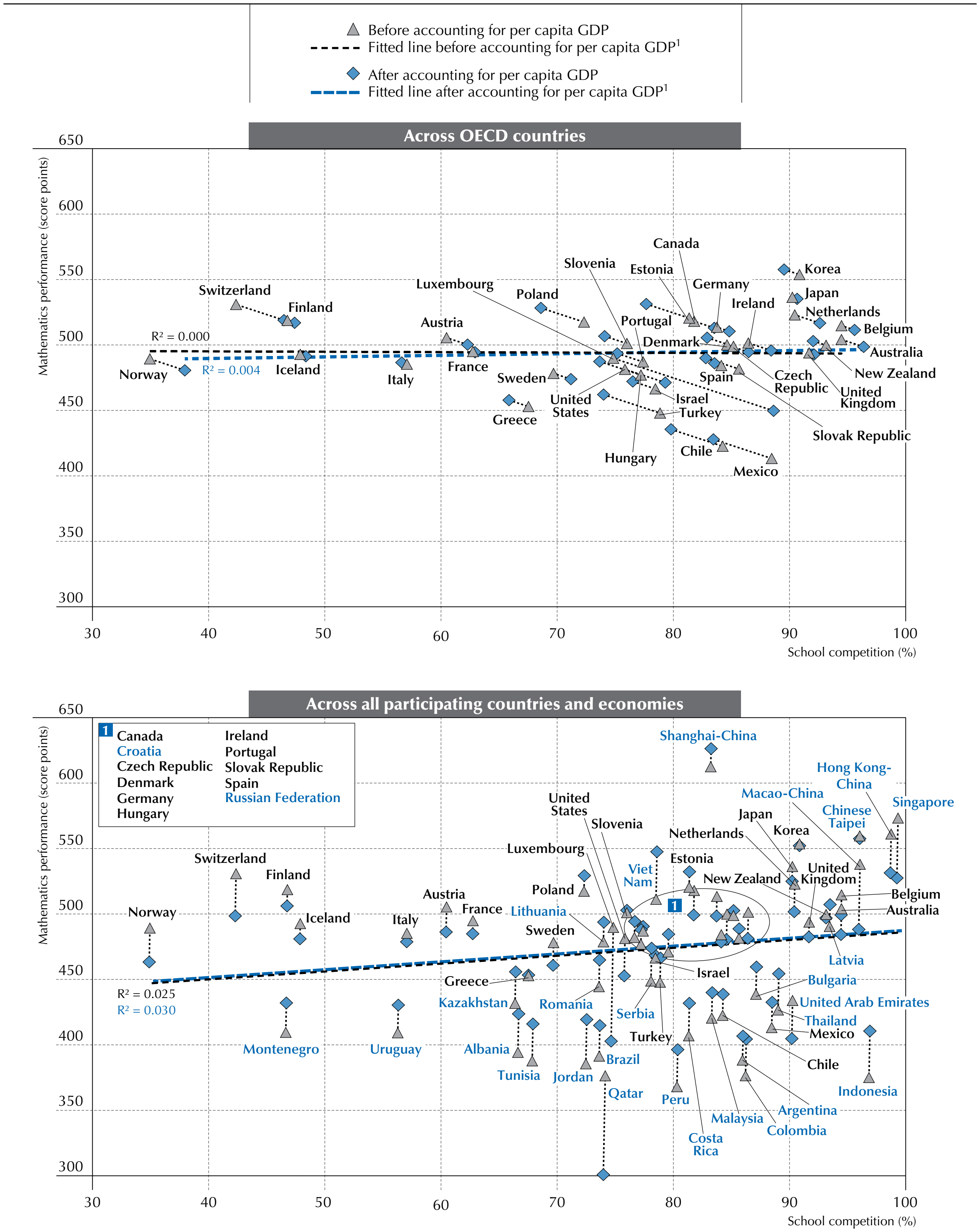
Public and private stakeholders

The evidence on the impact of public and private funding and management on student performance is mixed. Cross-country studies conducted by Woessmann (2006) based on the PISA 2000 assessment, and by Woessmann, et al. (2009) and West and Woessmann (2010), based on the PISA 2003 assessment, concluded that countries that combine private management and public funding tend to produce better overall academic performance. Studies in Chile (Lara, Mizala and Repetto, 2009), the Czech Republic (Filer and Münich, 2003), Sweden (Sandström and Bergström, 2005), the United Kingdom (Green et al., 2011) and the United States (Couch, Shugart and Williams, 1993; Peterson et al., 2003) show that larger proportions of private school enrolments are related to better performance, based on cross-sectional or longitudinal data or the data before and after structural changes. But the debate on performance is far from conclusive, as other studies report little, negative or insignificant effects, and the results often depend on methodological choices. For example, other studies based on state-level data from the United States concluded that higher private school enrolment is not significantly related to performance (Wrinkle et al., 1999; Sander, 1999; Geller, Sjoquist and Walker, 2006). A few studies show small negative effects (Smith and Meier, 1995), negative effects for low-income districts (Maranto, Milliman and Scott, 2000), or that the relationship depends on the education outcome that is measured (Greene and Kang, 2004).

Across OECD countries and all countries and economies that participated in PISA 2012, the percentage of students enrolled in private schools is not related to a system's overall performance (Table IV.1.4).

■ Figure IV.1.18 ■

School competition and mathematics performance



Note: School competition refers to the percentage of students in schools whose principal reported that one or more schools compete for students in the same area.

1. A non-significant relationship (p > 0.10) is shown by the dotted line.

Source: OECD, PISA 2012 Database, Table IV.1.4.

StatLink http://dx.doi.org/10.1787/888932957403

■ Figure IV.1.19 ■

School type and mathematics performance

Score-point difference in mathematics performance between public and private schools (government-dependent and government-independent schools combined)

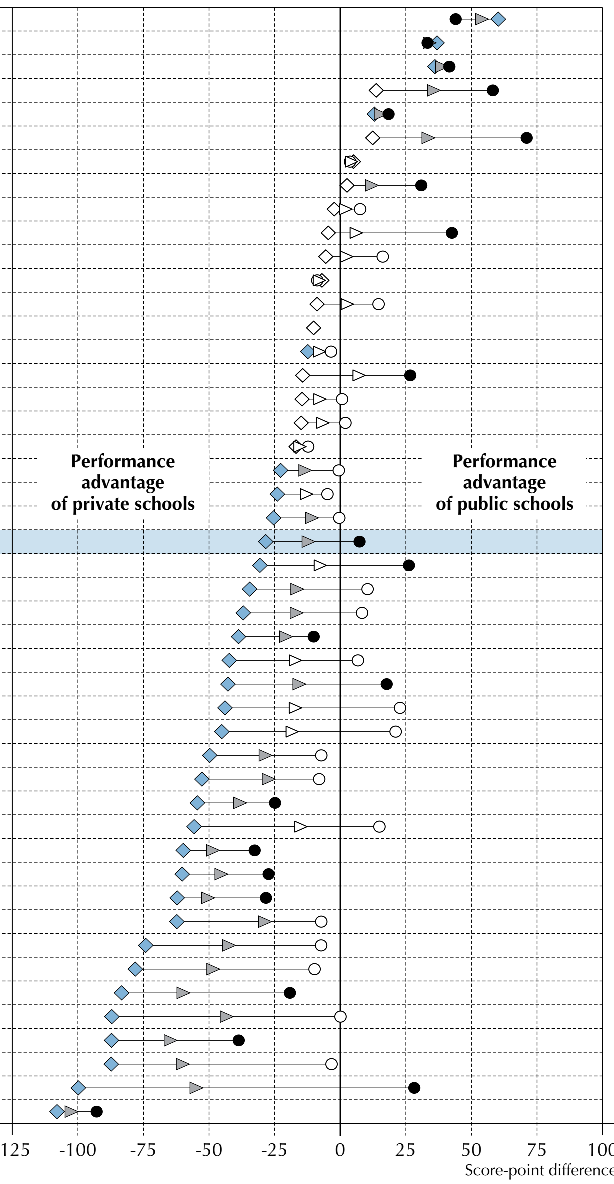
◇ ◆ Observed performance difference

▷ ▶ Performance difference after accounting for the *PISA index of economic, social and cultural status* **of students**

