2

Student Background and Low Performance

This chapter examines the many ways that students' backgrounds affect the risk of low performance in PISA. It considers the separate and combined roles played by students' socio-economic status, demographic characteristics, and progression through education, from pre-primary school up to age 15.

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.

Low performance is not associated with a single student or school characteristic. Rather, over time, a combination and accumulation of factors and experiences in the family, the school and the education system may limit opportunities for learning and thus undermine student performance. This chapter focuses on student-related factors, specifically students' socio-economic, demographic and education background (Figure 2.1). New analyses explore the relationship between these variables and low performance, and describe the cumulative effect of these variables on student performance.

What the data tell us

- Differences in student's socio-economic, demographic and education background explain 15% of the variation in low performance across students, on average across OECD countries.
- On average across OECD countries, a student of average socio-economic status who is a boy living in a two-parent family, has no immigrant background, speaks the same language at home as in school, lives in a city, attended more than one year of pre-primary education, did not repeat a grade and attends a general curricular track (or school) has a 10% probability of low performance in mathematics, while a student with the same socio-economic status but who is a girl living in a single-parent family, has an immigrant background, speaks a different language at home than at school, lives in a rural area, did not attend pre-primary school, repeated a grade and attends a vocational track has a 76% probability of low performance.
- Other than socio-economic status, grade repetition is the single factor most strongly associated with low performance. After accounting for socio-economic background and other student characteristics, the odds of low performance in mathematics are 6.4 times greater for a student who has repeated a grade in primary or secondary school compared to a student who has not repeated a grade, on average across OECD countries.

As the chapter reveals, social and demographic background do not determine student achievement, but they do create the conditions for opportunities – or the lack of them – that influence students' progression through the school system. Attending pre-primary education, for example, is a positive experience that puts potential low performers on a better track; but not every child is enrolled in pre-primary education, and those who do attend, do so for different lengths of time. Similarly, while many countries do not allow their students to repeat grades or to be separated into education tracks at an early age, wherever grade repetition and early tracking occur, they tend to be strongly linked with poor performance at age 15.

The findings of the chapter highlight the need to address multiple risks simultaneously and to tailor policies to local contexts. They also confirm the importance of identifying students at high risk of low performance early on so that they can be given the support they need and avoid the deleterious effects of grade repetition.

■ Figure 2.1 ■

Student background and low performance

Potential areas of risk	Sub-areas	Risk factors
Socio-economic status	Economic, cultural and social status	Socio-economic disadvantage
Demographic background	Gender	Being a girl (in mathematics)
		Being a boy (in reading and science)
	Immigrant background	Immigrant background
	Language spoken at home	Different from mainstream language
	Location	School in a rural area
	Family structure	Single-parent family
Progress through education	Attendance at pre-primary education	No pre-primary education
	Grade repetition	Repeated at least one grade
	Programme orientation	Enrolled in a vocational track

The first part of the chapter explores the multidimensional nature of the risk of low performance by analysing each of the nine risk factors separately. The second part explores the cumulative nature of the risk of low performance by showing how the probability of low performance in mathematics increases among students with different combinations of risk factors.

THE MULTIDIMENSIONAL RISK OF LOW PERFORMANCE

Socio-economic background

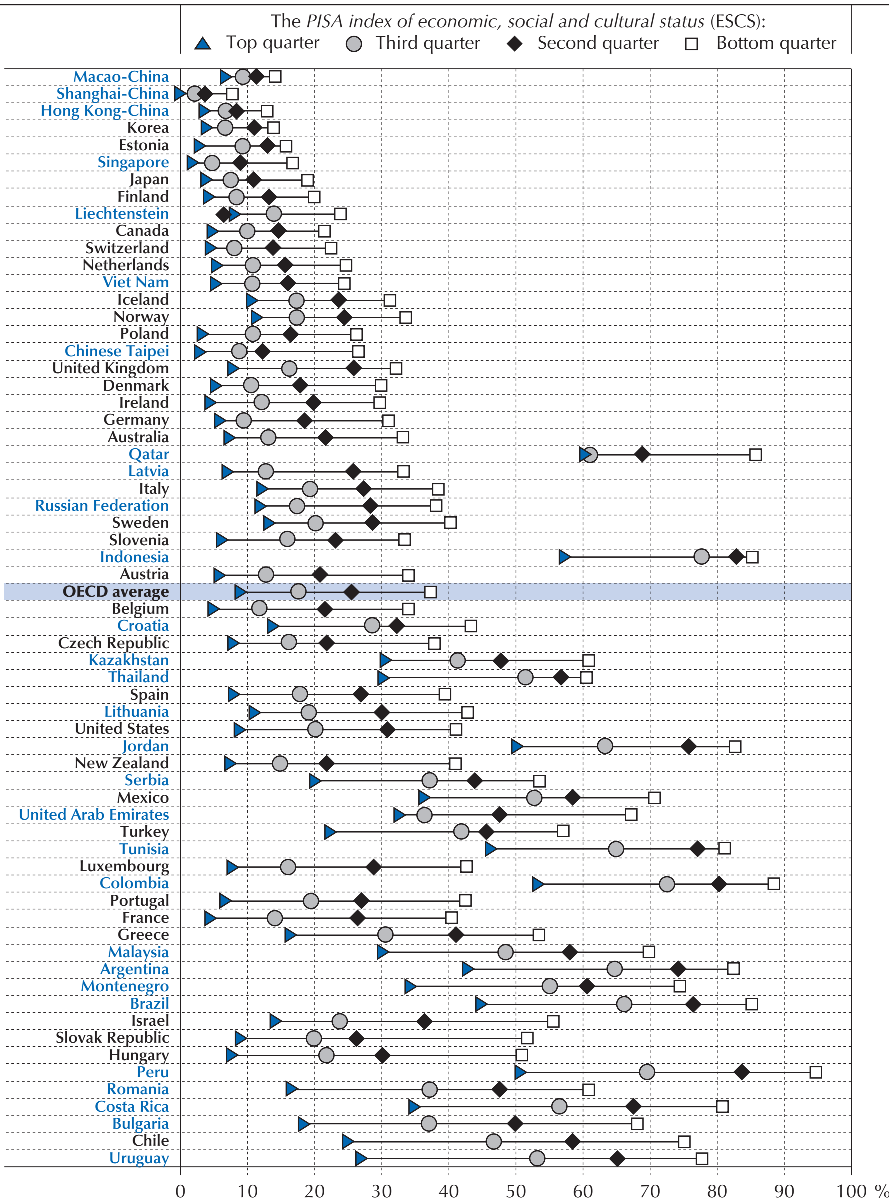
The effects of socio-economic background on student achievement are well-known, and specific economic and cultural mechanisms linking students' background and achievement have been studied extensively (e.g. Bourdieu, 1986; Coleman, 1988; Kao and Thompson, 2003; Paino and Renzulli, 2013; Baker, Goesling and LeTendre, 2002). Students whose parents have higher levels of education and more prestigious and better-paid jobs benefit from accessing a wider range of financial (e.g. private tutoring, computers, books), cultural (e.g. extended vocabulary, time-management skills) and social (e.g. role models and networks) resources that make it easier for them to succeed in school, compared with students from families with lower levels of education or from families that are affected by chronic unemployment, low-paid jobs or poverty. For this reason, the primary measure of equity in education outcomes used in PISA is the relationship between the *PISA index of economic, social and cultural status* (ESCS)[1] and student performance (OECD, 2013a).

At the same time, the link between socio-economic status and student achievement is neither absolute nor automatic, and should not be overstated. Regardless of the school subject concerned, ESCS explains about 15% of the variation in PISA scores, on average across OECD countries, with substantial differences across countries. Many countries have managed to reduce the influence of socio-economic background on performance over time. In addition, some 6% of students across OECD countries are considered "resilient" in that, while they are disadvantaged, they manage to beat the odds against them and perform among the top quarter of students in PISA (OECD, 2013a).

■ Figure 2.2 ■

Socio-economic status and low performance in mathematics

Percentage of low performers in mathematics, by socio-economic quartiles



Note: Differences between the top and the bottom quarter of ESCS are statistically significant in all countries and economies.
Countries and economies are ranked in ascending order of the difference in the percentage of students who are low performers in mathematics between the top and bottom quarters of ESCS.
Source: OECD, PISA 2012 Database, Table 2.1.
StatLink http://dx.doi.org/10.1787/888933315272

While low performers come from all socio-economic backgrounds, they are disproportionately disadvantaged. As shown in Figure 2.2, the difference in the percentage of low performers in mathematics between the top and the bottom quartile of ESCS varies considerably across countries, but is significant in all countries and economies that participated in PISA 2012. On average across OECD countries, 37% of disadvantaged students are low performers in mathematics, compared to nearly 10% of advantaged students, a difference of around 28 percentage points. In Bulgaria, Chile and Uruguay, that difference is around 50 percentage points, while in Hong Kong-China, Korea, Macao-China and Shanghai-China, the difference is less than 10 percentage points (Table 2.1).

It is possible, however, that other factors related to student background, such as students' demographic characteristics and their progression through education, might be correlated with both students' socio-economic status and academic achievement, and may partially account for the differences displayed in Figure 2.2. For example, students from immigrant families or those studying in vocational tracks often come from disadvantaged families (OECD, 2013a). A more precise way to calculate the specific association between socio-economic status and low achievement is to hold other potential factors constant.

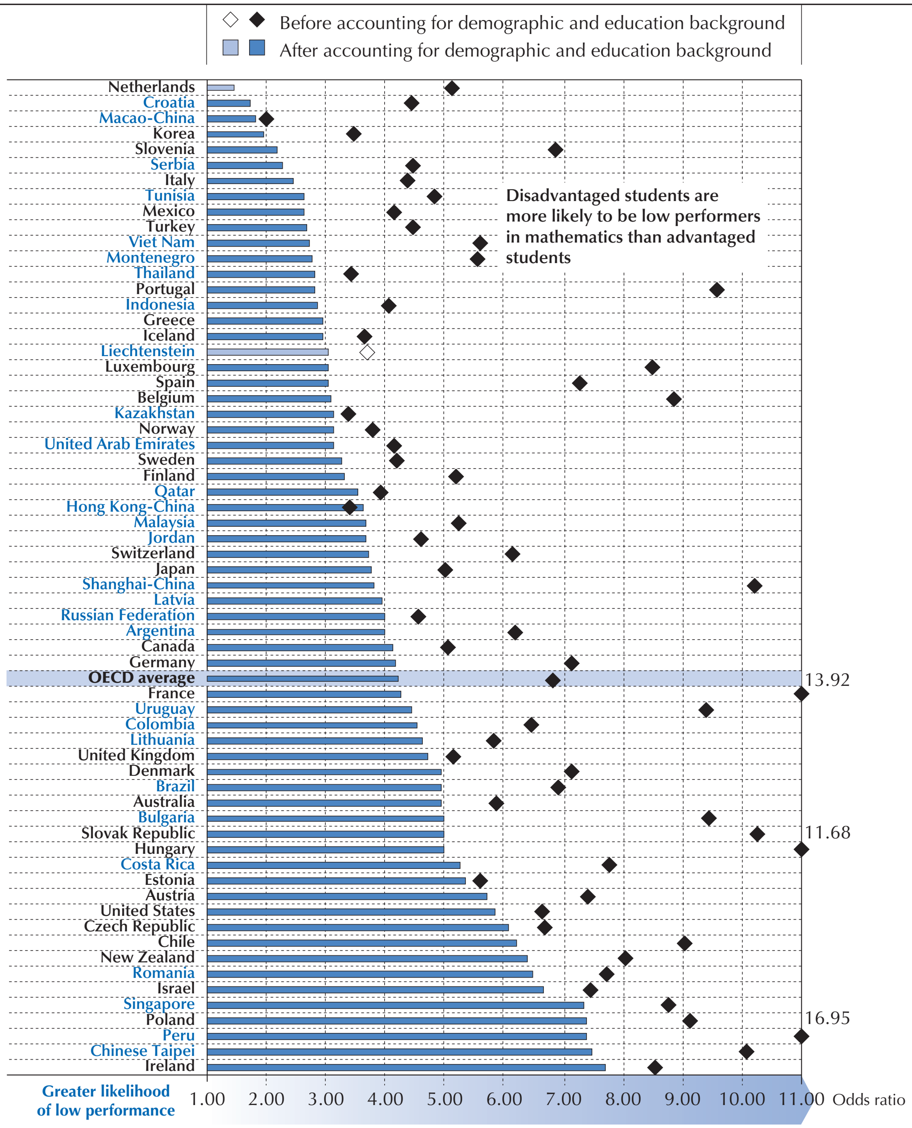
Figure 2.3 shows the association between students' socio-economic status and low performance in mathematics before and after accounting for students' demographic characteristics and progression through education. Greater values in the odds ratio indicate a stronger association of socio-economic background and low performance. More specifically, values in the figure indicate how much greater are the chances of low performance for socio-economically disadvantaged students (those in the bottom quarter of the ESCS index) compared with socio-economically advantaged students (those in the top quarter of the ESCS index).

The figure reveals that the influence of socio-economic status on the likelihood of low performance in mathematics is partially weakened, yet remains statistically significant and strong, in all countries and economies that participated in PISA 2012 (except Liechtenstein and the Netherlands), even after accounting for students' demographic characteristics and education career. On average across OECD countries, the odds of low performance for a disadvantaged student are almost seven times higher (odds ratio of 6.8) as those for an advantaged student before accounting for other student characteristics, and more than four times as high (odds ratio of 4.2) after other student characteristics have been taken into account. This indicates that these other dimensions of student background have a substantial mediating effect on performance (Table 2.2).

Countries differ in the extent to which other student characteristics mediate the relationship between socio-economic disadvantage and underachievement. In some countries and economies, such as Belgium, France, Hungary, Luxembourg, Peru, Portugal, Shanghai-China, the Slovak Republic and Uruguay, the odds of low performance among disadvantaged students decreases considerably after accounting for demographic and education background. In Estonia, Hong Kong-China, Kazakhstan, Macao-China, Qatar and the United Kingdom, these other student characteristics have a weaker mediating effect (the odds vary less than 0.6 after accounting for other variables (Table 2.2).

