



### 3

# Learning Outcomes and Socio-Economic Background

This chapter examines the relationship between student performance and different aspects of socio-economic background. It also discusses the extent to which countries have been able to moderate the impact of socio-economic background on learning outcomes. The chapter defines and uses the socio-economic gradient extensively, which summarises many of the aspects of educational equity that can be analysed by PISA.

While education has expanded over recent decades, inequalities in educational outcomes and in educational and social mobility persist in many countries (OECD, 2010d; OECD, 2010e). The long-term social and financial costs of educational inequalities can be high, as those without the competencies to participate in society fully may not realise their potential and they are likely to generate higher costs for health, income support, child welfare and security (Levin, 2009; Belfield and Levin, 2007). Given that education is a powerful determining factor of life chances, overall, equity in education can improve equity in economic and social outcomes. This is because depending on the equity levels of an education system, education can either reinforce economic advantages across generations or help improve social and economic mobility from one generation to another (OECD, 2010e; OECD, 2010f).

## STUDENTS' SOCIO-ECONOMIC AND CULTURAL STATUS AND PERFORMANCE

Analyses of the impact of students' socio-economic background and their performance in school have usually provided discouraging conclusions, particularly at the national level. For example, using longitudinal methods, researchers who have tracked children's vocabulary development have found that growth trajectories for children from differing socio-economic backgrounds begin to diverge early on, and that when children enter school the impact of socio-economic background on both cognitive skills and behaviour is already well established (Willms, 2002). In addition, during the primary and middle-school years, children whose parents have low incomes, have low education levels, are unemployed or working in low-prestige occupations are less likely to do well in academic pursuits than children growing up in more socio-economically advantaged households. They are also less likely to be engaged in curricular and extra-curricular school activities than their more advantaged peers (Datcher, 1982; Voelkl, 1995; Finn and Rock, 1997; Johnson *et al.*, 2001).

The international comparative evidence from PISA offers a more encouraging outlook on educational equity. Although the relationship between student's background and school performance points to inequities in all countries, the strength of this relationship varies across school systems. Thus, by comparing the relationship between student performance and different aspects of socio-economic background it is possible to identify school systems that successfully reduce the strong relationship between background and performance.

Furthermore, PISA results show that some countries simultaneously demonstrate both high average performance and a relatively moderate relationship between student background and performance, suggesting that equity and performance are by no means opposing or impossible policy objectives. These successful school systems are analysed in more detail in Volume IV, *What Makes a School Successful?*, as they set important benchmarks and policy orientations of what can be achieved in terms of quality and equity in learning outcomes.

Understanding the relationship between students' socio-economic background and performance helps analyse the distribution of educational opportunities. From a school-policy perspective, the relationship indicates how equitably the benefits of education – due to the schools themselves or to other social interactions and policies – are shared among students from different socio-economic backgrounds, as seen in student performance. More generally, these analyses also show how economic, social and cultural status is distributed among the population. Moreover, the relationship between students' performance and their socio-economic background points to how well education systems succeed in providing quality education for all students.