○ ● Performance difference after accounting for the *PISA index of economic, social and cultural status* **of students and schools**

Percentage of students attending:

	Government or public schools[1]	Government-dependent private schools[2]	Government-independent private schools[3]
Chinese Taipei	68	5	28
Hong Kong-China	7	92	1
Thailand	83	12	5
Viet Nam	93	0	7
Luxembourg	85	13	2
Switzerland	94	1	5
Indonesia	59	17	24
Italy	95	2	3
Kazakhstan	97	1	2
Japan	70	0	30
Czech Republic	92	7	1
Netherlands	34	66	0
Estonia	98	2	1
Albania	92	0	8
Ireland	44	54	2
United States	95	0	5
Hungary	84	16	0
Sweden	86	14	0
Korea	53	31	16
United Kingdom	56	36	8
Finland	97	3	0
Denmark	77	19	4
OECD average	**82**	**14**	**4**
France	83	17	0
Shanghai-China	91	0	9
Australia	61	26	13
Spain	68	24	7
Slovak Republic	91	9	0
Mexico	91	0	9
Germany	95	5	0
Austria	91	8	1
Colombia	86	4	10
Chile	37	48	14
Canada	92	4	3
Poland	97	2	1
Jordan	83	1	16
Argentina	68	26	7
United Arab Emirates	55	1	45
Portugal	90	6	4
Peru	85	0	15
Costa Rica	87	4	10
Brazil	87	1	13
New Zealand	95	0	5
Malaysia	97	0	3
Slovenia	98	2	0
Uruguay	83	0	17
Qatar	62	1	37



Note: White symbols represent differences that are not statistically significant.
1. Schools that are directly controlled or managed by: a public education authority or agency; or a government agency directly or a governing body, most of whose members are either appointed by a public authority or elected by public franchise.
2. Schools that receive 50% or more of their core funding (i.e. funding that supports the basic educational services of the institution) from government agencies.
3. Schools that receive less than 50% of their core funding (i.e. funding that supports the basic educational services of the institution) from government agencies.
Countries and economies are ranked in descending order of the score-point difference in mathematics performance between public and private schools (government-dependent and government-independent schools combined).
Source: OECD, PISA 2012 Database, Table IV.4.7.
StatLink http://dx.doi.org/10.1787/888932957403

At the school level, when average performance is compared simply between public and private schools, without accounting for background aspects, private schools tend to show better performance than public schools in 28 countries and economies (Figure IV.1.19 and Table IV.4.7 in Chapter 4). The score-point difference ranges from 12 points in Ireland to 108 points – or the equivalent of nearly three years of schooling – in Qatar. By contrast, in Chinese Taipei, Hong Kong-China, Thailand and Luxembourg, the average score among public schools is higher than that among private schools by 13 to 60 points. The proportion of students in private schools is unrelated to the magnitude of the difference in performance between students who attend private and public schools.[20] Students who attend private schools tend to be more socio-economically advantaged than students who attend public schools. Thus, after accounting for the socio-economic status of students and schools, private schools outperform public schools in only 13 countries and economies, and public schools outperform private schools in eight countries and economies (Table IV.4.7). In addition, after accounting for the demographic background of students and schools and various other school characteristics, private schools outperform public schools in 10 countries and economies, while public schools show better average performance than private schools in five countries and economies (Table IV.1.12c).

Assessment and accountability

Tests that have direct and high-stakes consequences for students can serve as powerful incentives for students to put greater effort into learning. For teachers, student-based standardised assessments provide a way to compare the performance of their students to performance achieved elsewhere in the school systems and can also be used to customise pedagogy accordingly. At the school level, achievement data can be used to determine how resources and additional support are allocated and/or may trigger intervention by higher authorities. Achievement data can also be used to inform policies to create more efficient learning environments and to prompt schools, teachers and the students themselves to work towards centrally established education outcomes.

Critics of the use of standardised tests based on students' test performance rather than on improvements in test scores argue that standardised tests may reinforce the advantages of schools that serve students from socio-economically advantaged backgrounds (Ladd and Walsh, 2002; Downey, Von Hippel and Hughes, 2008). In addition, teachers may respond strategically to accountability measures by sorting out or retaining disadvantaged students (Jacob, 2005; Jennings, 2005). Standardised tests might have the adverse effect of limiting school goals to passing or proficiency on particular tests and focusing instruction on those students who are close to average proficiency and ignoring those who are far below or above the average (Neal and Schanzenback, 2010).