■ Figure 2.3 ■

Socio-economic status and the likelihood of low performance in mathematics



Notes: Disadvantaged students are those in the bottom quarter of the *PISA index of economic, social and cultural status* (ESCS); advantaged students are those in the top quarter of the index.
Statistically significant coefficients are marked in a darker tone.
Demographic and education background covariates include: gender, immigrant background, language spoken at home, location of student's school (rural area, town or city), family structure, attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of students with disadvantaged socio-economic status performing below baseline Level 2 in mathematics, compared with students with advantaged socio-economic status, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.2.
StatLink http://dx.doi.org/10.1787/888933315284

Box 2.1 **How odds ratios are calculated and interpreted**

Some of the figures in this report use odds ratios to assess the increased likelihood that a student with certain characteristics (e.g. a student who is a girl or who attends a school with more supportive teachers) will perform below the baseline level of proficiency in PISA. Three outcomes are possible for the odds ratios (OR):

- OR = 1 Student or school characteristic does not affect the odds of low performance
- OR > 1 Student or school characteristic is associated with higher odds of low performance
- OR < 1 Student or school characteristic is associated with lower odds of low performance

In odds ratios, student or school characteristics of interest are compared with a predetermined reference category. For example, to analyse the relationship between the predictor variable "gender" and the outcome variable "mathematics low performance", girls were chosen as the category of interest and assigned a value of 1, and boys were defined as the reference category and assigned a value of 0. Odds ratios can be interpreted in such a way that for a one-unit change in the predictor variable (e.g. the student is a girl instead of a boy), the odds ratio of performing below the baseline in mathematics, relative to the reference category (e.g. the student is a boy), is expected to change by a certain factor (by 1, more than 1 or less than 1). The same interpretation holds when other variables are accounted for (i.e. held constant) in the model.

Odds ratios in this chapter are based on binary logistic regression analyses. These analyses allow for an estimation of the relationship between one or more independent variables (predictors) and a dependent variable with two categories (binary outcome). The outcome variable in these analyses was whether a student performed below (value 1) or above (value 0) the baseline level of proficiency in mathematics. Binary logistic regression analyses were conducted for each country separately because prior analysis showed noticeable differences in regression coefficients between countries. When a logistic regression is calculated, the statistical software (Stata) first generates the regression coefficient (s), which is the estimated increase in the log odds of the outcome per unit increase in the value of the predictor variable. Then, the exponential function of the regression coefficient is obtained, which is the odds ratio (OR) associated with a one-unit increase in the predictor variable. The transformation of log odds into odds ratios (OR) makes the data easier to interpret. The OECD average is the arithmetic mean of the odds ratios of OECD countries.

Note that with cross-sectional data such as PISA data, no causal relations can be established.

Demographic background

Gender

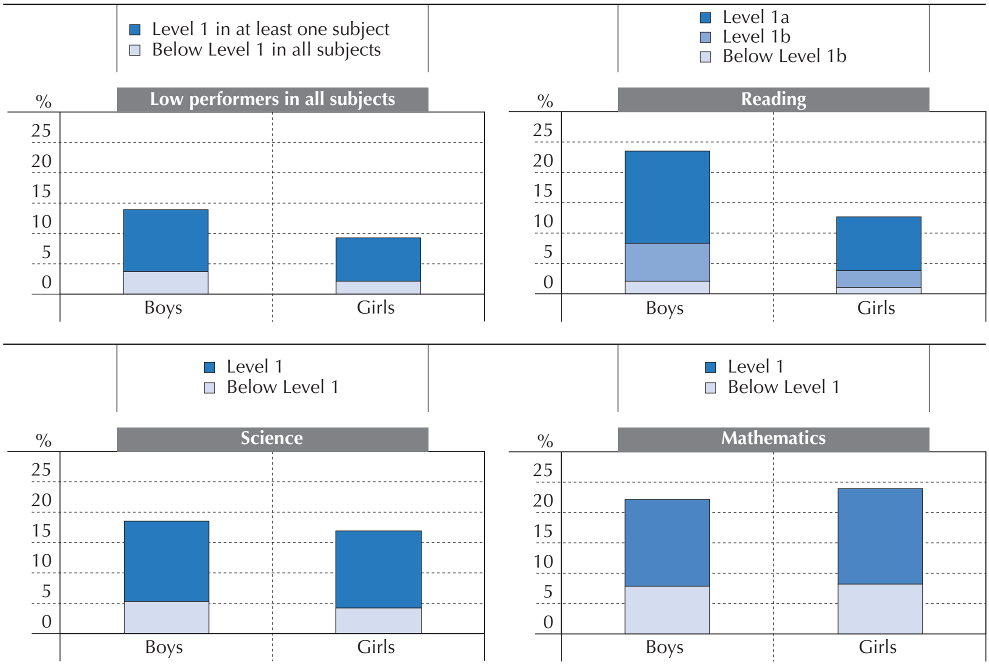
In most countries and economies, differences in student performance related to gender are large – and complex. A recent PISA report that examined this issue in depth (OECD, 2015a) shows that gender differences in achievement are not explained by innate ability; instead, social and cultural contexts reinforce stereotypical attitudes and behaviours that, in turn, are associated with gender differences in student performance. For example, boys are significantly more likely than girls to be disengaged from school, get lower marks, to have repeated grades, and to play video games in their free time, whereas girls tend to behave better in class, get higher marks, are less likely to repeat grades, spend more time doing homework, and read for enjoyment, particularly complex texts, such as fiction, in their free time. But girls are less likely than boys to believe that they can successfully perform mathematics and science tasks at designated levels (low self-efficacy), are more likely than boys to feel anxious about mathematics, are less likely than boys to be enrolled in technical and vocational programmes, and are also less likely than boys to gain "hands-on" experience, through internships or job shadowing, in potential careers.

Figure 2.4 shows the percentage of low performers in all subjects and in reading, mathematics and science separately. On average across OECD countries in 2012, 14% of boys and 9% of girls did not attain the baseline level of proficiency in any of the three core PISA subjects (Table 2.3b). Boys perform significantly worse than girls in reading: 24% of boys but only 12% of girls score below the baseline level of proficiency in reading. In every country and economy that participated in PISA 2012, the share of low performers in reading is larger among boys than among girls (Table 2.3a).

■ Figure 2.4 ■

Percentage of low-performing students in mathematics, reading, science, and in all three subjects, by proficiency level and gender

OECD average



Source: OECD, PISA 2012 Database, Table 2.4.

StatLink http://dx.doi.org/10.1787/888933315297

In science, 19% of boys and 17% of girls, on average across OECD countries, performed below the baseline level of proficiency in PISA 2012. In 27 countries and economies, a larger share of boys than girls were low performers in science; in Bulgaria, Jordan, Qatar, Thailand and the United Arab Emirates, this difference was equal to or larger than 10 percentage points. In Colombia, Costa Rica, Luxembourg and Mexico, the share of science low performers was larger among girls than boys (Table 2.3a).

In mathematics, however, the picture is inverted. On average across OECD countries in PISA 2012, 24% of girls and 22% of boys were low performers in mathematics. In 17 countries and economies, there were significantly more girls than boys who were low performers in mathematics, whereas in only eight countries (including Finland and Iceland, the only OECD countries in this group) was there a statistically significant difference in favour of girls (Table 2.3a). Between 2003 and 2012, there was a small yet statistically significant increase of 0.8 percentage point in the share of girls scoring below Level 2 in mathematics, on average across OECD countries, while no trend, positive or negative, was observed among boys (OECD, 2014a, Table I.2.2b).

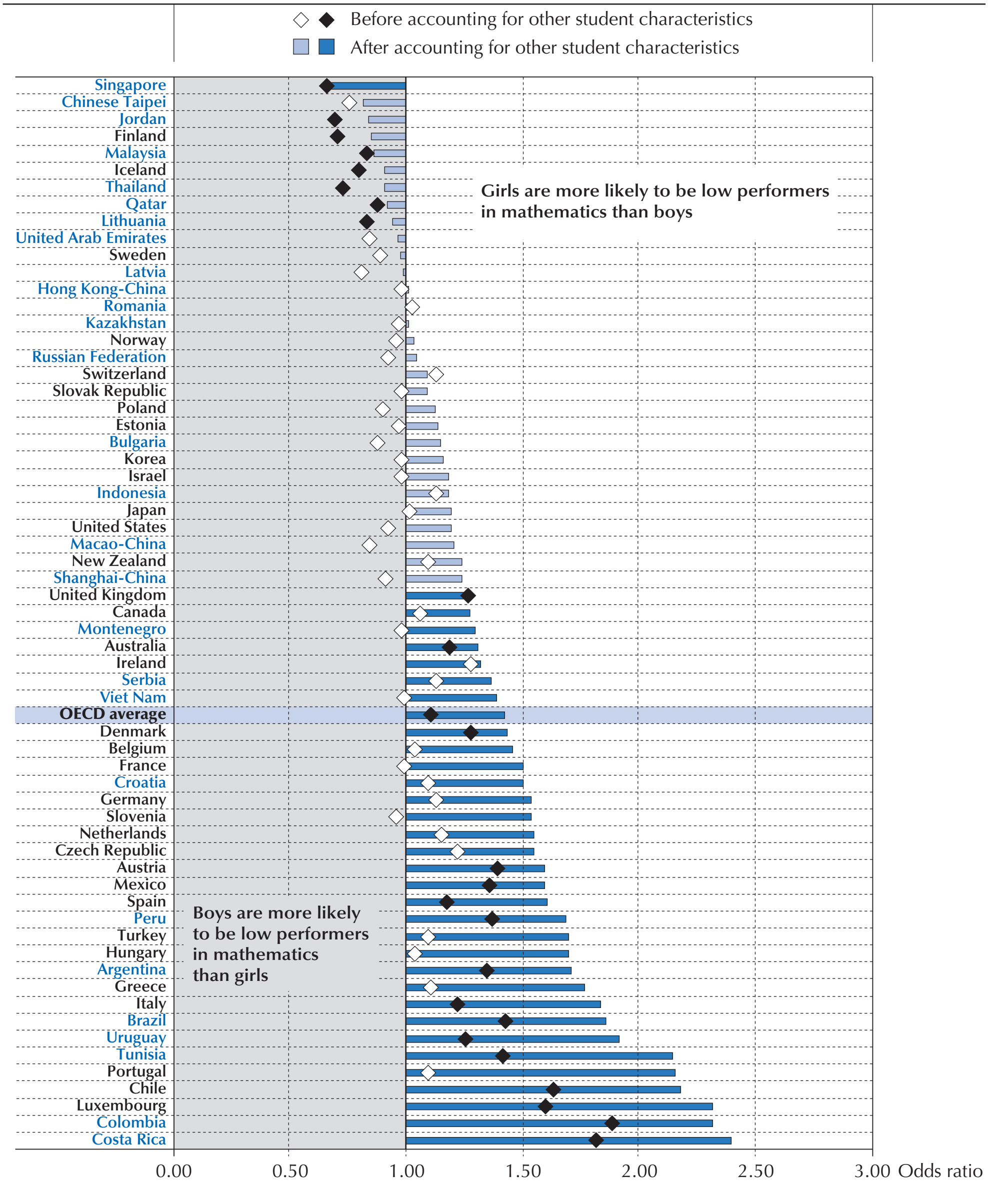
Girls are more likely than boys to be low achievers in mathematics even after student background characteristics (socio-economic status, family structure, immigrant background, language spoken at home, geographic location, attendance at pre-primary school, grade repetition and curricular track at age 15) are taken into account. Before taking these characteristics into consideration, in 16 countries and economies, girls are significantly more likely than boys to perform poorly in mathematics; after taking these characteristics into account, they are more likely to be low performers in 32 countries and economies. On average across OECD countries, girls are 1.1 times more likely than boys to be low performers in mathematics before accounting for other student characteristics, and 1.4 times more likely after accounting for those characteristics (Figure 2.5 and Table 2.5).

This increase in girls' likelihood to be low performers in mathematics after accounting for other student characteristics largely reflects the impact of grade repetition and enrolment in vocational tracks of education on performance (the "inconsistent mediation" of these factors[2]). Students who have repeated a grade and who are enrolled in a vocational track are more likely to be low performers in mathematics at age 15; and, as mentioned above, girls are less likely to be in either category. However, those girls who do repeat grades and/or are enrolled in vocational tracks are even more likely to be low performers in mathematics. Thus, when comparing boys and girls with similar profiles as regards these specific characteristics as well as others, in most countries and economies that participated in PISA 2012, girls are even more likely than boys to underachieve in mathematics.

Gender is unique among the risk factors for low performance analysed in this chapter in that all other factors have a similar effect across the school subjects assessed in PISA, while the impact of gender varies, depending on the subject. Boys are at greater risk than girls of low performance in reading and in science, but in many countries/economies, girls are at greater risk than boys of low performance in mathematics.

■ Figure 2.5 ■

Gender and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, immigrant background, language spoken at home, location of student's school (rural or urban area), family structure, attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of girls performing below baseline Level 2 in mathematics compared with boys, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.5.
StatLink http://dx.doi.org/10.1787/888933315305

Immigrant background and language spoken at home

As economies have become increasingly globalised, the flow of people among countries has increased as well. As a result, education systems have had to adapt to accommodate larger numbers of immigrant students (OECD, 2012). PISA reports show that the percentage of students with an immigrant background, including both students who were born in a different country ("first generation") and students whose parents were born in a different country ("second generation"), has grown over the past decade. On average across OECD countries in 2012, 11% of students had an immigrant background, compared to 9% of students in 2003. This increase was accompanied by an improvement in the socio-economic status of immigrant students (0.18 point higher, on average, on the ESCS index), and also by a narrowing of the performance gap between immigrant students and students without an immigrant background (the difference in mathematics scores narrowed by 10 points). Still, on average across OECD countries in 2012, the gap in mathematics performance between immigrant students and students without an immigrant background was as large as 34 score points – the equivalent of nearly one year of formal schooling (OECD, 2015b).

The proportion of immigrant students varies greatly across countries. In Macao-China, Qatar and the United Arab Emirates, more than one in two students are immigrants, in Hong Kong-China, Liechtenstein and Luxembourg, more than 30% are immigrant students, while in Australia, Canada, New Zealand, Switzerland and the United States, between 20% and 30% of the total student population are immigrants. In 19 countries, 1% of students or less report an immigrant background (Table 2.6).