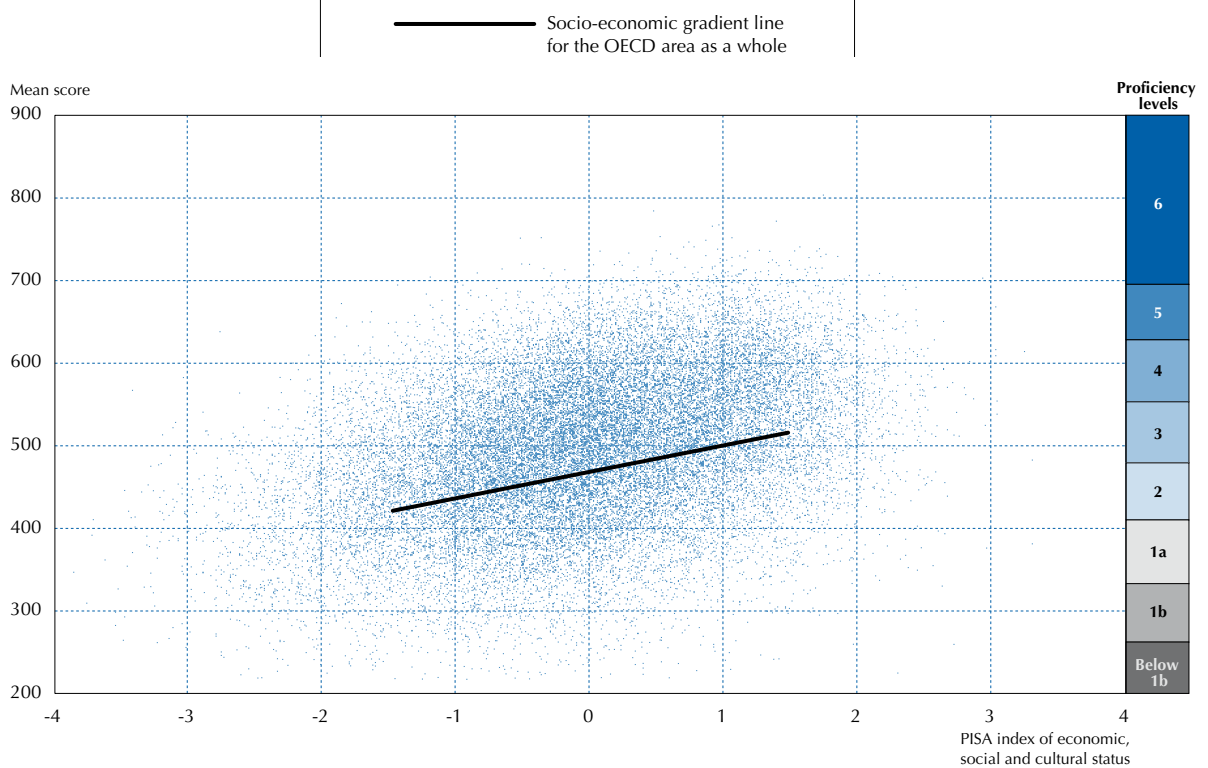
## THE SOCIO-ECONOMIC GRADIENT: AN APPROACH TO EQUITY IN PISA

Within a single construct, the socio-economic gradient summarises many of the aspects of educational equity that can be analysed by PISA.<sup>1</sup> Throughout this volume, the term socio-economic gradient is used to refer to the overall relationship between socio-economic background and performance. More specifically, it refers to the relationship between student performance and the *PISA index of economic, social and cultural status* (see Box II.1.2 for a description of the index). Figure II.3.1 shows the socio-economic gradient for the PISA 2009 assessment. It shows how well students with different socio-economic backgrounds perform on the PISA reading scale for the combined OECD area (Box II.3.1). Summary statistics on different aspects of this relationship for individual countries are shown in Figure II.3.2.




■ Figure II.3.1 ■

### Socio-economic background and reading performance in the OECD area



Note: Each dot represents an OECD student picked at random out of 10 OECD students.

Source: OECD, *PISA 2009 Database*.

StatLink  <http://dx.doi.org/10.1787/888932343589>

#### Box II.3.1 How to read Figure II.3.1

Each dot on this graph represents one in ten 15-year-old students drawn randomly from the combined OECD area. Figure II.3.1 plots their performance in reading against their economic, social and cultural status.

The vertical axis shows student scores on the reading scale, for which the mean was set in PISA 2000 at 500. About two-thirds of the dots fall between 400 and 600. The different shaded areas show the seven proficiency levels in reading.

The horizontal axis shows values on the *PISA index of economic, social and cultural status*. This has been constructed to have a mean of 0 and a standard deviation of 1 in the OECD area, so that about two-thirds of students are between +1 and -1.<sup>2</sup>

The dark line is the gradient line. It summarises the socio-economic gradient, by showing the average association between reading performance and socio-economic background across students in OECD countries.

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

Figure II.3.1 highlights three recurrent findings regarding the socio-economic background of students and their reading performance:

- Students with more socio-economically advantaged backgrounds generally perform better. This finding is shown by the upward slope of the gradient line. Across the OECD countries, this advantage averages to 38 score points in reading for each increase of one standard deviation in socio-economic background (*i.e.* one point in the index shown on the horizontal axis), which is roughly equivalent to a year's worth of schooling, on average across OECD countries.
- A given difference in socio-economic background is associated with a difference in student reading performance that is roughly the same throughout the distribution – *i.e.* the marginal benefit of a greater socio-economic advantage neither diminishes nor rises by a substantial amount as this advantage grows. This is shown by the fact that the socio-economic gradient line is nearly straight.
- The relationship between student performance and the *PISA index of economic, social and cultural status* is far from deterministic. Many disadvantaged students, shown on the left of the figure, score well above what is predicted by the gradient line; in this sense they are “resilient”. Meanwhile, a sizeable proportion of students from privileged home backgrounds perform below what those backgrounds would suggest. In fact, for any group of students with similar backgrounds, there is a considerable range in performance.

The relationship between socio-economic background and performance, as depicted in Figure II.3.1, has five features worth considering from an international comparative perspective: the strength of the gradient and the slope, length, height and linearity of the gradient line. Figure II.3.2 presents each of these dimensions for each country and economy that participated in the PISA 2009 assessment. Each of the five dimensions is considered separately below. The study of these dimensions of the relationship between socio-economic status and reading performance sheds light on which countries succeed in moderating the relationship between background and performance.