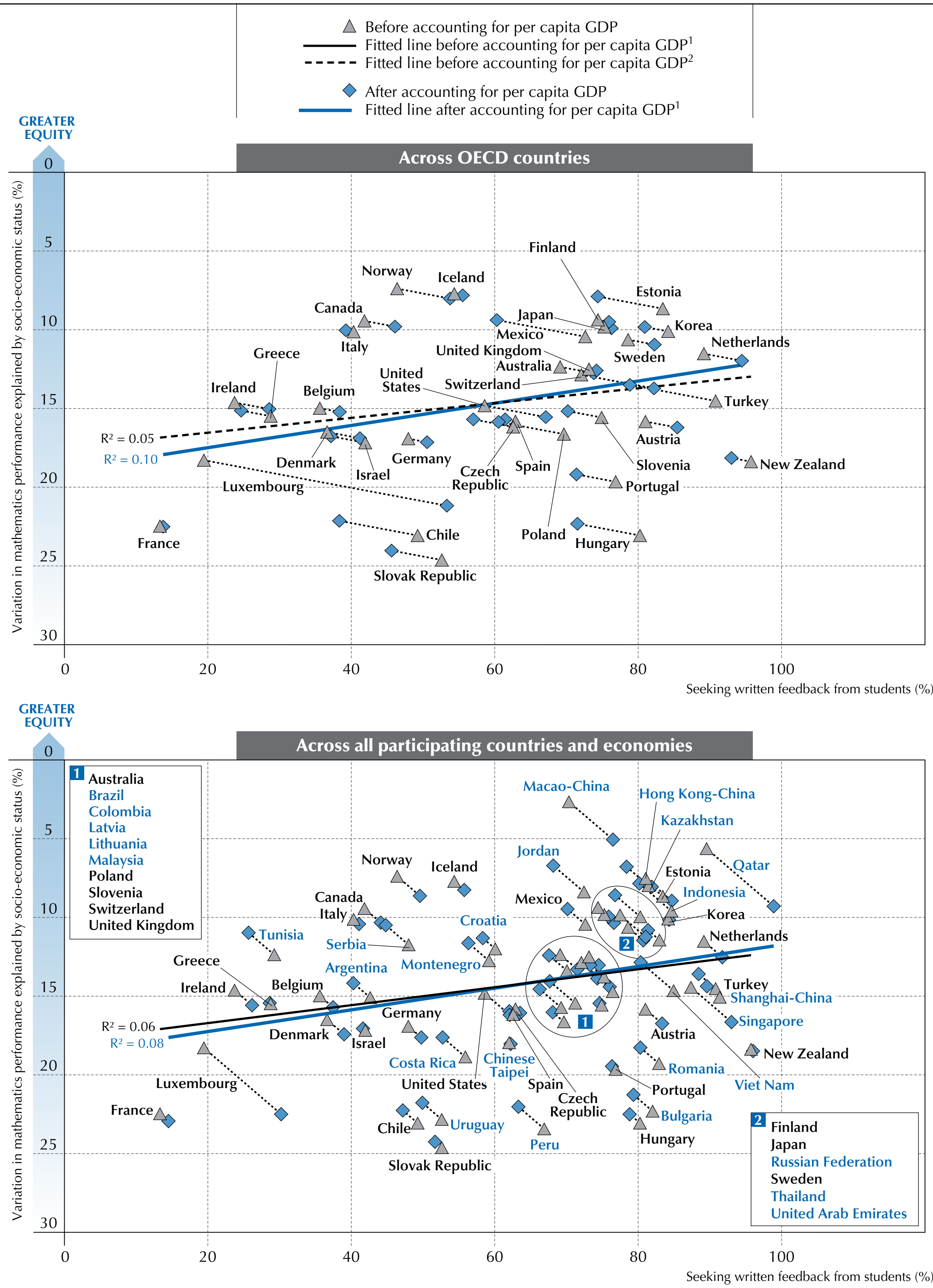
In order to avoid the negative impact of "teaching to the test," evaluations are expanding and becoming more diverse in most OECD countries. Countries do not solely focus on student assessments; they also evaluate schools and appraise teachers and school leaders. All school staff and students need to be engaged in a broader range of evaluation exercises, targeting both schools and teachers; student feedback is an important contribution to be used for formative purposes (OECD, 2013b).

PISA shows that the degree to which systems seek feedback from students regarding lessons, teachers or resources tends to be related to systems' level of equity. PISA 2012 asked school principals to report whether written feedback from students regarding lessons, teachers or resources is sought for quality-assurance and improvement of the school. Systems where more students attend schools with such practices tend to show less impact of student socio-economic status on performance. This is observed across OECD countries and across all participating countries and economies. As shown in Figure IV.1.20, across OECD countries, some 10% of the variation in the impact of students' socio-economic status on their mathematics performance can be accounted for by differences in the degree to which systems use this approach, after accounting for per capita GDP (Table IV.1.4). Systems seeking written feedback from students also tend to perform better across OECD countries.[21]

At the school level, on average across OECD countries, schools seeking written feedback from students tend to perform better, even after accounting for the socio-economic status of students and schools (Table IV.1.18). However, this relationship also varies by country/economy. After accounting for the socio-economic status of students and schools, in Switzerland, Belgium, Mexico, Portugal, Colombia and Macao-China, schools with higher average performance tend to use this approach, while in Qatar, New Zealand, Shanghai-China and Montenegro, schools with lower average performance tend to do so (Table IV.1.18). After accounting for the socio-economic status and demographic background of students and schools and various other school characteristics, in Viet Nam and Colombia schools with better average performance tend to use this practice, while in Qatar, New Zealand, Croatia and Chile, the opposite is observed (Table IV.1.12c).

■ Figure IV.1.20 ■

Written feedback from students and equity



Note: Seeking written feedback from students refers to the percentage of students in school whose principal reported that written feedback from students regarding lessons, teachers or resources is sought for quality assurance and improvement of schools.

1. A significant relationship ($p < 0.10$) is shown by the solid line.

2. A non-significant relationship ($p > 0.10$) is shown by the dotted line.

Source: OECD, PISA 2012 Database, Table IV.1.4.

StatLink http://dx.doi.org/10.1787/888932957403

Systems with poorer overall performance tend to be those where more students are in schools whose principals reported that achievement data are tracked over time by an administrative authority. This observation holds across OECD countries and across all participating countries and economies (Table IV.1.4). This relationship is also observed at the school level in Qatar, Korea, Albania and Shanghai-China (Table IV.1.12c). In these countries and economies, schools with lower average performance tend to be those where an administrative authority tracks their achievement data over time. This negative relationship may reflect the fact that low-performing schools or systems use this practice in order to monitor school performance and hold lower-performing schools accountable. Indeed, systems where this practice is more common tend to have greater equity in education opportunities. Systems where more principals reported their achievement data are tracked over time by an administrative authority tend to show a weaker impact of the socio-economic status of students and schools on student performance in mathematics (Table IV.1.4).[22]

Across all countries and economies that participated in PISA 2012, but not across OECD countries, the extent to which schools provide an opportunity for teacher mentoring is related to equity. In the systems where more schools provide teacher mentoring, students' socio-economic status has less impact on their performance, both before and after accounting for per capita GDP (Table IV.1.4).

The analysis above has shown that system-level policies through which schools post results publicly interact with school autonomy in ways that yield better student performance. When looking at these policies in isolation at the school level, schools that post achievement data publicly perform higher in 21 countries and economies (Tables IV.1.17). But, after accounting for the socio-economic status and demographic profile of students and schools, no relationship is observed in most countries and economies (Table IV.1.12c).

Trends in the relationship between mathematics performance and school governance

Chapter 3 highlights how, in some countries and economies, the relative enrolment in public schools has increased while in others it has declined, but on average across OECD countries, the share of students attending public and private schools remained stable between 2003 and 2012. In PISA 2003, students in private schools outperformed students in public schools by 19 points in mathematics, but this difference was not observed when comparing students with similar socio-economic status. In fact, after comparing students of similar socio-economic status who attend schools with a similar socio-economic profile, students in public schools outperformed their peers in private schools by 14 points in mathematics (Table IV.4.19).