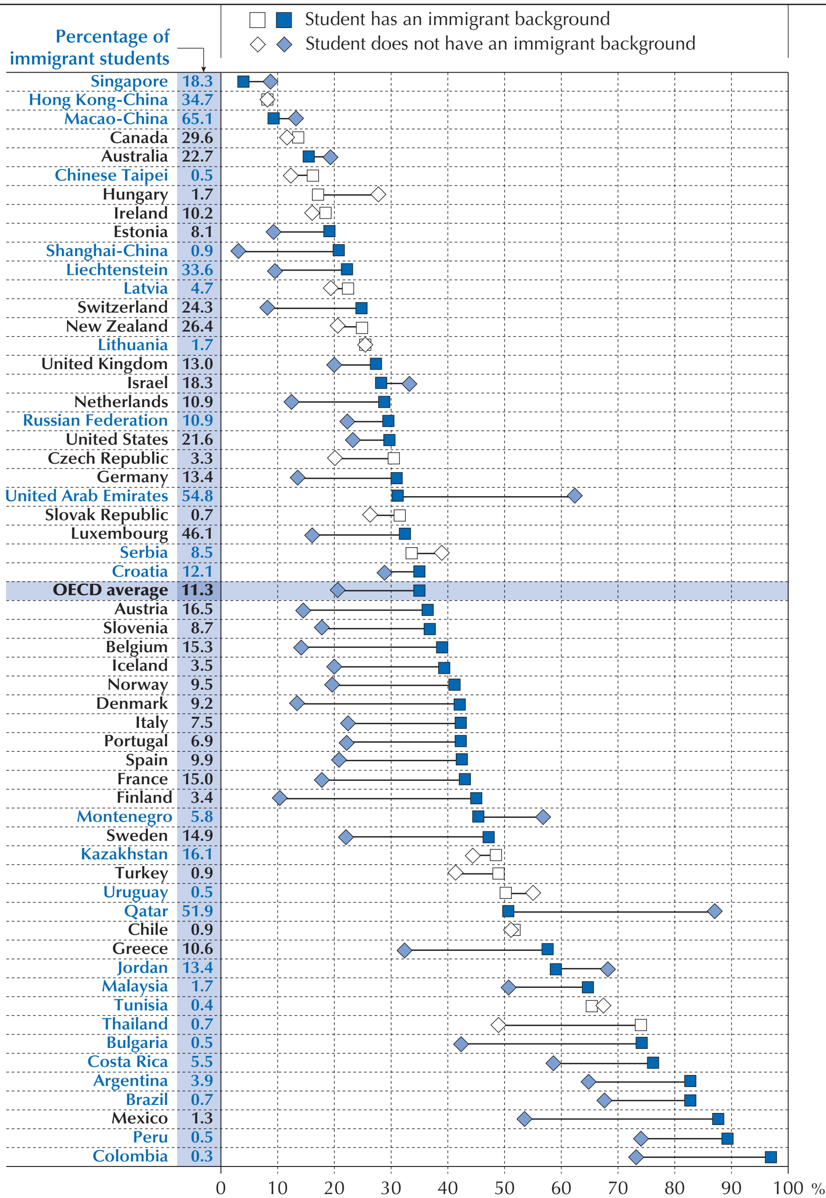
Research indicates that the education outcomes of immigrant students are shaped both by the different resources, skills and dispositions of individual students, their families and immigrant communities and by the social and education policies, and attitudes towards immigrants, in general, in the countries of destination (e.g. Buchman and Parrado, 2006; Marks, 2005; Portes and Zhou, 1993). Previous PISA reports have shown that: immigrant students who have spent more time in the country of destination ("early arrival") tend to perform better than those who have spent less time ("late arrival"); second-generation immigrant students tend to perform better than first-generation students; and students who belong to immigrant communities that are larger and more socio-economically diverse tend to perform better than those coming from smaller and more homogeneous and marginalised communities (OECD, 2013b; OECD, 2013c; OECD, 2011).

Low performers tend to be more prevalent among immigrant students than among students without an immigrant background; yet there are countries where this is not the case, and still others where the opposite is true. Figure 2.6 shows that, on average across OECD countries, the share of low performers among students with an immigrant background is 14 percentage points larger than the share of low performers among students without an immigrant background. This difference exists in 32 of the countries and economies that participated in PISA 2012; in Bulgaria, Denmark, Finland, France, Greece, Mexico and Sweden, the difference is equal to or larger than 25 percentage points. By contrast, in Australia, Israel, Jordan, Macao-China, Montenegro, Qatar, Singapore and the United Arab Emirates, immigrant students perform better than students without an immigrant background (Table 2.6).

■ Figure 2.6 ■

Immigrant background and low performance in mathematics

Percentage of low performers in mathematics, by immigrant background



Note: Statistically significant percentage-point differences between the share of low-performing students with and those without an immigrant background are marked in a darker tone.

Countries and economies are ranked in ascending order of the percentage of low-performing students with an immigrant background.

Source: OECD, PISA 2012 Database, Table 2.6.

StatLink http://dx.doi.org/10.1787/888933315314

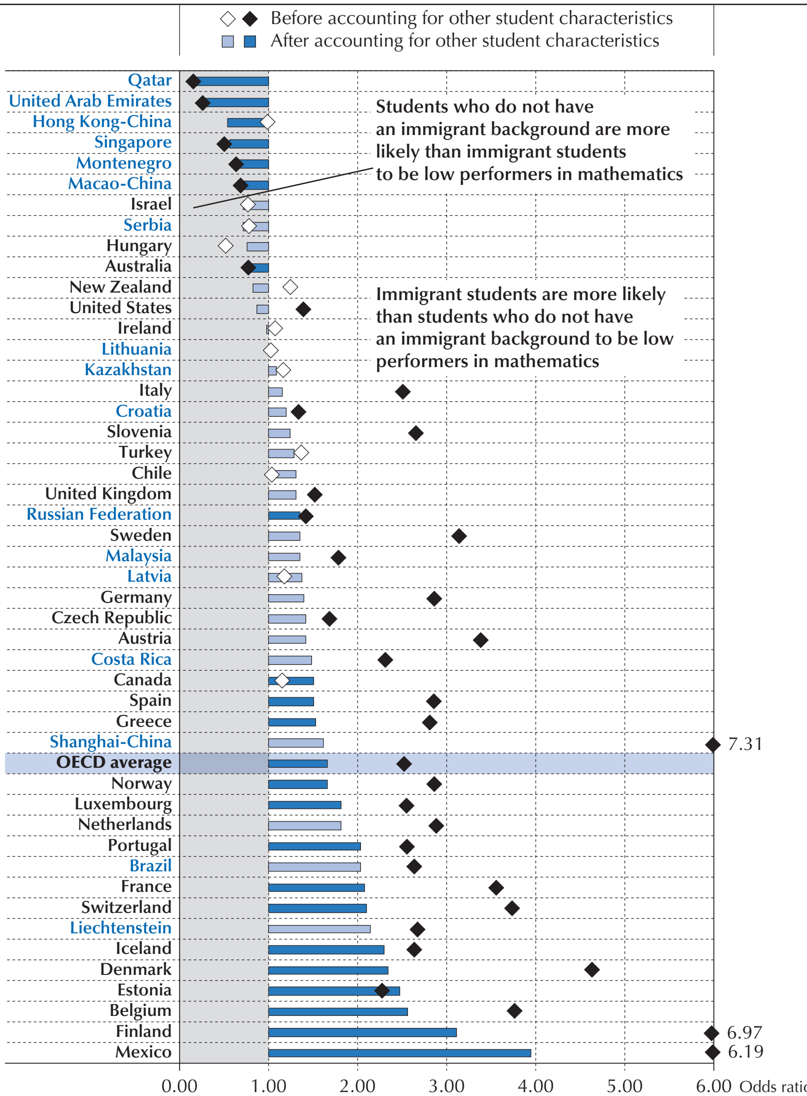
Since an immigrant background is correlated with a number of other student characteristics, to better understand the association between immigrant background and low performance, those other variables should be taken into account. Figure 2.7 shows how the odds of low performance change after accounting for students' socio-economic, demographic and education background. On average across OECD countries with sufficient data, immigrant students were 1.6 times more likely to be low performers in mathematics in PISA 2012 than students without an immigrant background who are similar in all other background characteristics. Before accounting for these other background characteristics, the odds of low performance for immigrant students were much higher (2.5), meaning that part of the difference in low performance between immigrant students and students without an immigrant background is related to factors other than immigrant background (Table 2.7).

Figure 2.7 also shows that the way in which an immigrant background is related to other student characteristics is not the same in all countries. On average across OECD countries, the higher odds of low performance among immigrant students, compared with students without an immigrant background, decrease, but remain significant, after accounting for other student characteristics. In 15 countries, the odds are reduced to the point of becoming statistically insignificant. In another 10 countries, there is no performance gap between immigrant students and students without an immigrant background either before or after accounting for other factors. In Australia, Macao-China, Montenegro, Qatar, Singapore and the United Arab Emirates, immigrant students are less likely than students without an immigrant background to underachieve, and the odds of low performance remain virtually unchanged after accounting for other student characteristics. In Hong Kong-China, where there is no difference in the likelihood of low performance between immigrant and non-immigrant students before accounting for other factors, immigrant students are less likely to underachieve than non-immigrant students who share similar socio-economic, demographic and education backgrounds.

Speaking a different language at home from the language of assessment is one of the barriers to learning that students with an immigrant background and other students must try to overcome (Figure 2.8). On average across OECD countries, the odds of low performance in mathematics among students who speak a different language at home are more than twice as high (odds ratio of 2.3) as the odds among students who speak the same language, before accounting for other student-related variables, including socio-economic status and immigrant background. After accounting for these characteristics, language-minority students still have 1.4 times higher odds of underachieving than mainstream-language students. Yet, the specific association varies from country to country. In 17 countries and economies that participated in PISA 2012, speaking a different language at home increases the likelihood of low performance even after accounting for other variables, but in 4 countries and economies, speaking a different language at home reduces the chances of low performance. In 16 other countries and economies, statistically significant differences become insignificant after accounting for the other variables, thus factors other than language at home explain the differences in performance (Table 2.9).

■ Figure 2.7 ■

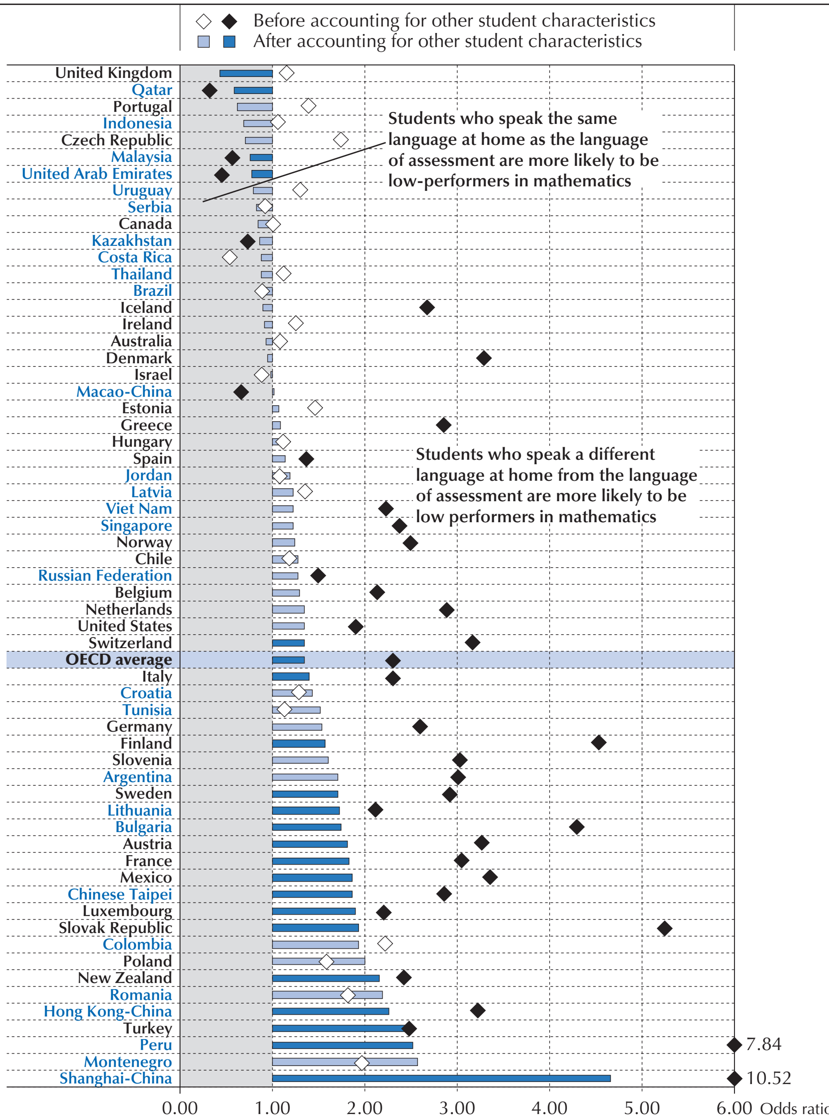
Immigrant background and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, gender, language spoken at home, location of student's school (rural or urban area), family structure, attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of immigrant students performing below baseline Level 2 in mathematics, compared with students who do not have an immigrant background, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.7.
StatLink http://dx.doi.org/10.1787/888933315329

■ Figure 2.8 ■

Language spoken at home and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, family structure, immigrant background, location of student's school (rural or urban area), attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of students who speak a different language at home performing below baseline Level 2 in mathematics, compared with students who speak the same language at home as the language of assessment, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.9.
StatLink http://dx.doi.org/10.1787/888933315337

Family structure

Family structure – whether a student grows up in a single-parent, two-parent or extended family; how many siblings live in the household; and such important family events as divorce and remarriage – also shapes students' education outcomes (McLanahan and Sandefur, 1994; Beller and Chung, 1992; Ginther and Pollak, 2004; Pong, Dronkers and Hampden-Thompson, 2003; Sandefur and Wells, 1999). Research suggests that students who live in single-parent families receive less encouragement and less help with school work than students who live in two-parent families (Astone and McLanahan, 1991). On average across OECD countries, 85% of students come from two-parent households, and 15% from single-parent or other kinds of family structures. In 15 countries that participated in PISA 2012, at least 20% of students came from single-parent families; only in five countries did less than 10% of students come from such families (Table 2.10).

The share of low performers is larger among students who live in single-parent families than among those living with two parents[3] (Figure 2.9). On average across OECD countries, 26% of students in single-parent families performed below the baseline level of proficiency in mathematics in PISA 2012, while nearly 20% of students from two-parent families performed at that level. Although the difference of around 7 percentage points is statistically significant, the performance gap related to family structure is smaller than the gap related to socio-economic status (28 percentage-point difference, in favour of advantaged students), the gap related to immigrant background (15 percentage-point difference, in favour of students without an immigrant background), the gap related to language spoken at home (15 percentage-point difference, in favour of mainstream-language speakers), and the gender gap in reading (12 percentage-point difference, in favour of girls). It is larger than the gender gap in mathematics (2 percentage-point difference, in favour of boys) and science (2 percentage-point difference, in favour of girls) (Tables 2.1, 2.3a, 2.6 and 2.8).

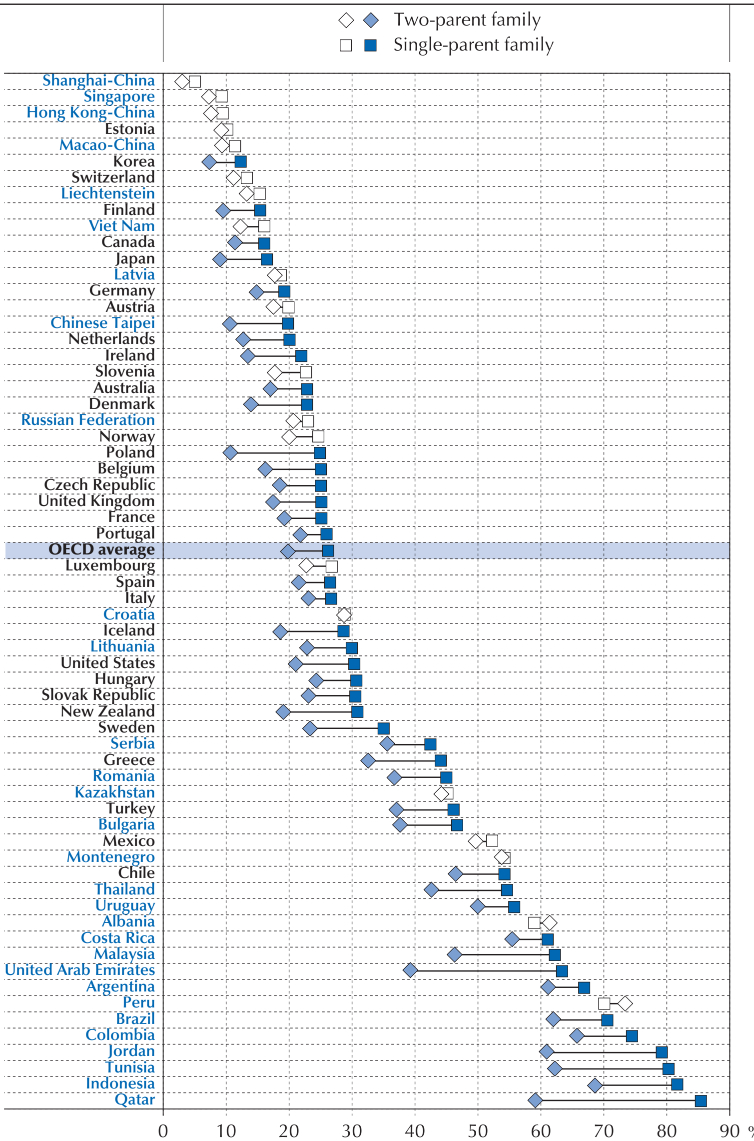
Before accounting for any other variable, students in single-parent families are 1.5 times more likely than those in two-parent families to be low performers in mathematics, on average across OECD countries (Figure 2.10). After accounting for students' socio-economic status and other background characteristics, those odds shrink to 1.2. In 16 countries and economies, this greater likelihood is statistically significant after accounting for other student characteristics. In 27 countries and economies, the difference in likelihood becomes insignificant after accounting for other variables. There is no country or economy in PISA 2012 where students from single-parent families are less likely to be low performers than students from two-parent families.

Urban or rural location

Whether urban or rural areas provide more opportunities or risks for students' academic performance is far from obvious. Greater economic and cultural resources are concentrated in large cities, but many social problems, including crime, are more prevalent in urban areas too. In many countries, ethnic and linguistic minorities are concentrated in rural areas, but in other countries, immigrant communities are more frequently found in large cities. Differences in education opportunities and outcomes related to geographic location are observed in the availability of qualified teachers and other resources across schools, or as differences in student behaviour, depending on where the student goes to school (e.g. Schafft and Jackson, 2010).

■ Figure 2.9 ■

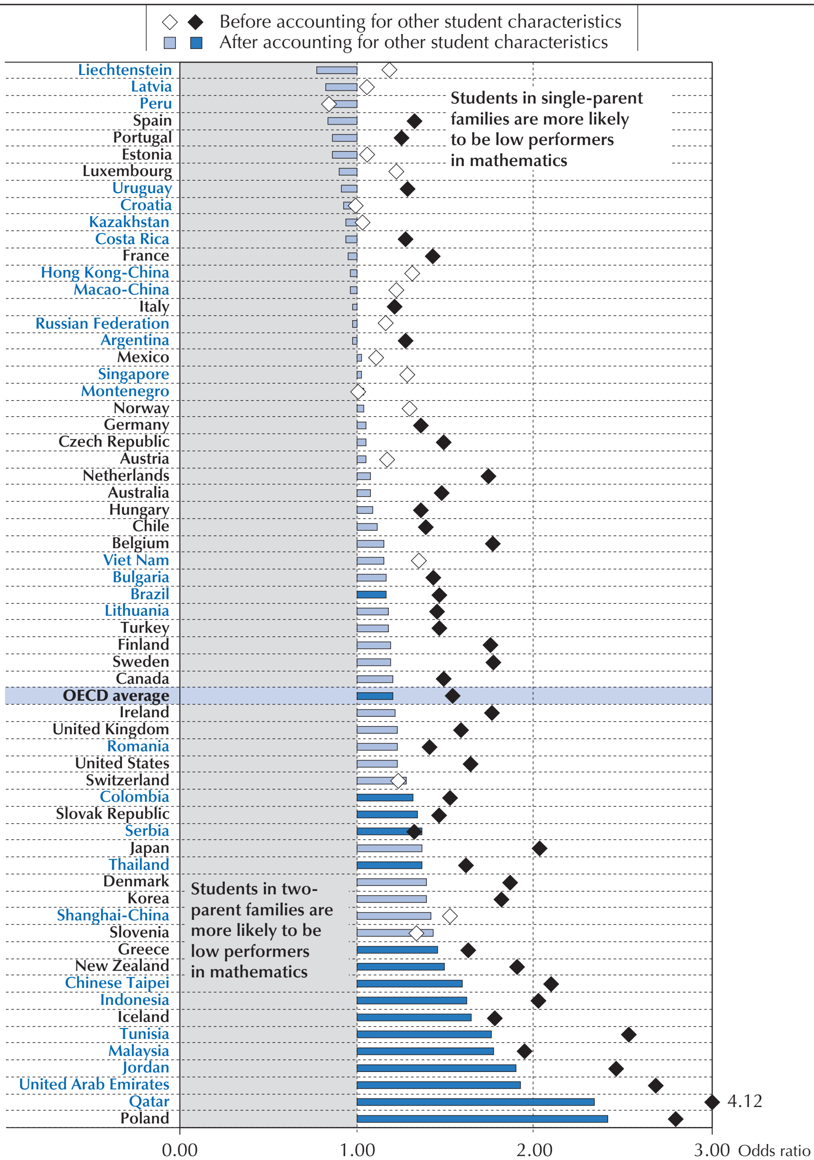
Percentage of low performers in mathematics, by family structure



Notes: Statistically significant percentage-point differences between the share of underperforming students from single-parent families and those from two-parent families are marked in a darker tone.
The "single-parent family" group includes also students from "other type" of families.
Countries and economies are ranked in ascending order of the percentage of low-performing students from single-parent families.
Source: OECD, PISA 2012 Database, Table 2.10.
StatLink http://dx.doi.org/10.1787/888933315342

■ Figure 2.10 ■

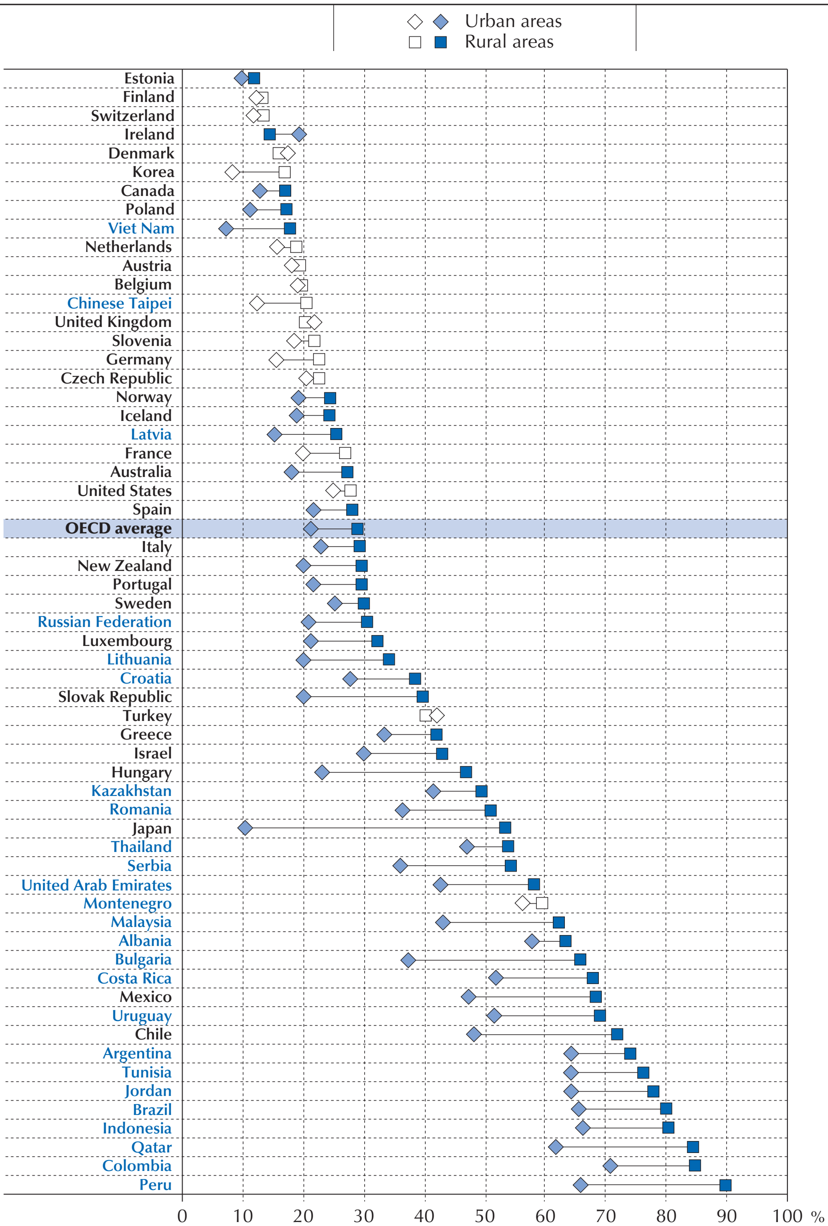
Family structure and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, location of student's school (rural area, town or city), attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of students in single-parent families performing below baseline Level 2 in mathematics compared with students in two-parent families, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.11.
StatLink http://dx.doi.org/10.1787/888933315357

■ Figure 2.11 ■

Percentage of low performers in mathematics, by geographic location



Note: Statistically significant percentage-point differences between the share of low-performing students from rural area and those from cities or towns are marked in a darker tone.

Countries and economies are ranked in ascending order of the percentage of low-performing students in schools in rural areas.

Source: OECD, PISA 2012 Database, Table 2.12.

StatLink *http://dx.doi.org/10.1787/888933315360*

But as shown in Figure 2.11, in most countries and economies that participated in PISA 2012, there is a clear relationship between the share of low performers and geographic location. Rural areas host the largest proportions of low performers, and urban areas, defined as cities and towns of at least 3 000 inhabitants, host the smallest proportions.[4] On average across OECD countries, 29% of students who attend school in rural areas and 21% of students in cities or towns perform below Level 2 in mathematics. In the majority of countries and economies, the share of low performers is larger in rural areas than in urban areas, and the difference is statistically significant.

After accounting for other characteristics of student background (i.e. socio-economic status, gender, immigrant and language background, family structure, attendance at pre-primary school, grade repetition and programme orientation), differences in the likelihood of low performance related to geographic location shrink, but remain significant in 24 countries and economies (Figure 2.12). On average across OECD countries, the odds of low performance among students in rural areas are 1.5 times higher than the odds among urban students, but are 1.3 times higher after accounting for other student characteristics.

Progression through education

Pre-primary education

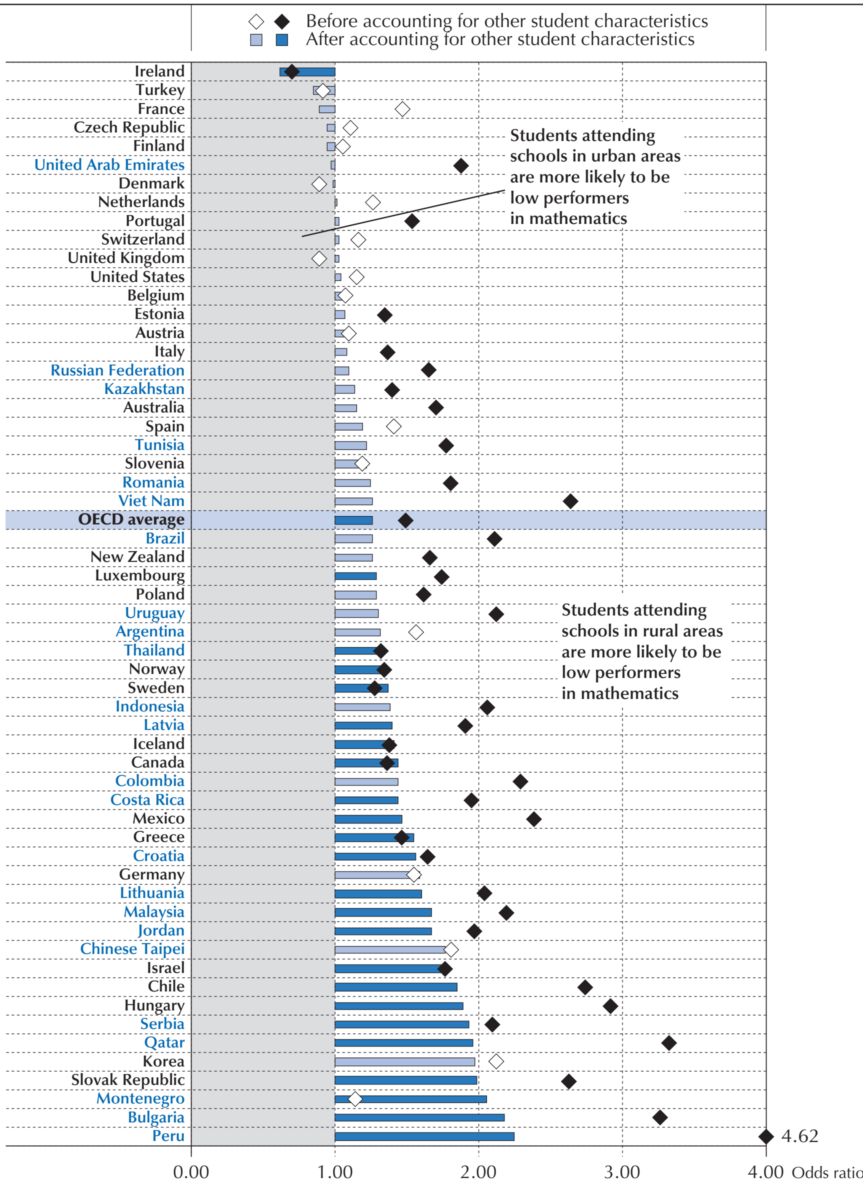
Evidence of the importance of pre-primary education for early child development and for later education outcomes is convincing (e.g. Berlinski, Galiani and Gertler, 2009; Barnett, 1995; Currie, 2001). Enrolment in pre-primary education is high among OECD countries, where on average only 7% of students who participated in PISA 2012 reported that they had not attended any pre-primary education. Pre-primary enrolment has also increased over time, as 74% of students in PISA 2012 reported that they had attended more than one year of pre-primary school, compared with 69% of students who so reported in PISA 2003. The growth in pre-primary enrolment is significantly greater among advantaged students than disadvantaged students, and among students who attend advantaged schools than those who attend disadvantaged schools (OECD, 2013a).