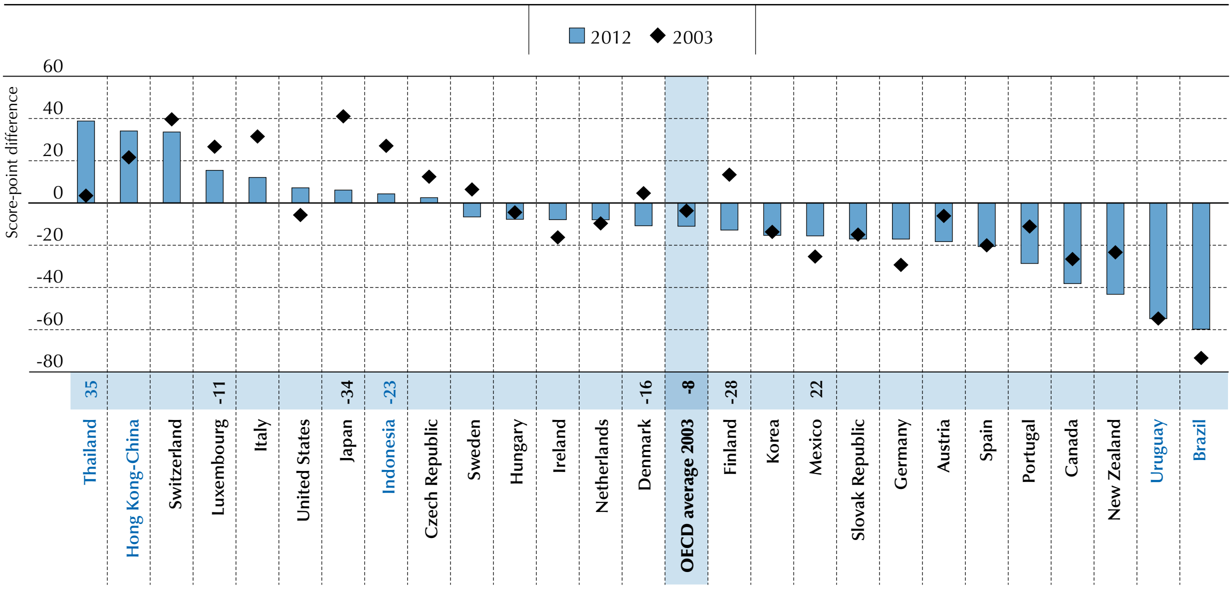
Between PISA 2003 and PISA 2012 all these differences shifted in favour of students in private schools. The overall difference in performance between public and private school students across OECD countries widened by nine points (up to 28 points in favour of students in private schools); after accounting for students of similar socio-economic status, the difference, which was not significant in 2003, was 11 points in favour of private-school students in 2012. However, after accounting for students of similar socio-economic status who attend schools with similar socio-economic profiles, the public-school advantage remained, but narrowed to nine score points.[23]

During the same period, the performance gap between private and public schools narrowed in Brazil, Ireland, Mexico and Thailand, either before or after accounting for students' socio-economic status. In Ireland, the difference in mathematics performance between students in public and private schools narrowed by 18 points, and by 2012 was one of the smallest among OECD countries, although it remains statistically significant. This trend is largely explained by the change in the socio-economic status of the students attending both types of schools. In Thailand, there was no performance gap between the two types of schools in 2003; but in 2012, public schools outperformed private schools by more than 30 score points – and this difference holds even when comparing students and schools of similar socio-economic status. In Mexico and Brazil, the performance of students in public schools also improved relative to that of students with similar socio-economic status who attend private schools. The socio-economic status of students in public schools has increased in Korea and Ireland. In 2003, students in public schools came from lower socio-economic backgrounds than students in private schools, on average. But by 2012, students in public and private schools had similar socio-economic status. In Ireland, the proportion of students from relatively advantaged socio-economic backgrounds who attended public schools grew so significantly over the period that by 2012 the socio-economic disadvantage associated with public schools was among the lowest in Ireland among all OECD countries (Figure IV.1.21 and Table IV.4.19).

■ Figure IV.1.21 ■

Change between 2003 and 2012 in the relationship between students' mathematics performance and their attendance in private or public schools, after accounting for socio-economic status

Score-point difference in mathematics performance between students in public and private schools, after accounting for students' PISA index of economic, social and cultural status



Notes: The change in the score-point difference in mathematics performance between 2003 and 2012 (2012 - 2003) is shown above the country/economy name. Only statistically significant differences are shown.
OECD average 2003 compares only OECD countries with comparable mathematics scores and attendance in private and public schools since 2003.
Only countries and economies with comparable data from PISA 2003 and PISA 2012 are shown.
Countries and economies are ranked in descending order of the score-point difference in mathematics performance between public and private schools, after accounting for students' PISA index of economic, social and cultural status *in 2012.*
Source: OECD, PISA 2012 Database, Table IV.4.19.
StatLink http://dx.doi.org/10.1787/888932957403

HOW LEARNING OUTCOMES ARE RELATED TO SYSTEMS' LEARNING ENVIRONMENTS

The results from earlier PISA assessments showed that students who are in a school climate characterised by high expectations, classrooms conducive to learning, and good teacher-student relations tend to perform better than those who are not. Building on these findings, this chapter examines disciplinary climate, teacher-student relations, teacher-related factors affecting school climate, student-related factors affecting school climate, students' sense of belonging, teacher morale, and the level of student truancy, including arriving late for school, skipping school and dropping out.

Research studying effective schools suggests a strong relationship between the quality of the learning environment and both student performance and the level of equity in the school system. Students learn more in schools that provide an orderly environment, where students feel supported by teachers, and that enjoy clearly articulated leadership by the principal, for example (Scheerens and Bosker 1997). Research also has shown that most of the variation in learning environments is found between classes or courses rather than between schools. As these differences at the classroom levels are included in within-school variation in the analyses based on PISA data, caution is advised when interpreting results.

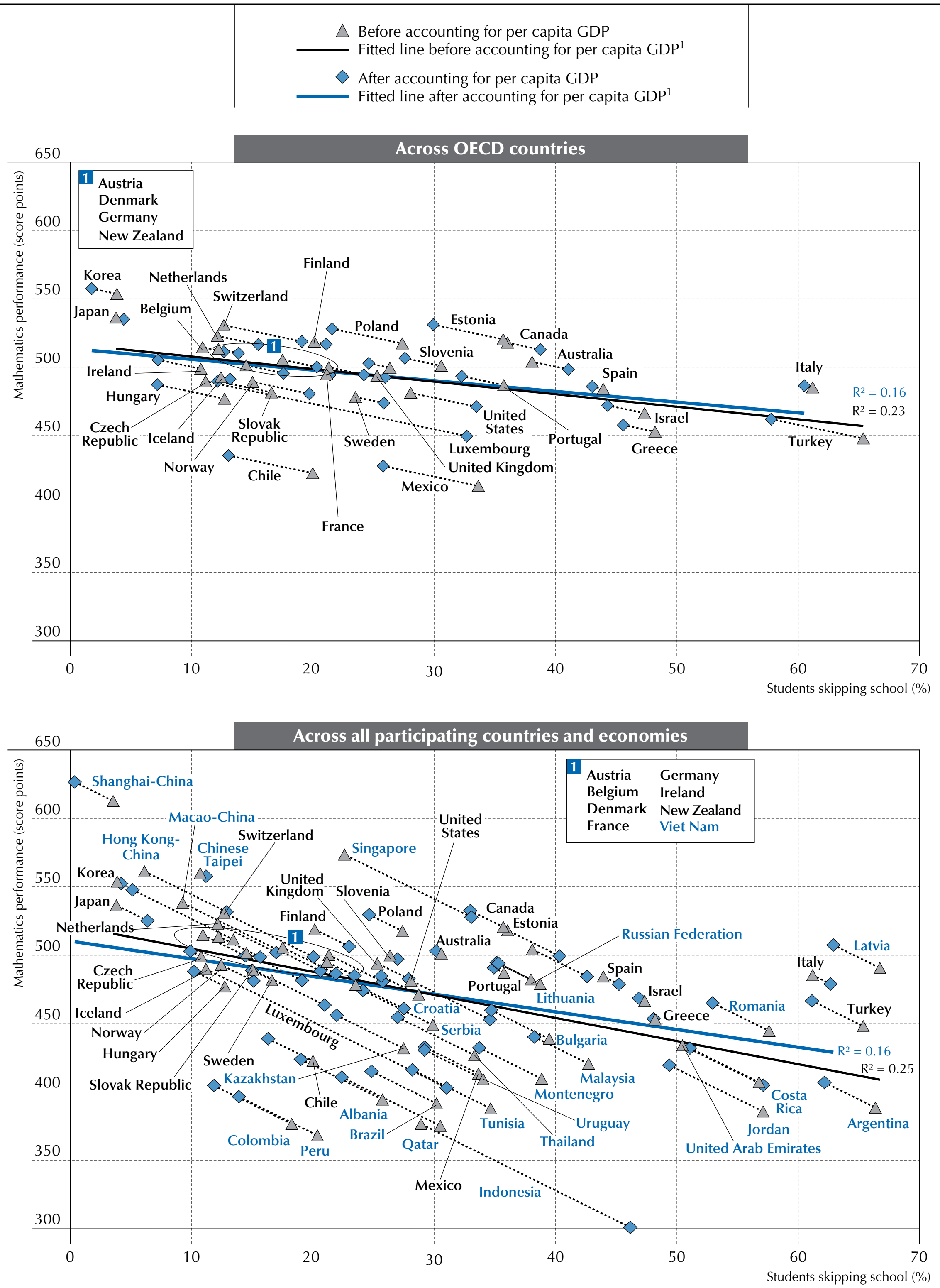
Studies of effective schools find that a school culture that prioritises high academic achievement is positively related to student achievement. In such an environment, characterised by amiable and supportive teacher-student relationships that extends beyond the boundaries of the classroom, the values held by both teachers and students are clear. In these schools, academic activities and student performance are considered central to the success of the school (Scheerens and Bosker, 1997; Sammons, 1999; Taylor, Pressley and Pearson, 2002).