The lack of pre-primary education is a strong predictor of low performance at age 15. In 2012, on average across OECD countries, 41% of students without any pre-primary education performed below the baseline proficiency level in mathematics. By comparison, 30% of students who had attended pre-primary education for less than a year, and 20% of students who had attended pre-primary education for more than one year performed at that level. The difference in the share of low performers between students with no pre-primary education and students with more than one year of pre-primary education is statistically significant in all countries except Albania, Estonia, Ireland and Latvia (Figure 2.13 and Table 2.14).

After adjusting for other characteristics, the difference in the odds of low performance between students without any pre-primary schooling and those with more than a year of pre-primary education shrinks, as shown in Figure 2.14. On average across OECD countries, the odds of low performance in mathematics for a student with no pre-primary education are 3.3 times higher than the odds for a student who had attended more than a year of pre-primary educations before accounting for other student characteristics, and 1.9 times higher after accounting for them.

■ Figure 2.12 ■

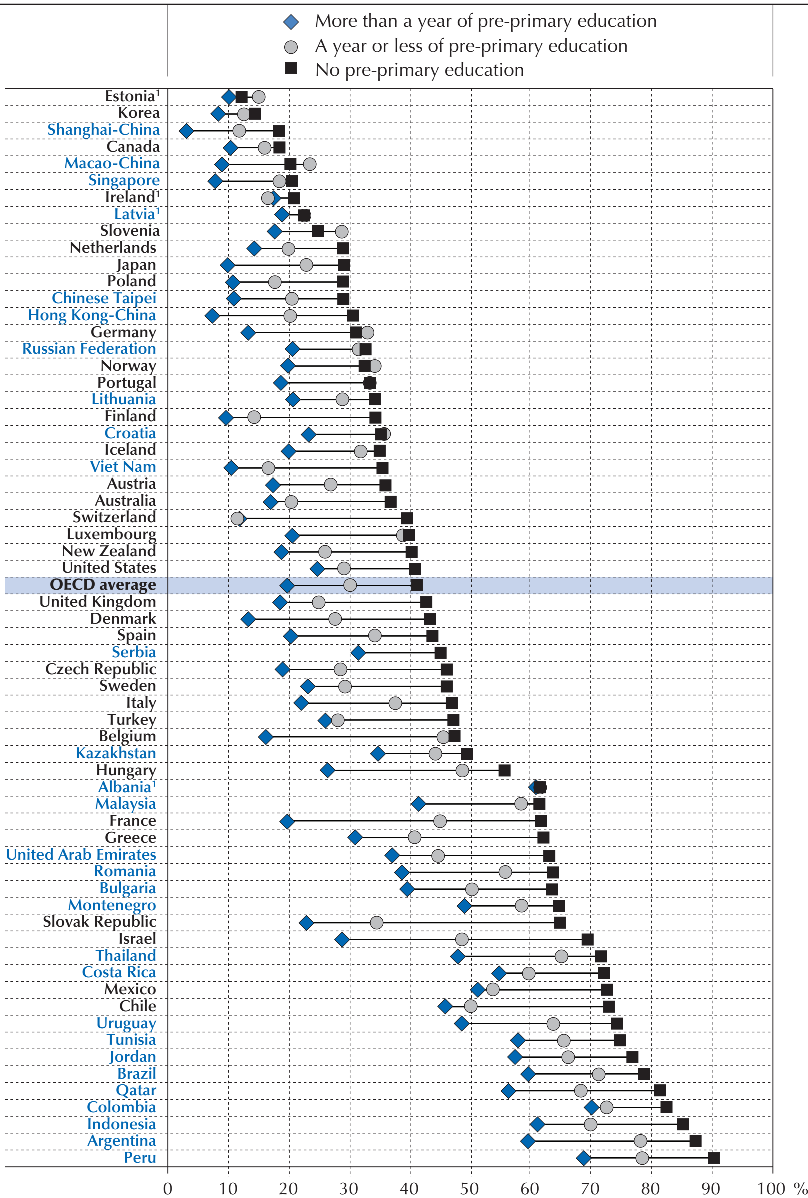
Geographic location and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, family structure, attendance at pre-primary school, grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of low performance in mathematics among students in schools in rural areas compared to students in schools in urban areas, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.13.
StatLink http://dx.doi.org/10.1787/888933315376

■ Figure 2.13 ■

Percentage of low performers in mathematics, by attendance at pre-primary school



1. Percentage-point differences between the share of low-performing students who had not attended pre-primary school and those who had attended for at least one year are not statistically significant.

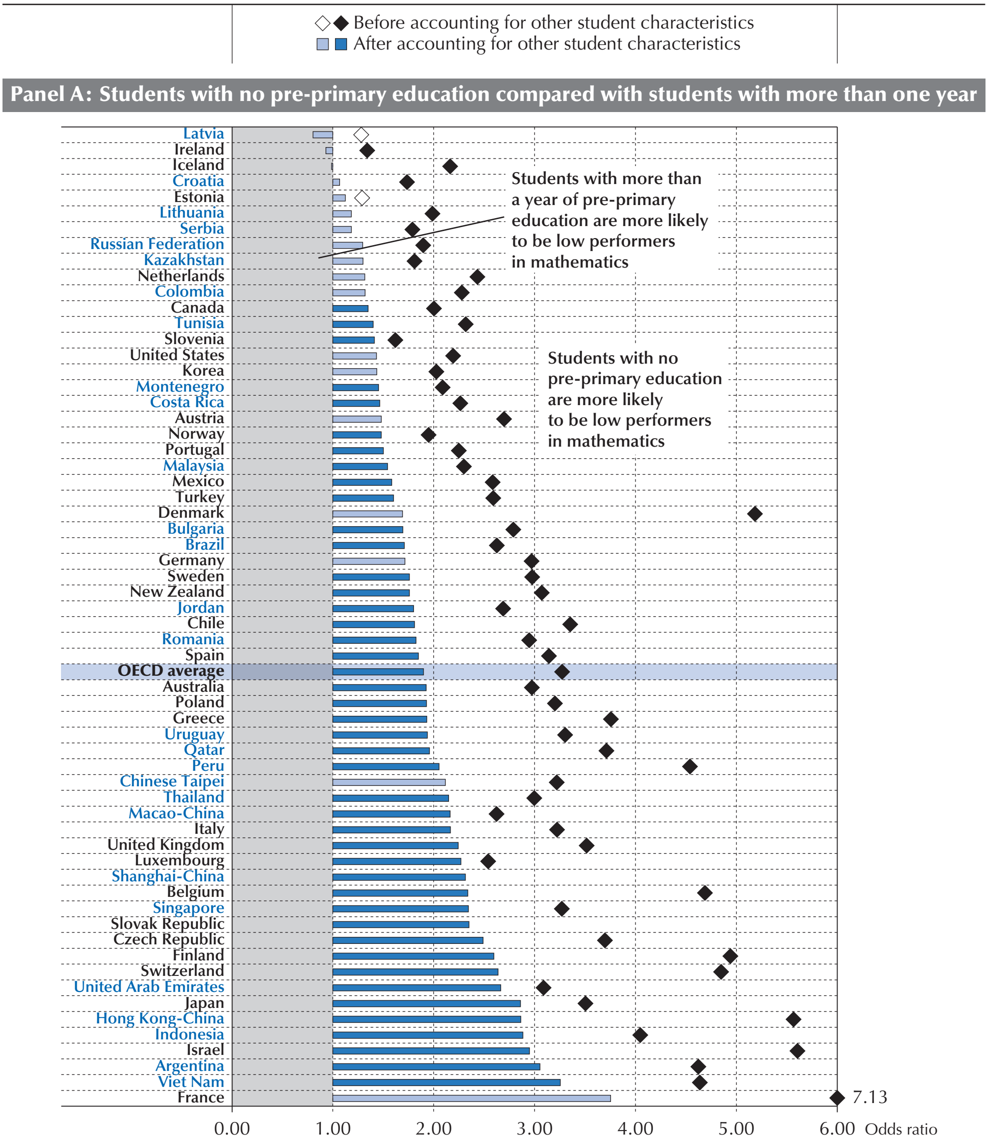
Countries and economies are ranked in ascending order of the percentage of low-performing students who had not attended pre-primary school.

Source: OECD, PISA 2012 Database, Table 2.14.

StatLink http://dx.doi.org/10.1787/888933315381

■ Figure 2.14 [Part 1/2] ■

Pre-primary education and the likelihood of low performance in mathematics



Notes: Statistically significant coefficients are marked in a darker tone.

Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, family structure, location of student's school (rural area, town or city), grade repetition and programme orientation (vocational or general).

Countries and economies are ranked in ascending order of the odds ratio of students who had no pre-primary education (Panel A) performing below the proficiency baseline Level 2 in mathematics compared to students with more than a year of pre-primary education, after accounting for other student characteristics.

Source: OECD, PISA 2012 Database, Table 2.15.

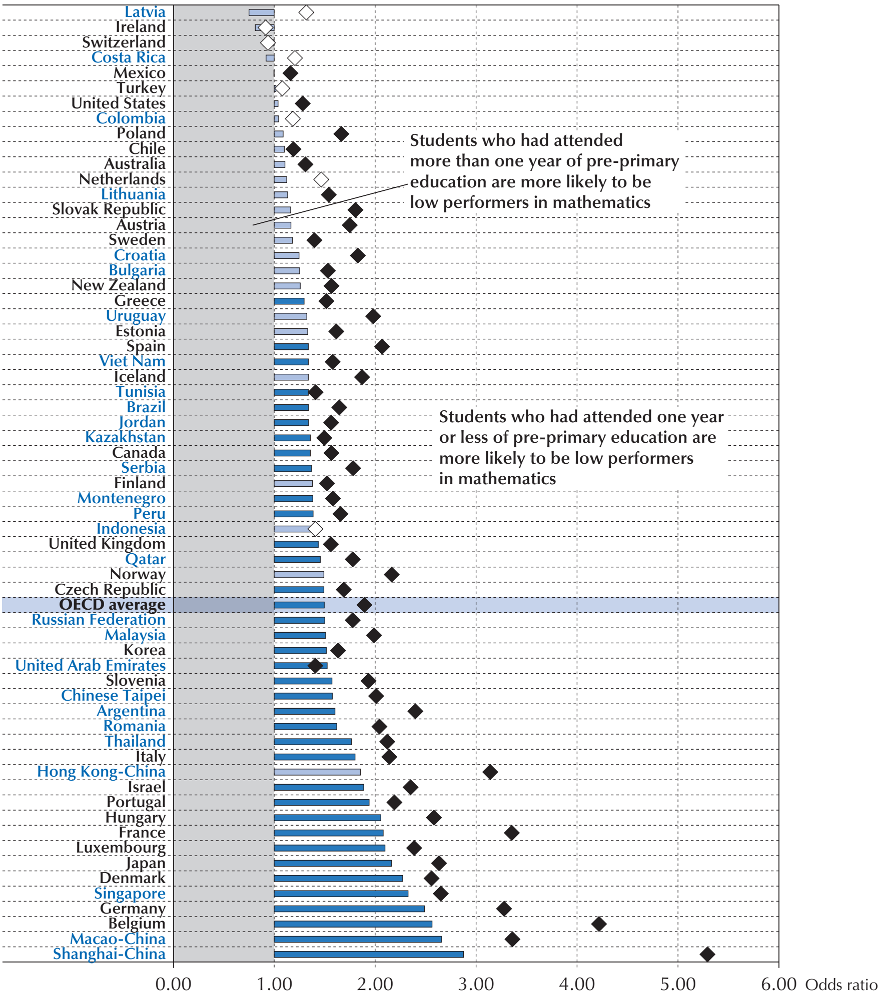
StatLink http://dx.doi.org/10.1787/888933315392

■ Figure 2.14 [Part 2/2] ■

Pre-primary education and the likelihood of low performance in mathematics

◇◆ Before accounting for other student characteristics
□■ After accounting for other student characteristics

Panel B: Students with a year or less of pre-primary education compared with students with more than one year



Notes: Statistically significant coefficients are marked in a darker tone.
Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, family structure, location of student's school (rural area, town or city), grade repetition and programme orientation (vocational or general).
Countries and economies are ranked in ascending order of the odds ratio of students who had a year or less of pre-primary education (Panel B) performing below the proficiency baseline Level 2 in mathematics compared to students with more than a year of pre-primary education, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.15.
StatLink http://dx.doi.org/10.1787/888933315392

The odds of low performance for a student who had attended one year or less of pre-primary education are 1.9 times higher, on average, than the odds for a student who had more than one year of pre-primary education before accounting for other characteristics, and 1.5 times higher after accounting for those characteristics. Differences in socio-economic status account for a large part of the variation in the relationship between pre-primary education and low performance.

Grade repetition

As important as pre-primary education is, it is not the only element of a student's progress through school that influences whether she or he will be at risk of low performance by the age of 15. Grade repetition in primary or secondary school is another element. Grade repetition is a long-standing and highly contentious practice. Its intended purpose is to give students who perform below standard more time to master the curriculum and catch up with their peers. Yet evidence on whether grade repetition yields positive results is mixed (Xia and Kirby, 2009; Allen et al., 2009; Eide and Showalter, 2001; Jacob and Lefgren, 2004). Students who are "left back" are more likely to drop out of high school than students who progress steadily through grades (Jimerson, Anderson and Whipple, 2002; Stearns et al., 2007). Students who have repeated a grade also tend to hold more negative attitudes towards school than those who have not (Ikeda and García, 2014). Previous PISA reports have suggested that grade repetition is a costly policy, that it is sometimes used as a form of punishment to sanction misbehaviour in school, and that it can reinforce inequalities in education because socio-economically disadvantaged students are more likely to repeat grades than advantaged students (OECD, 2013d; OECD, 2014b; OECD, 2015a).

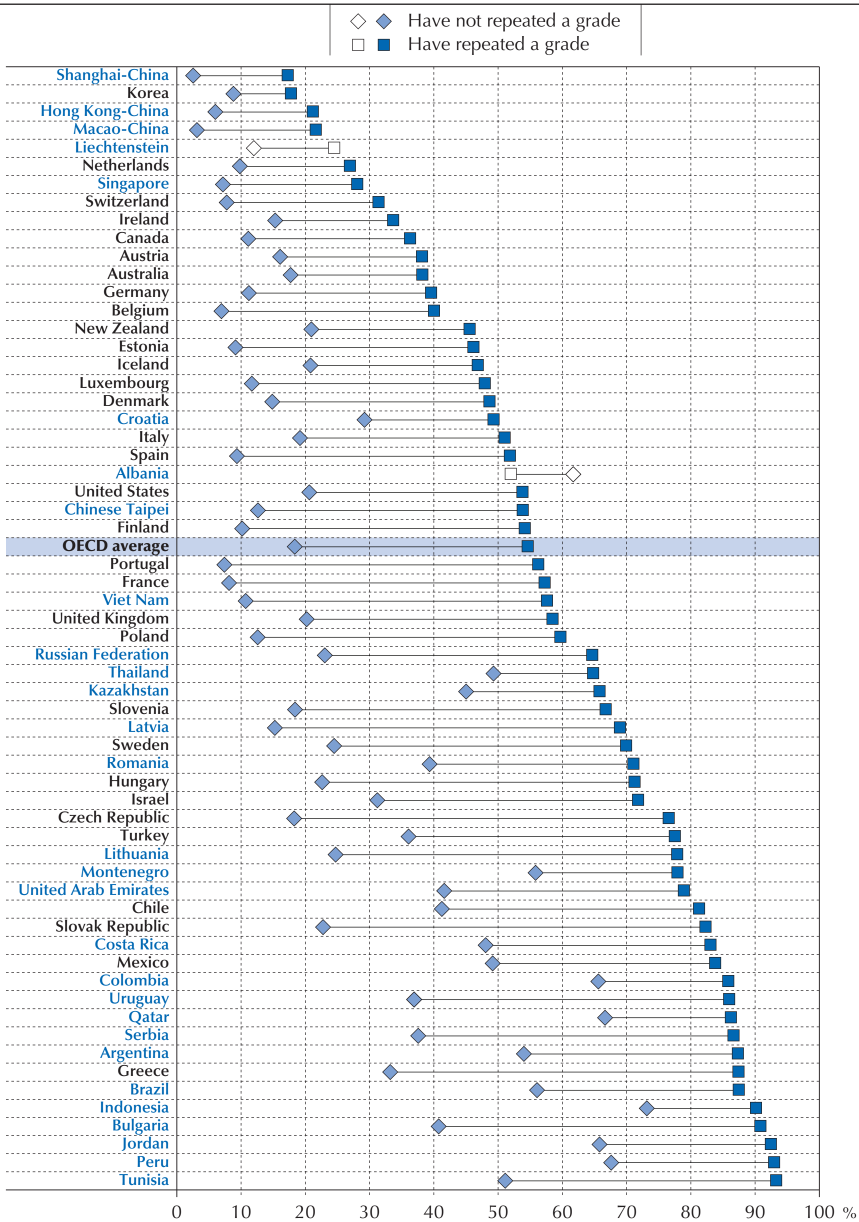
While the percentage of students who reported that they had repeated a grade has decreased during the past decade, it is still relatively high. In 2003, 20% of students reported that they had repeated a grade at least once, whereas in 2012 the share of self-reported repeaters shrank to 12%, on average across OECD countries (OECD, 2013d). The prevalence of grade repetition varies widely across countries, ranging from at least 20% of students who had repeated a grade in 16 countries and economies to 5% or less of such students in 27 other countries and economies (Table 2.16). Japan, Malaysia and Norway show no incidence of grade repetition. Most of the grade repetition that was reported in PISA 2012 occurred in primary and lower secondary school, and some occurred in upper secondary school. Most of the students who reported that they had repeated a year of school came from disadvantaged families (OECD, 2013d).

In all countries and economies that participated in PISA 2012 and have sufficient data, except Albania and Liechtenstein, there are large differences in the shares of low performers who have repeated a grade and low performers who have been continuously promoted. Figure 2.15 shows that, on average across OECD countries, the share of low performers in mathematics who have repeated a grade is 36 percentage points larger than the share of low performers who have not repeated a grade. In Bulgaria, the Czech Republic, Greece, Latvia, Lithuania and the Slovak Republic, the difference between the two groups is equal to or more than 50 percentage points. Only in Korea and Shanghai-China is the difference less than 15 percentage points (Table 2.16).

Figure 2.16 shows whether the relationship between grade repetition and low performance varies after accounting for students' socio-economic, demographic and education backgrounds.

■ Figure 2.15 ■

Percentage of low performers in mathematics, by grade repetition



Note: Statistically significant percentage-point differences between the share of low-performing students who have repeated a grade and those who have not repeated a grade are marked in a darker tone.

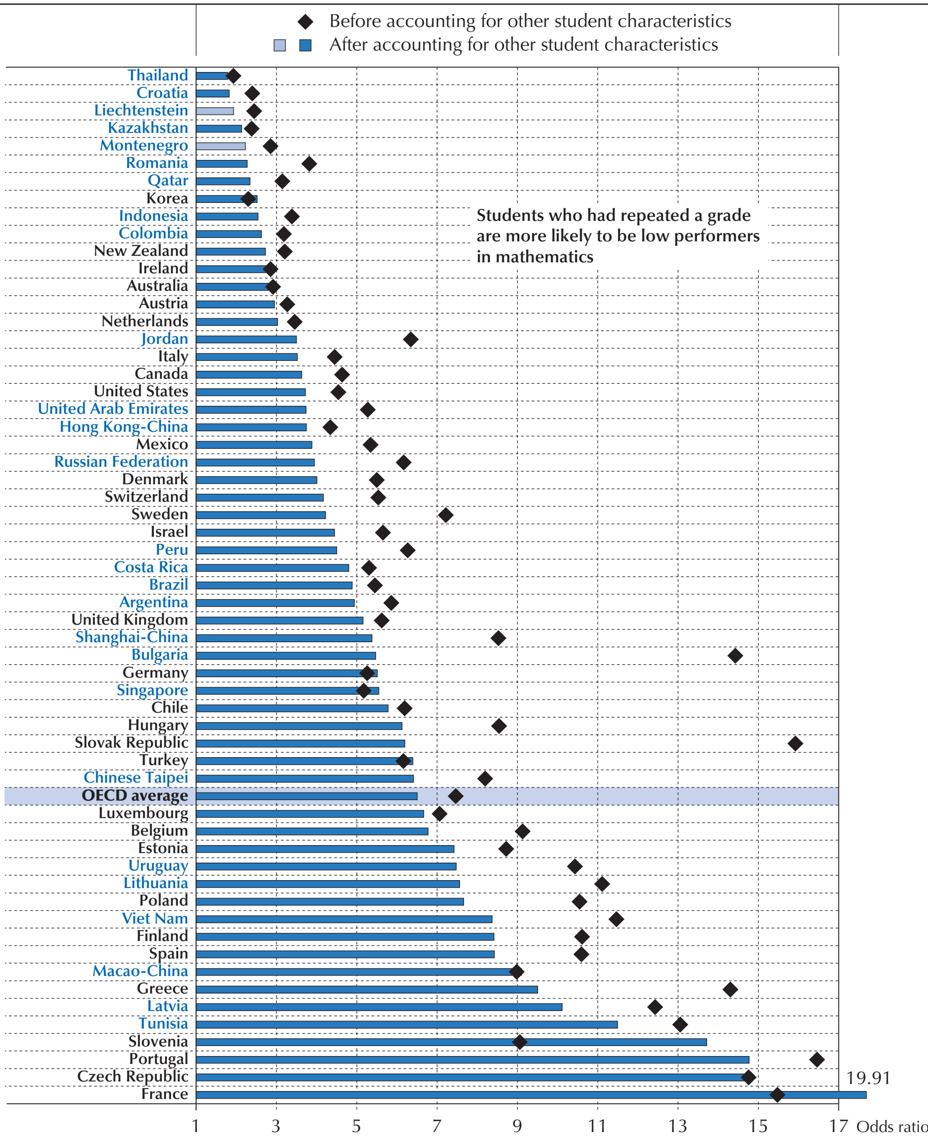
Countries and economies are ranked in ascending order of the percentage of low-performing students who have repeated a grade.

Source: OECD, PISA 2012 Database, Table 2.16.

StatLink http://dx.doi.org/10.1787/888933315409

■ Figure 2.16 ■

Grade repetition and the likelihood of low performance in mathematics



Notes: Coefficients before accounting for other students characteristics are statistically significant. Statistically significant coefficients for after accounting for other student characteristics are marked in a darker tone.

Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, family structure, location of student's school (rural area, town or city), attendance at pre-primary school and programme orientation (vocational or general).

Countries and economies are ranked in ascending order of the odds ratio of students who had repeated a grade performing below baseline Level 2 in mathematics, compared with students who had not repeated a grade, after accounting for other student characteristics.

Source: OECD, PISA 2012 Database, Table 2.17.

StatLink *http://dx.doi.org/10.1787/888933315416*

Before accounting for students' background, the odds of performing below the baseline level of proficiency in mathematics for a student who repeated a grade are 7.4 times higher than for a student who had not repeated a grade, on average across OECD countries. After accounting for other student characteristics, the odds of underachievement in mathematics are still 6.5 times higher for a student who had repeated a grade compared with a student who had been continuously promoted. This suggests that the link between grade repetition and low performance is not only strong, but that it is not mediated by differences in socio-economic status, demographic characteristics or a student's progress through education.

Caution is advised when interpreting the link between grade repetition and low performance, however, because determining the direction of the association is particularly difficult. On the one hand, grade repetition in the earlier grades makes a student more likely to perform poorly in a later grade, because teachers have lower expectations for these students, because these students might have greater difficulties in integrating themselves into peer and school cultures, or for other reasons (Kaplan, Peck and Kaplan, 1997; Roderick, 1994). But the association might run in the opposite direction if students repeat a grade simply because they are chronic low performers. PISA data provides only correlational evidence, so no causal inferences should be drawn from this analysis.

Programme orientation

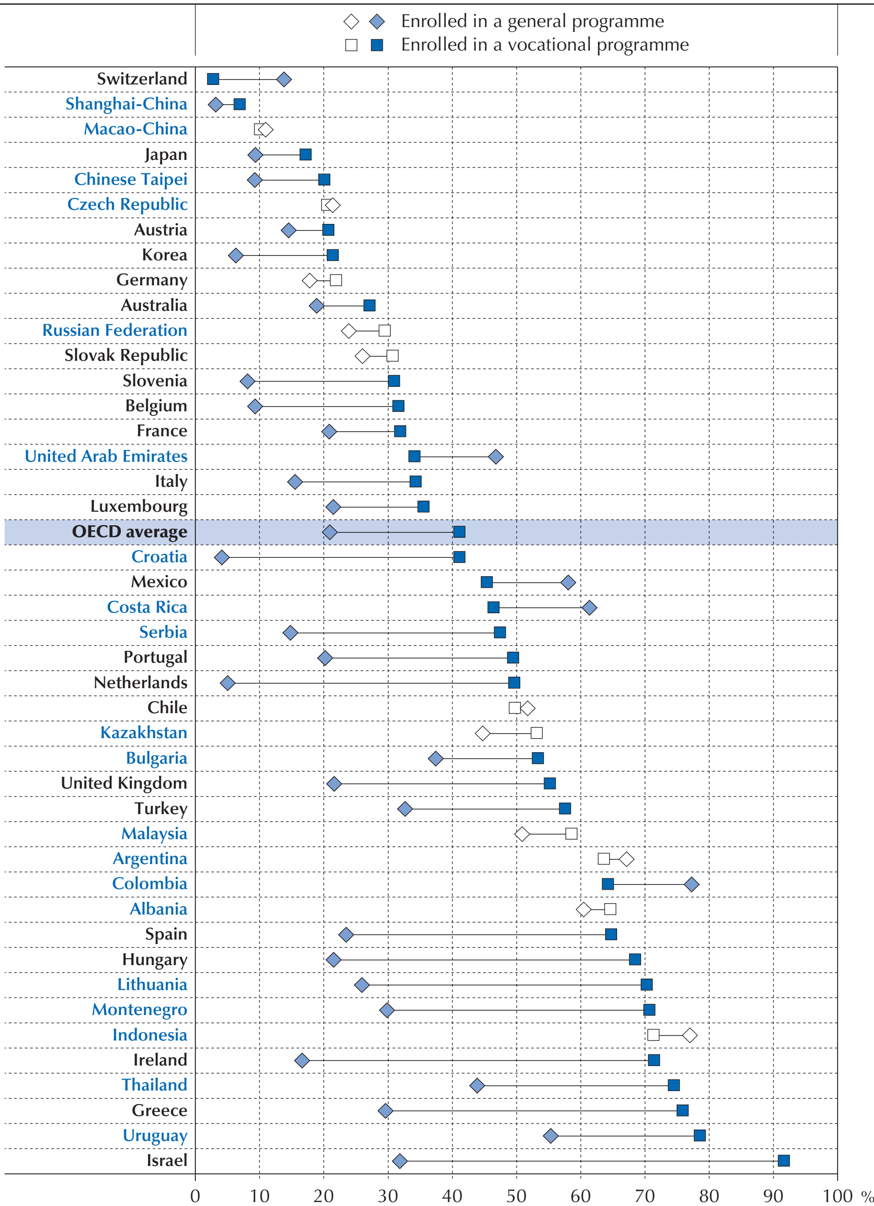
Curricular tracking is another long-standing and hotly debated way to handle student heterogeneity (Oakes, 1985; LeTendre, Hofer and Shimizu, 2003; Van de Werfhorst and Mijs, 2010). Separating students into homogeneous groups might help teachers to be more effective. Many students might benefit from more practical, vocational training that prepares them for the labour market. But students in these tracks might lose more than they gain – from lower expectations from their teachers to more disengaged classmates. Previous PISA reports have shown that education systems in which students are selected into separate tracks at an earlier age tend to show lower levels of equity in education outcomes (OECD, 2013d).