Student truancy

Student truancy tends to be negatively related to systems' overall performance. Among OECD countries, after accounting for per capita GDP, systems with higher percentages of students who arrive late for school tend to have lower scores in mathematics, and systems with higher percentages of students who skip school also tend to score lower in mathematics.

■ Figure IV.1.22 ■

Students skipping school and mathematics performance



Note: Students skipping school refers to the percentage of students who had skipped a class or a day of school at least once in the two weeks prior to the PISA test.
1. A significant relationship ($p < 0.10$) is shown by the solid line.
Source: OECD, PISA 2012 Database, Table IV.1.5.
StatLink http://dx.doi.org/10.1787/888932957403

Among all countries and economies, after accounting for per capita GDP, systems with larger proportions of students who arrive late for school and skip classes tend to show lower overall performance (Table IV.1.5). As shown in Figure IV.1.22, after accounting for per capita GDP, 16% of the variation in mathematics performance across OECD countries can be explained by differences in the proportion of students who skip school. A similar result is observed among all countries and economies that participated in PISA 2012.

This negative relationship is also observed at the school level. In 29 countries and economies, schools with more students who arrive late for school tend to show lower average performance as do schools with more students who skip school. In Korea, Japan, Chinese Taipei, the Netherlands, Croatia, Slovenia, Viet Nam and New Zealand, a 10 percentage-point increase of such students corresponds to a decrease in average school performance of between 10 and 34 points, after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics (Table IV.1.12c). In Korea and Japan, a 10 percentage-point increase in such students corresponds to a drop in average school performance of 25 points and 22 points, respectively. In these countries, an below-OECD-average proportion of students attends schools where over 10% of students skipped a day or a class at least once in the two weeks prior to the PISA test, (9% in Korea and 7% in Japan, while the OECD average proportion is 73%) (see Table IV.5.4, which is discussed in Chapter 5).

School climate

Disciplinary climate is also consistently related to higher average performance at the school level. In 48 participating countries and economies, schools with better average performance tend to have a more positive disciplinary climate, even after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics (Table IV.1.12c). In-depth analysis of schools' disciplinary climates and other school features in Chapter 5 shows that, in almost all countries and economies, a school's average disciplinary climate is related to the average socio-economic status of its student population, but it is also related to other school features as well. On average across OECD countries, school size, school location, school type, and the incidence of teacher shortage are related to a school's disciplinary climate, even after accounting for all other school features (see Table IV.5.13 in Chapter 5).

Trends in the relationship between mathematics performance and the learning environment

Among OECD countries, the performance disadvantage among students who reported that they arrived late for school at least once in the two weeks prior to the PISA assessment was significantly larger in 2012 than it was in 2003. In 2003 students who had arrived late for school scored an average of 23 points lower than students who had not arrived late; by 2012, this difference had grown to 27 points. This disadvantage grew significantly, and by more than 10 score points, in the Czech Republic, Luxembourg, Norway, New Zealand, Portugal, Korea, the Slovak Republic, Canada and Ireland. In these countries and economies either the performance disadvantage associated with arriving late for school grew, or students who had arrived late for school were increasingly those who were low achievers. To the extent it is the latter association, the performance disadvantage related to arriving late for school grew because low-achieving students were more likely to have arrived late. If it's the case that low-achieving students are becoming more likely to arrive late, then it's precisely the group of students that would benefit the most from enhanced engagement with school that is arriving late and showing signs of disengagement with school. In Belgium, Turkey, Uruguay and Latvia, the performance difference between students who had arrived late for school and those who had not shrank (Table IV.1.28).

The proportion of students in a school who reported arriving late for school gives some indication of the learning environment. In both PISA 2003 and PISA 2012, students in schools with a larger concentration of students who reported to have arrived late performed worse than students in schools with a smaller proportion of students who reported so. But between 2003 and 2012 the performance disadvantage worsened among students who attended schools with a larger concentration of students who reported to have arrived late. In 2003 and on average across OECD countries, students in schools where more than one in four of their peers reported to have arrived late scored 18 points lower on the PISA mathematics assessment than students in schools where fewer than one in four of their peers so reported; by 2012, this performance difference grew significantly to 26 points. This could mean that, in 2012, a large concentration of students who had arrived late for school disrupted student learning to a greater extent than in 2003, or that schools with a higher concentration of students who had arrived late were enrolling more lower-achieving students. Whatever the reason, lower-achieving schools were more likely in 2012 than in 2003 to have learning climates that were not as conducive to learning (Table IV.1.29).

HOW THE FEATURES OF SCHOOLS AND SCHOOL SYSTEMS ARE INTERRELATED

Many of the aspects related to the organisation of school systems are closely interrelated. Figure IV.1.23 shows the relationship between school organisation and aspects of the learning environment. The aspects included in this figures are those that show a significant relationship,[24] either with performance or equity (i.e. the strength of the relationship between student socio-economic status and performance in mathematics), both across OECD countries and across all countries and economies that participated in PISA 2012.

Across OECD countries, two inter-related aspects of vertical stratification (the variation in grade levels in which 15-year-old students are enrolled, and the percentage of students who repeated one or more grades) are negatively related to school autonomy in curricula and assessments. This means that comprehensive systems that have to manage heterogeneous student populations within schools grant greater autonomy to schools to determine course content and assessment policies (Figure IV.1.23 and Table IV.1.19).