School systems vary widely in the extent to which they place students into separate academic and vocational tracks. In PISA 2012, an average of 18% of students in OECD countries were enrolled in a vocational track. In Austria, Croatia, Italy, Montenegro, Serbia and Slovenia, at least one in two students were enrolled in a vocational track, while in 15 other countries and economies, no student was enrolled in a vocational track, as defined in PISA. In Canada, a 100% of students are enrolled in modular schools, which are considered in this analysis in combination with vocational programmes (Table 2.18).

The share of low performers is twice as large among students enrolled in a vocational track than among students enrolled in a general track (Figure 2.17). On average across OECD countries, 41% of students pursuing a vocational education were low performers in mathematics in 2012, whereas 21% of students in a general track were. The difference in the share of low performers between vocational and general students is larger than 40 percentage points in Greece, Hungary, Ireland, Israel, Lithuania, Montenegro, the Netherlands and Spain. But in Colombia, Mexico and Switzerland, where more than 10% of students are enrolled in vocational schools, the share of low performers is larger among students in general programmes (Table 2.18).

■ Figure 2.17 ■

Percentage of low performers in mathematics, by programme orientation



Note: Statistically significant percentage-point differences between the share of low-performing students who are enrolled in vocational programmes and those who are enrolled in general programmes are marked in a darker tone.
Students enrolled in vocational programmes are those enrolled in pre-vocational, vocational and modular programmes.
Countries and economies are ranked in ascending order of the percentage of low-performing students who are enrolled in vocational programmes.
Source: OECD, PISA 2012 Database, Table 2.18.
StatLink http://dx.doi.org/10.1787/888933315424

Figure 2.18. reveals that, on average across OECD countries, students in vocational tracks are 5 times more likely to perform below the baseline level of proficiency in mathematics than students in academic tracks, before accounting for other student characteristics, and are 4.4 times more likely after accounting for those characteristics. Socio-economic status accounts for most of this weakening of the link between vocational tracks and low performance after accounting for other factors. In 25 countries and economies, students in vocational programmes are more likely than students in general programmes to be low performers in mathematics before accounting for other student characteristics (black diamonds in the right panel of Figure 2.18); in 18 of them, the odds of low performance among students in vocational tracks shrink after student characteristics are accounted for. In 12 other countries and economies, the odds are higher after taking other student characteristics into account.

Caution is also advised when interpreting these results, since the causal relationship between programme orientation and low performance could run in both directions.

THE CUMULATIVE RISK OF LOW PERFORMANCE

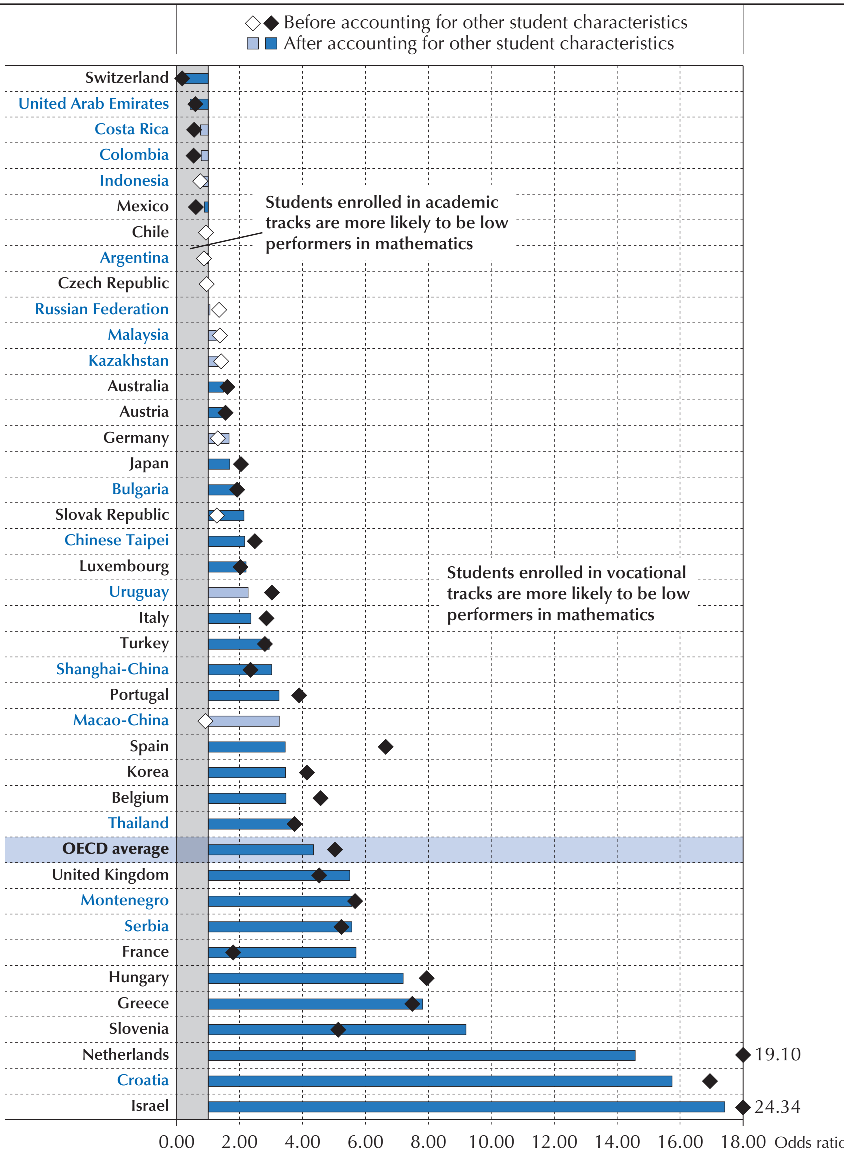
As shown above, each of the risk factors for low performance has a specific, separate association with the likelihood of low performance among individual students. Yet risk factors are also cumulative, in that they interact with one another, usually within individual students (e.g. a rural student who is also poor and is enrolled in a vocational track). Combinations of these risk factors result in even greater probabilities of low performance.

Figure 2.19 shows the intersection and accumulation of risks of low performance related to socio-economic, demographic and education background. The horizontal axis in the figure represents a progression of risk scenarios, or "risk profiles", from lower risk to higher risk of low performance in mathematics. Based on the analyses presented in this chapter, a "low risk profile" is a 15-year-old student who: is a boy, does not have an immigrant background, speaks the same language at home that is spoken at school, lives in a two-parent family, in a city, had attended pre-primary school for more than one year, had never repeated a grade, and is enrolled in an academic track. On the opposite end of the spectrum, a "high risk profile" is a girl who has an immigrant background, speaks a language at home that is different from the language spoken at school, lives in a single-parent family, in a rural area, did not attend pre-primary school, repeated a grade at least once, and is enrolled in a vocational track.

Figure 2.19 shows how the predicted probability of low performance in mathematics increases as each one of the characteristics of the low risk profile is changed for its opposite value. For example, the second value in the horizontal axis, "girl", is the probability of low performance for a student with the same "low risk" characteristics, but who is a girl instead of a boy. Similarly, the third value represents the probability of low performance for a student with the same "low risk" characteristics but who is a girl and has an immigrant background. The fourth value represents the probability of low performance for a student with the same "low risk" characteristics but who is a girl, has an immigrant background and speaks a different language; and so on. The right-most column presents the "high risk" profile, which encompasses all of the risk factors.

■ Figure 2.18 ■

Programme orientation and the likelihood of low performance in mathematics

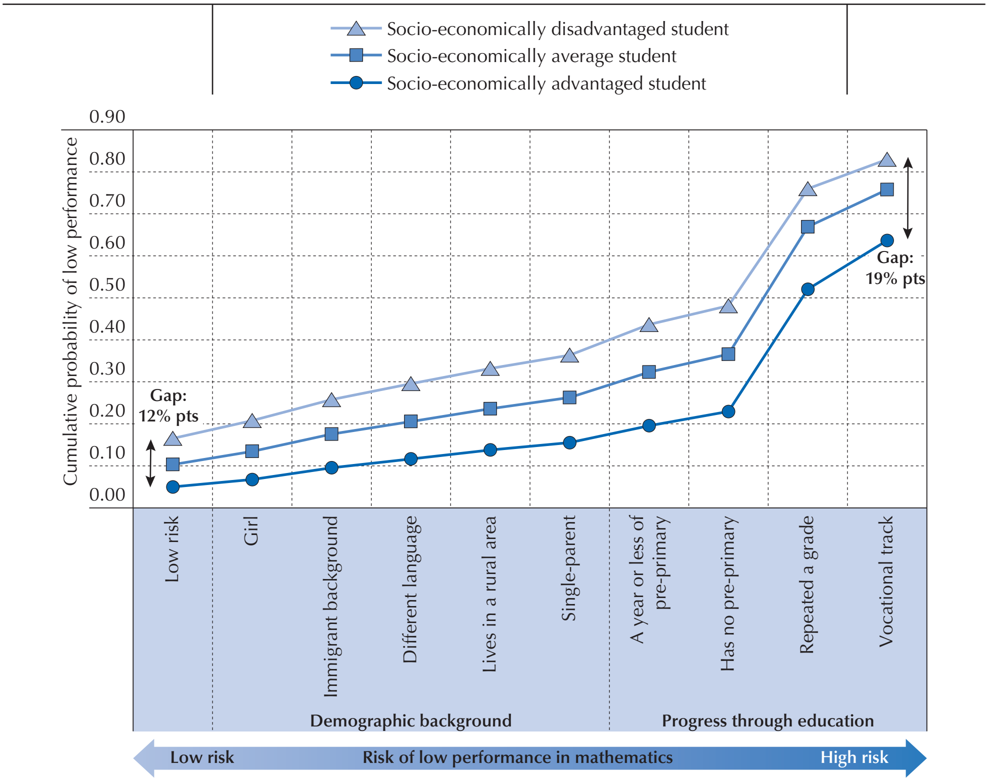


Notes: Statistically significant coefficients are marked in a darker tone.
Students enrolled in vocational tracks are those enrolled in pre-vocational, vocational and modular programmes.
Other student characteristics include: socio-economic status, gender, immigrant background, language spoken at home, family structure, location of student's school (rural area, town or city), attendance at pre-primary school and grade repetition.
Countries and economies are ranked in ascending order of the odds ratio of students enrolled in vocational programmes performing below baseline Level 2 in mathematics, compared with students enrolled in general programmes, after accounting for other student characteristics.
Source: OECD, PISA 2012 Database, Table 2.19.
StatLink http://dx.doi.org/10.1787/888933315431

■ Figure 2.19 ■

Cumulative probability of low performance in mathematics across risk profiles

OECD average



Notes: Risk profiles are based on students' socio-economic, demographic and education characteristics.
The profile of a low risk student is a student who is a boy, has no immigrant background, speaks the same language at home as the language of assessment, lives in a two-parent family, attends a school located in a city, attended pre-primary education for more than one year, has not repeated a grade, and is enrolled in a general track.
A socio-economically advantaged student is a student at the top quarter of the *PISA index of economic, social and cultural status* (ESCS). A socio-economically disadvantaged student is a student at the bottom quarter of ESCS, and a socio-economically average student is a student at the average of the second and third quarters of ESCS.
Coefficient estimates come from a multivariate logistic regression with low performance in mathematics as the outcome and each of the variables in the figure as a covariate.
Source: OECD, PISA 2012 Database, Table 2.21.
StatLink *http://dx.doi.org/10.1787/888933315444*

The figure shows that the probability of low performance in mathematics varies by socio-economic status, as indicated by the three symbols (circle, square and triangle). A socio-economically advantaged student is defined as a student in the top quarter of ESCS; a socio-economically average student is a student at the average of the second and third quarters of ESCS; and a socio-economically disadvantaged student is a student in the bottom quarter of ESCS. On average across OECD countries, a student with a low-risk profile who comes from a disadvantaged family has a 17% probability of low achievement in mathematics, whereas a student who comes from a socio-economically average family has a 10% probability, and an advantaged student has a 5% probability of low performance in mathematics.

On average across OECD countries, a student with a high-risk profile who comes from a disadvantaged family has an 83% probability of low achievement in mathematics, compared with a 76% probability for a student who comes from a socio-economically average family and a 64% probability for an advantaged students. These findings show that while differences in socio-economic status matter, other factors have to be considered too when designing policies to tackle low performance among students.

Which of the other student characteristics are most strongly related to low performance? On average across OECD countries, the variables related to the students' progress through education are associated with larger increases in the probability of low performance compared with variables related to students' demographic background. In particular, repeating a grade leads to an increase in the probability of low performance in mathematics of 28 percentage points for disadvantaged students, 30 percentage points for socio-economically average students, and 29 percentage points for socio-economically advantaged students (see the "Repeated a grade" category in Figure 2.19). This does not necessarily mean that repeating a grade once or more in primary or secondary school causes low performance; but it does show that when students of similar socio-economic, demographic and education backgrounds are compared, by far the largest proportions of low performers are found among students who have repeated a grade.

Enrolment in a vocational track is also a major risk factor. Combined with all other risks, attending a vocational programme leads to an increase in the probability of low performance of 7 percentage points for disadvantaged students, 9 percentage points for socio-economically average students, and 12 percentage points for advantaged students, on average across OECD countries (see "vocational track" in Figure 2.19). For all socio-economic groups, the probability of low performance in mathematics is greater than 50% only for students who have repeated a grade and/or are enrolled in a vocational track. In other words, a student who has never repeated a grade and is enrolled in a general track could be a girl living in a disadvantaged, single-parent family with an immigrant background whose mother tongue is not the same as the language spoken in school, and she would still be expected to score above the baseline level of proficiency in mathematics, based on OECD average estimates. (See Table 2.21 for specific values for each country, and Figure 2.20 hereafter for the variation across groups of countries).