School systems that grant more discretion to schools to determine curricula and assessment policies tend to be those with fewer students who skip school. This relationship is observed both across OECD countries and across all countries and economies that participated in PISA 2012 (Figure IV.1.23 and Tables IV.1.19 and IV.1.20).

In summary, when all the indicators listed in Figure IV.1.23 and per capita GDP are related to a school system's overall performance, around 60% of the variation in performance across OECD countries is accounted for. Across all PISA-participating countries and economies, these system characteristics together with national income account for around 75% of the variation across school systems.

At the school level, after considering the socio-economic and demographic profile of students and schools as well as school organisation and the learning environment, across OECD countries, an average of 87% of the between-school variation in mathematics performance can be explained by the aspects measured by PISA (Figure IV.1.24 and Table IV.1.12a). Almost a quarter of the performance variation between schools is solely accounted for by aspects of school organisation and the learning environment measured by PISA, independent of the effect of the socio-economic status and demographic profile of students and schools. As school organisation and the learning environment are related to the socio-economic status and demographic profile of students and schools, about half of the between-school variation in performance is explained by these factors combined.

Box IV.1.5. **How to interpret the figures**

Figure IV.1.24 shows the extent to which variation in student performance is related to a particular school characteristic. The values that underlie the figures are extracted from Table IV.1.12a. The total length of the bar represents between-school variation in student performance for each country. The longer the bar, the greater the differences in student performance among schools.

Figure IV.1.24 considers the extent to which between-school variation can be explained by differences in schools' policies, practices, resources and the learning environment, either independently of students' and schools' socio-economic status and demographic profile (light blue) or jointly with those factors (dark blue). This means that the total length of the two sections (light blue and dark blue combined) present the overall variation attributable to schools' policies, practices, resources and the learning environment.

The variation jointly accounted for by both schools' policies, practices, resources and the learning environment, and students' and schools' socio-economic status and demographic profile (dark blue) indicates the extent to which school policies, practices, resources and the learning environment are inequitably distributed according to students' and schools' socio-economic status and demographic profiles.

The figure also shows the amount of variation attributable to socio-economic status and demographic background independent of schools' policies, practices, resources and the learning environment (light grey), and the amount of variation that is not attributable either to socio-economic and demographic background or to schools' policies, practices, resources and the learning environment (dark grey).

The variation in performance is presented as a percentage of the average variation in student performance across OECD countries, so that performance differences can be compared across all participating countries and economies. The OECD average variation in student performance is set to 100%.

■ Figure IV.1.23 ■

Relationship between selected policy, practice and resource indicators

Correlation coefficients between two relevant measures

Correlation coefficients range from -1.00 (i.e. a perfect negative linear association) to +1.00 (i.e. a perfect positive linear association). When a correlation coefficient is 0, there is no linear relationship between the two measures.

Upper triangle is across OECD countries

Lower triangle is across all participating countries and economies

				Vertical stratification		Horizontal stratification (between schools)	Financial resources	Material resources	Time resources	Inequity in allocation of material resources	School autonomy	Assessment and accountability policies		Student truancy	
				Standard deviation of grade levels in which 15-year-olds are enrolled	Percentage of students who repeated one or more grades	Number of years between age of selection and age 15	Teachers' salaries relative to per capita GDP[1]	Average index of quality of schools' educational resources	Percentage of students reporting that they had attended pre-primary education for more than one year	Difference in the index of quality of schools' educational resources between socio-economically advantaged and disadvantaged schools[2]	Average index of school responsibility for curriculum and assessment	Percentage of students in schools that use achievement data to have their progress tracked by administrative authorities	Percentage of students in schools that seek written feedback from students for quality assurance and improvement	Percentage of students who arrived late for school in the two weeks prior to the PISA test	Percentage of students who skipped some lessons or a day of school in the two weeks prior to the PISA test
			Mathematics performance	*-0.31[x]*	-0.25	0.10	*0.31*	**0.58**	*0.30[x]*	**-0.55**	**0.58**	*-0.31*	*0.34*	**-0.44**	**-0.40**
		Mathematics performance	Inequity	**0.56**	**0.45**	*0.32[x]*	-0.02	0.04	-0.04	0.04	-0.11	0.04	*-0.31*	0.01	-0.12
Vertical stratification	Standard deviation of grade levels in which 15-year-olds are enrolled	**-0.36**	**0.26**		**0.71**	**0.45**	0.18	-0.08	-0.20	0.17	*-0.31*	0.02	-0.16	0.01	0.12
	Percentage of students who repeated one or more grades	**-0.34**	**0.25**	**0.80**		0.25	**0.42**	0.10	0.06	0.07	*-0.31*	-0.02	-0.24	-0.01	0.01
Horizontal stratification (between schools)	Number of years between age of selection and age 15	0.12	**0.42**	0.19	0.16		-0.05	0.01	0.17	-0.28	-0.02	*-0.29*	0.16	**-0.48**	-0.24
Financial resources	Teachers' salaries relative to per capita GDP[1]	-0.05	-0.21	-0.04	0.16	-0.12		**0.37**	-0.18	0.03	0.00	-0.13	0.06	-0.08	-0.09
Material resources	Average index of quality of schools' educational resources	**0.51**	0.15	**-0.28[x]**	-0.20	0.16	0.05		0.12	-0.20	0.28	-0.20	0.10	**-0.36**	-0.23
Time resources	Percentage of students reporting that they had attended pre-primary education for more than one year	**0.57**	*0.23[x]*	**-0.25[x]**	-0.08	*0.23*	*-0.24[x]*	**0.46**		**-0.44**	*0.34*	**-0.35**	-0.09	**-0.50**	**-0.46**
Inequity in the allocation of material resources	Difference in the index of quality of schools' educational resources between socio-economically advantaged and disadvantaged schools[2]	**-0.44**	0.12	**0.44**	**0.35**	**-0.28**	-0.06	**-0.42**	**-0.32**		*-0.31*	**0.39**	0.03	**0.34**	**0.37**
School autonomy	Average index of school responsibility for curriculum and assessment	**0.37**	-0.11	-0.08	-0.11	-0.03	-0.14	*0.21*	**0.39**	-0.14		-0.20	0.26	**-0.36[x]**	**-0.41**
Assessment and accountability policies	Percentage of students in schools that use achievement data to have their progress tracked by administrative authorities	**-0.32**	-0.07	0.00	-0.06	*-0.22*	0.11	*-0.22*	**-0.39**	**0.25**	**-0.28**		0.22	**0.55**	0.28
	Percentage of students in schools that seek written feedback from students for quality assurance and improvement	0.20	**-0.29**	-0.06	**-0.25[x]**	0.01	-0.08	0.17	-0.03	0.06	0.17	*0.21*		0.02	0.02
Student truancy	Percentage of students who arrived late for school in the two weeks prior to the PISA test	**-0.43**	*0.22[x]*	0.08	0.12	-0.20	-0.18	**-0.36**	**-0.34**	**0.28**	**-0.33**	**0.37**	-0.18		**0.60**
	Percentage of students who skipped some lessons or a day of school in the two weeks prior to the PISA test	**-0.41**	-0.08	0.01	0.00	-0.18	-0.12	**-0.25**	**-0.39**	**0.25**	**-0.40**	**0.32**	-0.06	**0.65**	

Notes: Values that are statistically significant at the 10% level (p<0.10) are indicated in italics and at the 5% level (p<0.05) are in bold. X indicates that the Pearson's correlation coefficient is significant at least at the 10% level but Spearman's rank correlation coefficient is not significant at the 10% level. Inequity refers to variation in mathematics performance explained by the *PISA index of economic, social and cultural status of students*. Correlations with mathematics performance and inequity are partial correlation coefficients after accounting for per capita GDP.