Of the demographic characteristics considered in this analysis, gender and immigration background matter the most. On average across OECD countries, being a girl leads to an increase of 4 percentage points for disadvantaged students, 3 percentage points for socio-economically average students, and 2 percentage points for advantaged students in the probability of low performance in mathematics. Having an immigrant background increases the probability by 5 percentage points, 4 percentage points and 3 percentage points, respectively, for these groups of students.

The figure also reveals that the difference between advantaged and disadvantaged students in the low-risk scenario (a gap of 12 percentage points) becomes even larger under high-risk conditions (a gap of 19 percentage points). This is because student characteristics can affect the probability of low performance among advantaged and disadvantaged students differently. There are some student characteristics, notably all demographic variables and attendance at pre-primary education, that affect disadvantaged students more than they affect advantaged students (i.e. the increase in the probability of low performance is larger), on average across OECD countries. Only repeating a grade and enrolment in a vocational track have greater penalties for advantaged students. Overall, the widening of the gap across the risk spectrum indicates that the concentration of different kinds of risk factors is more detrimental to disadvantaged students. In other words, disadvantaged students tend not only to be encumbered with more risk factors than advantaged students, but those risk factors have a stronger impact on these students' performance.

Different patterns of risk accumulation across countries

Different patterns of risk accumulation are observed in the PISA 2012 data, as shown in Figure 2.20. All countries and economies that participated in PISA 2012 are included in one of the four groups of countries in the figure. The main distinction between the groups is the way the difference in the probability of low performance that is related to socio-economic status varies across the risk spectrum. In the first and second groups (Panels A and B, respectively), the difference (related to socio-economic status) in the probability of low performance in mathematics increases from low-risk to high-risk profiles; in the third group of countries (Panel C), the difference remains stable across the risk spectrum; and in the fourth group (Panel D), the difference decreases in higher-risk profiles.

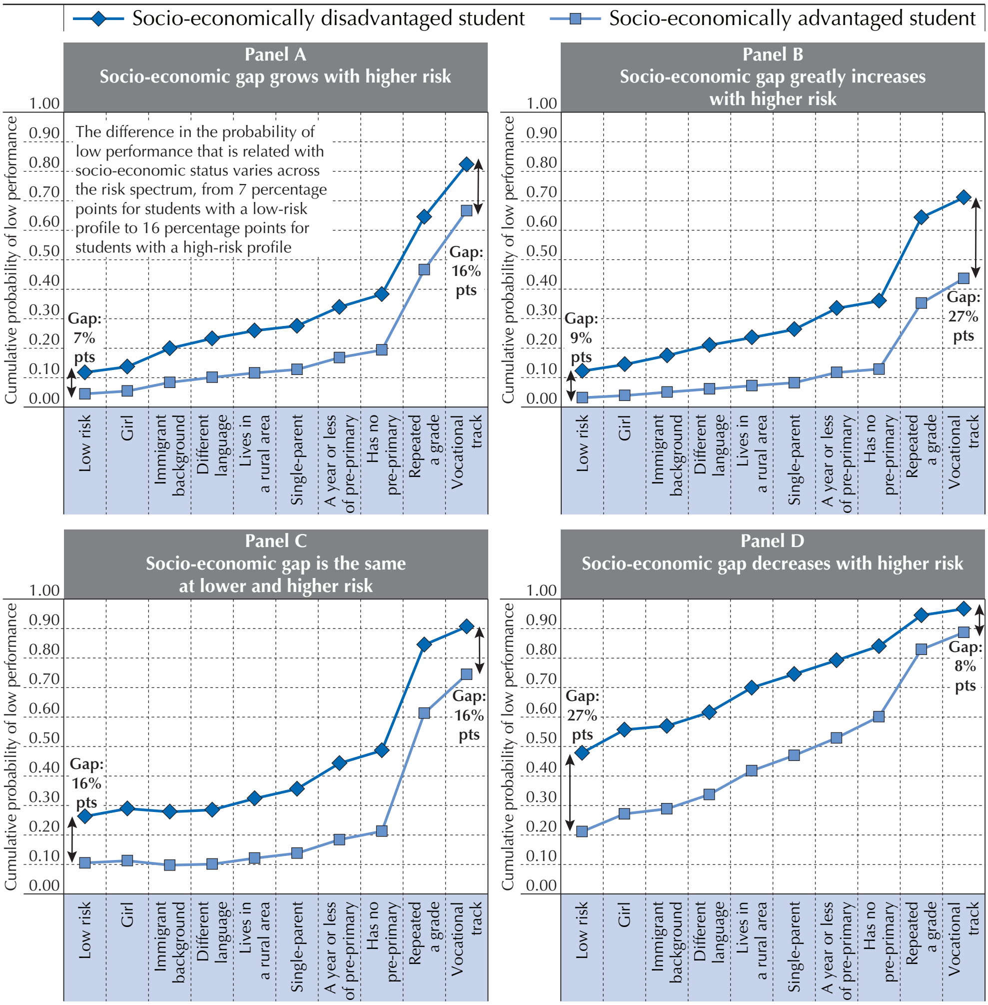
The first group in Figure 2.20 is composed of eight countries (five OECD and three partner countries). These countries show a pattern of risk accumulation that is similar to the OECD average, i.e. the difference in probability of low performance related to socio-economic status grows as more risk factors are added (Panel A). In these countries, the difference in the cumulative probability of low performance between disadvantaged and advantaged students is 7% for students with a low-risk profile and 16% for students with a high-risk profile – an increase of 8 percentage points from low-risk to high-risk profiles. The probability increases because in these countries, the "penalty" that is associated with each of the risk factors under analysis is slightly greater for disadvantaged students than for advantaged students (with the exception of grade repetition and enrolment in a vocational track, where the penalty is slightly greater for advantaged students).

In the second group of countries (Panel B), this difference related to socio-economic status not only increases from low risk to high risk profiles, but does so by a much larger magnitude than the OECD average. Twenty-five countries and economies are part of this group (17 OECD and 8 partner countries and economies), including many countries and economies that were top performers in PISA 2012 (e.g. Estonia, Hong Kong-China, Japan, Korea, Shanghai-China, Singapore, Switzerland and Chinese Taipei). In this group of countries/economies, the difference in the probability of low performance between disadvantaged and advantaged students is 9 percentage points under the low-risk scenario and 27 percentage points under the high-risk scenario – a difference of 18 percentage points. What differs here from the countries in Panel A is that in this group of countries, the penalty for having attended a year or less of pre-primary education (a 7 percentage-point increase for disadvantaged students and a 3 percentage-point increase for advantaged students) and for having repeated a grade (a 28 percentage-point increase for disadvantaged students and a 22 percentage-point increase for advantaged students) is much greater for disadvantaged students than for advantaged students.

■ Figure 2.20 ■

Patterns of risk accumulation across countries

Cumulative probability of low performance in mathematics across risk profiles



Notes: Risk profiles are based on students' socio-economic, demographic and educational background characteristics.
Panel A is the average of the following 8 countries: Croatia, Finland, Iceland, Italy, the Netherlands, the Russian Federation, Spain and Viet Nam.
Panel B is the average of the following 25 countries and economies: Australia, Austria, Belgium, Canada, Denmark, Estonia, Germany, Hong Kong-China, Ireland, Japan, Korea, Latvia, Liechtenstein, Luxembourg, Macao-China, New Zealand, Norway, Poland, Portugal, Serbia, Shanghai-China, Singapore, Switzerland, Chinese Taipei and the United States.
Panel C is the average of the following 9 countries: the Czech Republic, France, Hungary, Kazakhstan, Lithuania, Slovenia, Sweden, the United Arab Emirates and the United Kingdom.
Panel D is the average of the following 21 countries: Argentina, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Greece, Indonesia, Israel, Jordan, Malaysia, Mexico, Montenegro, Peru, Qatar, Romania, the Slovak Republic, Thailand, Tunisia, Turkey and Uruguay.
Coefficient estimates come from a multivariate logistic regression with low performance in mathematics as the outcome and each of the variables in the figure as a covariate.
Source: OECD, PISA 2012 Database, Table 2.21.
StatLink *http://dx.doi.org/10.1787/888933315457*

In a third group of 9 countries (6 OECD and 3 partner countries), there is a 16 percentage-point difference in the probability of mathematics underachievement related to socio-economic status, and it does not change across the risk spectrum (Panel C). In this group of countries, the penalty for repeating a grade (a 36 percentage-point increase in probability for disadvantaged students and a 40 percentage-point increase for advantaged students) and for being enrolled in a vocational track (a 6 percentage-point increase in probability for disadvantaged students and a 13 percentage-point increase for advantaged students) is greater for advantaged students. But the increase in probability of low performance related to demographic risk factors and to not having attended pre-primary education is still slightly larger for disadvantaged students than for advantaged students.

The pattern that diverges the most from the OECD average is found among the group of 21 countries (6 OECD and 15 partner countries) where the difference in the probability of low performance in mathematics related to socio-economic status does not grow but, instead, shrinks in the higher-risk profiles (Panel D). Many of these countries are those with large shares of low performers in mathematics (e.g. Argentina, Brazil, Chile, Colombia, Costa Rica, Indonesia, Jordan, Mexico, Montenegro, Peru, Qatar, Tunisia and Uruguay). In these countries, the difference in probability related to socio-economic status for students with a low-risk profile is, at 27 percentage points, much larger than that observed in the other three groups, and the difference in probability of low performance for students with a high-risk profile is much smaller (8 percentage points) than seen in the other groups. In this group of countries, repeating a grade carries a particularly high penalty for advantaged students (a 23 percentage-point increase in probability) compared with the penalty for disadvantaged students (a 10 percentage-point increase). Being enrolled in a vocational track and having attended a year or less of pre-primary school also carries a higher penalty for advantaged students in these countries.

When interpreting these results, countries should consider the percentage of low performers who have these characteristics. On average across OECD countries, out of all low performers in mathematics, 43% come from disadvantaged families, 51% are girls, 18% have an immigrant background, 15% speak a different language at home than at school, 35% live in rural areas, 20% live in single-parent families, 11% had not attended pre-primary education, 30% had repeated a grade, and 26% attend a vocational programme (see Table 2.22 for each country and economy).

In some countries, the share of some of these groups among the total population of low performers is noticeably greater than the OECD average. For example, in Shanghai-China, Singapore and Chinese Taipei, more than half of low performers come from the 25% most disadvantaged families, and these countries belong to the group shown in Panel B, where the probability of low performance increases steeply for disadvantaged students under conditions of higher risk. In Shanghai-China, 42% of low performers had repeated a grade and 38% are enrolled in a vocational programme. In Singapore, 73% of low performers speak a language at home that is different from the one spoken at school. In Chinese Taipei, 54% of low performers are enrolled in a vocational programme (Table 2.22). This information can help policy makers to tailor support for low performers more effectively.

Similarly, countries in the other groups might want to focus on specific populations of low performers. For example, in Turkey, more than 80% of low performers had not attended pre-primary school. In Germany, 48% of low performers had repeated a grade. In France, 30% of low performers

have an immigrant background, and 74% had repeated a grade. In Chile, where gender has a stronger impact on the likelihood of low performance among disadvantaged students, 58% of low performers in mathematics are girls (Table 2.22).

The policy implications from these findings are clear, and policy makers might want to tailor their policies to address the patterns of risk specific to their own countries. In most countries, students' demographic characteristics and a lack of pre-primary education carry a greater penalty for disadvantaged students, thereby reinforcing their already higher risk of low performance relative to advantaged students. In some countries, particularly in top-performing countries, the penalty for repeating a grade and for attending less than a year of pre-primary school is much greater for disadvantaged students. In other countries, particularly those with large shares of low performers, the differences related to socio-economic status are very large to begin with; but grade repetition, a lack of pre-primary education and being enrolled in a vocational track carry a greater penalty for socio-economically advantaged students. In still other countries, the risk factors for low performance analysed in this chapter affect students of different socio-economic status in similar ways. Chapter 6 discusses in greater depth how policy can be designed to address these diverse and complex relationships.

Notes

1. The *PISA index of economic, social and cultural status* (ESCS) is derived from the following three indices: *highest occupational status of parents* (HISEI), *highest educational level of parents*, in years of education according to ISCED (PARED), and *home possessions* (HOMEPOS). The *index of home possessions* (HOMEPOS) comprises all items on the indices of WEALTH, CULTPOSS and HEDRES, as well as books in the home recoded into a four-level categorical variable (0-10 books, 11-25 or 26-100 books, 101-200 or 201-500 books, more than 500 books). The *PISA index of economic, social and cultural status* (ESCS) is derived from a principal component analysis of standardised variables (each variable has an OECD mean of zero and a standard deviation of one), taking the factor scores for the first principal component as measures of the *PISA index of economic, social and cultural status*. Principal component analysis was also performed for each participating country or economy to determine the extent to which the components of the index operate in similar ways across countries and economies. The analysis revealed that patterns of factor loading were very similar across countries and economies, with all three components contributing to a similar extent to the index (for details on reliability and factor loadings, see the *PISA 2012 Technical Report* (OECD, 2014c).

2. When, as in this case, the inclusion of a variable or set of variables in a regression equation increases the predictive validity (i.e. magnitude of the regression coefficient) of an independent variable, this is known as a "suppression effect" or "inconsistent mediation" (MacKinnon, Krull and Lockwood, 2000; Tzelgov and Henik, 1991; Conger, 1974).

3. The "single-parent" category includes students who declared living in a "single-parent family" and in "other types" of family. Comparisons are made between these two groups combined and students living in "two-parent" families.

4. PISA defines rural areas as locations with fewer than 3 000 inhabitants, towns are those with between 3 000 and 100 000 inhabitants, and cities are locations with more than 100 000 inhabitants. In this analysis, towns and cities are grouped together because they present a similar distribution of low performers in mathematics across OECD countries: 21% of students in cities and 22% of students in towns are low performers, on average across OECD countries, when these groups are considered separately.

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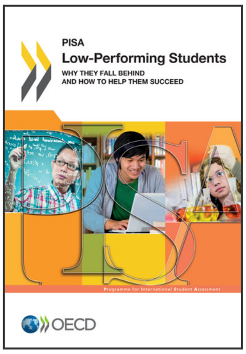

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