1. Weighted average of upper and lower secondary school teachers. The average is computed by weighting teachers' salaries for upper and lower secondary school according to the respective 15-year-old students' enrolment (for countries and economies with available information on both the upper and lower secondary levels).

2. See Box IV.3.1 for the definition of socio-economically advantaged and disadvantaged schools.

Source: OECD, PISA 2012 Database, Tables IV.1.1, IV.1.2, IV.1.3, IV.1.4, IV.1.5, IV.1.19 and IV.1.20.

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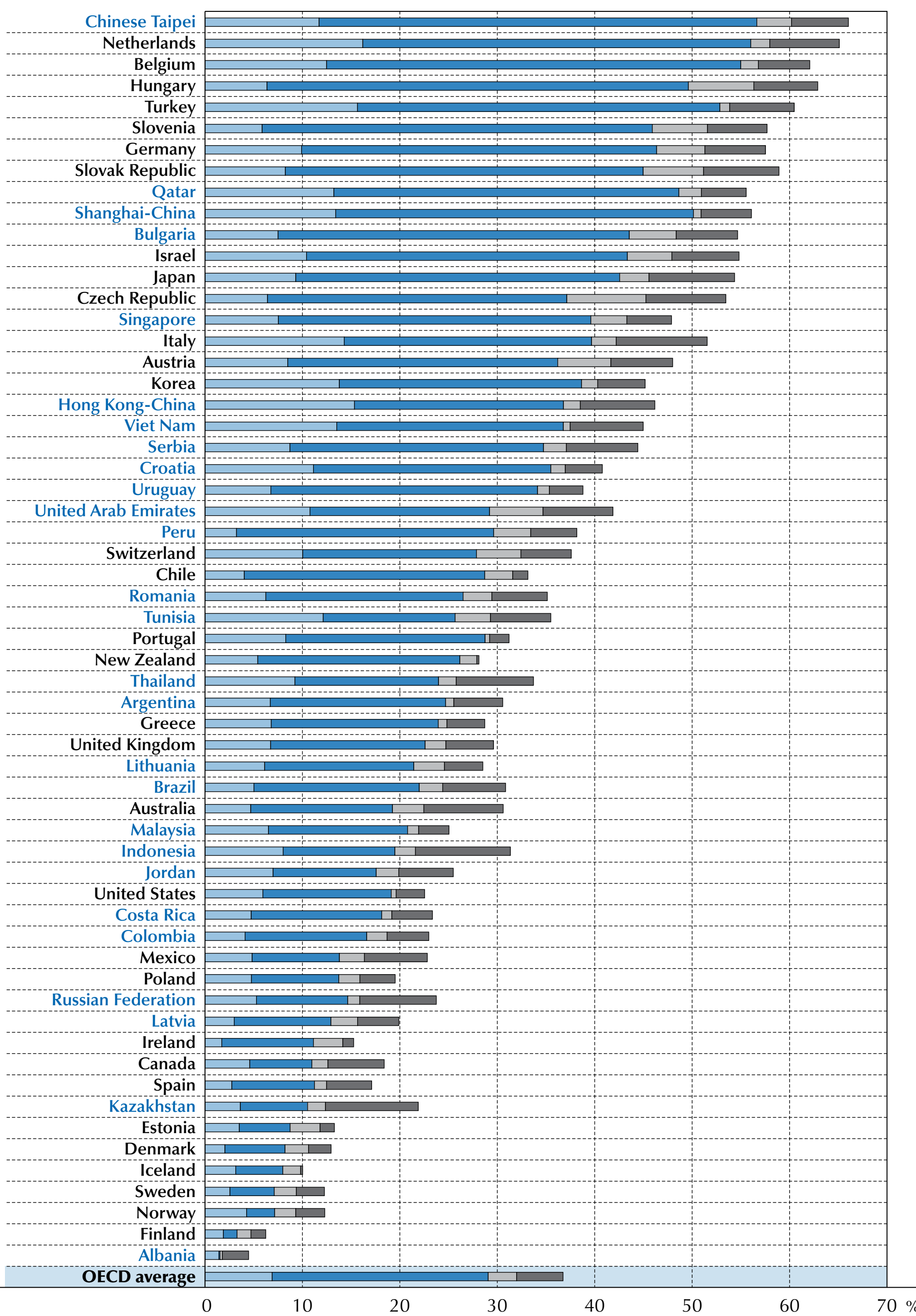
■ Figure IV.1.24 ■

How school characteristics are related to mathematics performance

Expressed as a percentage of the average variation in mathematics performance in OECD countries (100% is the average total variation in mathematics performance across OECD countries)

Variation in mathematics performance accounted for:

- Solely by schools' policies and practices, resources and the learning environment
- Jointly by schools' policies and practices, resources and the learning environment and students' and schools' socio-economic status and demographic profile
- Solely by students' and schools' socio-economic status and demographic profile
- Unaccounted for by any of the above aspects



Countries and economies are ranked in descending order of the between-school variation accounted for by schools' policies and practices, resources and the learning environment and students' and schools' socio-economic status and demographic profile, whether solely or jointly.
Source: OECD, PISA 2012 Database, Table IV.1.12a.
StatLink http://dx.doi.org/10.1787/888932957403

Notes

1. These data are extracted from *Education at a Glance 2013: OECD Indicators* (OECD, 2013c) for the countries that participate in the regular annual OECD data collection that is administered through the INES Network. For other countries and economies, a special system-level data collection was conducted in collaboration with PISA Governing Board members and National Project Managers.

2. While Pearson's correlation coefficients are presented in Tables IV.1.1, IV.1.2, IV.1.3, IV.1.4 and IV.1.5, Spearman's rank correlation coefficients are also examined in order to confirm the robustness of the results. When outliers drive the results, Pearson's correlation coefficients are stronger than Spearman's correlation coefficients. Thus, the cases where Pearson's correlation coefficient is significant at least at the 10% level but Spearman's rank correlation coefficient is not significant at the 10% level are flagged in the tables. The same procedure is applied to partial correlation coefficients.

3. The percentage is obtained by squaring the partial correlation coefficient and then multiplying it by 100.

4. Partial correlation coefficients are -0.36 among all participating countries and economies (significant at the 5% level).

5. Selection bias in this case refers to how to separate the effect of grade repetition from differences in achievement due to the selection of students who must repeat grades.

6. The partial correlation coefficient is -0.34.

7. These estimates do not address either the potential benefits of grade repetition or the costs if school systems do not allow for grade repetition. For example, students who had repeated a grade might be better prepared for the labour market than if they had not done so. And schools might have to spend more to offer remedial classes to struggling students if those students are not permitted to repeat a year.

8. Throughout this section, and the entire volume, trends in the OECD average refer to the group of OECD countries that have comparable data from PISA 2003 and PISA 2012. In general, this excludes Chile, Estonia, Israel and Slovenia, which did not take part in PISA 2003. For school-level resources, policies and practices, this also excludes France, which did not distribute the school questionnaire to school principals in PISA 2003.

9. Trends analyses on student performance are available only for the 39 countries and economies that participated in PISA 2012, distributed the PISA 2003 questionnaire, and have comparable samples for the two assessments. PISA 2003 did not include questions on school competition, teacher appraisal, school transfers, skipping school, dropping out of school, attending after-school lessons, parental pressure or parental involvement. It is thus not possible to determine trends for these. Similarly, some questions relating to the same policy or practiced changed between PISA 2003 and PISA 2012, making it impossible to track trends related to them. Such is the case for school admission policies, teaching staff qualifications, and school's responsibility for resource allocation and curricula.

With respect to school admission policies, in 2003, question SC10 asked, for each admission criteria, "How much consideration is given to the following factors when students are admitted to your school?" offering the following response options "Prerequiste", "High priority", "Considered" or "Not considered". In 2012, question SC32 asked, "How often are the following factors considered when students are admitted to your school?" and offered "Never", "Sometimes" and "Always" as response options.

With respect to teaching staff qualifications, although both PISA 2003 and PISA 2012 questionnaires asked school principals about the total number of teachers in the school and the number of those who hold an ISCED 5A (university-equivalent) degree and those who have a teaching certificate, the questions are not comparable. PISA 2012 asked school principals, in broad terms, about the number of teachers in the school who hold an ISCED 5A degree; PISA 2003 asked about the number of teachers in the school who hold an ISCED 5A degree in pedagogy.

Finally, with respect to schools' responsibility for resource allocation and curricula, in the PISA 2003 questionnaire, school principals were asked, "In your school, who has the main responsibility for <each governance attribute>" and were offered the following response options: "Not a main responsibility of the school", "School's governing board", "Principal", "Department Head" or "Teachers". In the PISA 2012 questionnaire, school principals were asked, "Regarding your school, who has a considerable responsibility for <each governance attribute>" and were offered the following response options: "Principal", "Teachers", "School governing board", "Regional or local education authority", "National education authority". In both PISA 2003 and PISA 2012, school principals could select as many response options as appropriate.

10. Caution is required when interpreting how the relationship between students' mathematics performance and educational resources, policies and practices has evolved over time. Two reasons explain why this change can occur. First, the resource, policy or practice could have become more strongly related to mathematics performance because it promotes mathematics performance more in 2012 than it did in 2003. Second, higher-performing students and schools may have been more likely to implement this particular resource, policy or practice in 2012 than they were in 2003.

The use of student-assessment data for judging teacher effectiveness provides an example:

In PISA 2003, and on average across OECD countries that have comparable data from PISA 2003 and PISA 2012, students in schools where observations by external personnel were used to monitor teacher practice outperformed students in schools where observations by external personnel were not used to monitor teacher practice. In PISA 2012, however, students in schools that use such observations

to monitor teacher practice underperformed compared with students in schools that did not use observations by external personnel for this purpose. This relationship holds, on average, across OECD countries, but is observed in only six OECD countries. One possible explanation for this reversal is that, on average across OECD countries, monitoring teachers by external personnel became less effective as a tool to promote learning. This explanation implies that the underlying process of using external observations to monitor teacher practice became less effective during the period. If, indeed, there was such a change, the specifics of this change remain unknown. PISA data cannot distinguish whether the reduced effectiveness of external monitoring – assuming that this explains the observed change – results from a change in the way the external monitors conducted their observations, the way school principals and teachers reacted to these observations, or the way students reacted to the teachers' and principals' reactions to the external observations. In addition, it is not possible to conclude from PISA trends analyses whether this hypothetical reduction in the effectiveness of external observations also applies to schools and school systems that had not yet chosen to use this type of observation, since instruction and learning may benefit from external observations of teacher practices.

Another explanation for this trend posits that the efficacy of external observations remained unchanged over the period, but that the types of schools that chose to use them have changed. Under this argument, better-performing schools tended to use external monitoring in 2003, but were less likely to do so by 2012. It could be the case that schools that used external observations in 2012 were those that were aware of their lower performance levels compared to schools in 2003. This alternative explanation suggests that schools used external observations *because* they showed poorer performance, as opposed to performing poorly because they used external observations. That causation between students' performance and the use of external observations could go either way underscores the importance of applying caution in interpreting these results.

11. It is difficult to explain these trends without further analyses of how students are selected into schools and the heterogeneity of these student populations. PISA was unable to undertake these analyses because variables on schools' admission criteria are not comparable between PISA 2003 and PISA 2012 (see note 3).

12. Comparisons of expenditure data from 2003 and 2012 are limited to a subset of 24 countries. Analyses for 2012 consider 48 countries and economies with information on cumulative expenditure on education for students aged 6 to 15. Of the countries and economies analysed in 2012, 16 did not participate in PISA 2003 and 7 do not have information on cumulative expenditure in 2003. Seven of the countries and economies not included in the trends analysis had cumulative expenditure per student above USD 50 000 and 17 had cumulative expenditures under USD 50 000 in 2012.

13. Across OECD countries, the correlation is 0.32.

14. The correlation is -0.22 across 17 countries and economies whose per capita GDP is less than USD 20 000.

15. Statistically significant coefficients in Table IV.1.2 are mainly the result of outliers. For example, the correlation between the student-teacher ratio and performance is -0.48 across OECD countries, but it is 0.09 after excluding two countries with extreme student-teacher ratios (31 in Mexico and 22 in Chile, while the average ranges from 8 to 18 in other OECD countries).

16. 46% = 17% / (8%+3%+17%+9%).

17. Across OECD countries, the correlation between mathematics performance and average learning time in regular mathematics lessons is -0.30 (significant at the 10% level), but this is mainly because of outliers.

18. Chapters 2, 3 and 4 of this volume and other volumes of this series highlight other country's improvements in PISA and outline their recent policy trajectories (e.g. Poland in Chapter 2, Tunisia in Chapter 3 and Colombia in Chapter 4 of this volume, Brazil, Turkey, Korea and Estonia in Volume I, Mexico and Germany in Volume II, and Japan and Portugal in Volume III).

19. Across OECD countries, the correlation between the degree of competition and equity is 0.33 (significant at the 10% level), while it is 0.23 after excluding Norway, where there is less school competition than in other countries (i.e. the degree of school competition is 35% in Norway, while it varies from 42% to 94% in other OECD countries).

20. Across all participating countries and economies with available data, the correlation between the percentage of students in private schools and the difference in mathematics performance between public and private schools is 0.14.

21. After accounting for per capita GDP, the correlation is 0.34 across OECD countries and 0.20 across all participating countries and economies.

22. Across OECD countries, the correlation is -0.33 after accounting for per capita GDP and it is -0.31 across all participating countries and economies.

23. The set of countries used to calculate trends in OECD averages includes only those OECD countries that have comparable data in PISA 2003 and PISA 2012 for the variable being examined.

24. Significant at the 10% level ($p < 0.10$).

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