**The strength of the gradient** measures the *strength* of the association between student performance and background: that is, it measures the proportion of the variation in student performance that is accounted for by socio-economic background.<sup>3</sup> Expressed as a percentage, it ranges from 0 to 100. If this number is low, relatively little of the variation in student performance is associated with students' socio-economic background; if it is high, a large part of the performance variation can be attributed to socio-economic background. This can be seen for the combined OECD area in Figure II.3.1 by how well the line fits the dispersion of the dots: the closer the dots are to the line, the more the variance is explained by socio-economic background, and the better the socio-economic and cultural status of a student can predict his or her achievement.

Figure II.3.2 shows the strength of the gradient for individual countries. On average across OECD countries, 14% of the variation in student performance in reading within each country is associated with the *PISA index of economic, social and cultural status*. In some OECD countries, the strength of the gradient is relatively weak. For example, less than 10% of the variance in student performance is explained in Estonia, Finland, Norway, Japan and Canada, and it is weakest in Iceland, at less than 7%. The relationship is strongest in Hungary, at 26%, and relatively strong, 18% or more, in Belgium, Turkey, Chile and Luxembourg. Among the partner countries and economies, the strength of the gradient is as high as 27% in Peru and more than 20% in Uruguay and Bulgaria. It is less than 10% in Macao-China, Qatar, Hong Kong-China, Azerbaijan, Indonesia, Jordan, Tunisia, Liechtenstein, Trinidad and Tobago and Serbia. For some of these countries, however, these numbers do not necessarily provide evidence of equity in education in general, because the proportion of students who are not at school at age 15, and so are not assessed by PISA, may be large (see Table A2.1). These students who are not assessed by PISA are more likely to perform poorly and come from socio-economically disadvantaged backgrounds. As a result, equity estimates are probably overestimated for educational systems with low enrolment rates.<sup>4</sup>

**The slope of the gradient line** measures the steepness of the average relationship between reading performance and socio-economic background. The slope shows how much students' performance changes, on average, with a change of one unit on the index of socio-economic status. In Figure II.3.1, the slope of the gradient is shown by the inclination of the gradient line: the sharper the inclination, or the closer it is to a vertical line, the greater the impact of economic, social and cultural status on student performance, suggesting greater inequity; gentler gradients indicate a lower impact of socio-economic background on student performance, *i.e.* more equity. On average across OECD countries, the slope of the gradient is 38 score points (Figure II.3.2, Table II.3.2).

■ Figure II.3.2 ■


## Measures of the relationship between socio-economic background and reading performance

	Strength of the gradient <sup>1</sup>	Slope of the gradient <sup>1</sup>	Mean performance in reading	Mean socio-economic background	Height of the gradient	Length of the gradient	Linearity of the gradient <sup>2</sup>	
	Percentage of variance in student performance explained by student socio-economic background	Score point difference associated with one unit increase in the PISA index of economic, social and cultural status	Average student performance	Average students' PISA index of economic, social and cultural status	Predicted performance for a student with a socio-economic background equal to zero, the OECD average	Range of socio-economic index points for the middle 90% of students (difference between the 95th and 5th percentiles)	Score point difference associated with one unit increase in the PISA index of economic, social and cultural status squared	
OECD	Australia	12.7	46	515	0.34	502	2.38	-2.58
	Austria	16.6	48	470	0.06	468	2.73	-1.29
	Belgium	<b>19.3</b>	47	506	0.20	499	2.93	1.87
	Canada	8.6	32	524	0.50	510	2.63	2.79
	Chile	<b>18.7</b>	31	449	-0.57	468	3.73	3.53
	Czech Republic	12.4	46	478	-0.09	483	2.30	-1.98
	Denmark	14.5	36	495	0.30	485	2.81	<b>-2.67</b>
	Estonia	7.6	29	501	0.15	497	2.53	1.61
	Finland	7.8	31	536	0.37	525	2.45	<b>-3.60</b>
	France	16.7	51	496	-0.13	505	2.74	-1.50
	Germany	<b>17.9</b>	44	497	0.18	493	2.94	-2.95
	Greece	12.5	34	483	-0.02	484	3.21	-0.29
	Hungary	<b>26.0</b>	48	494	-0.20	504	3.14	<b>-4.71</b>
	Iceland	6.2	27	500	0.72	483	2.88	<b>-4.85</b>
	Ireland	12.6	39	496	0.05	496	2.72	<b>-3.50</b>
	Israel	12.5	43	474	-0.02	480	2.75	2.14
	Italy	<b>11.8</b>	32	486	-0.12	490	3.32	<b>-3.09</b>
	Japan	8.6	40	520	-0.01	522	2.32	<b>-4.91</b>
	Korea	<b>11.0</b>	32	539	-0.15	544	2.71	-0.06
	Luxembourg	<b>18.0</b>	40	472	0.19	466	3.63	-0.13
	Mexico	14.5	25	425	-1.22	456	4.18	0.23
	Netherlands	12.8	37	508	0.27	499	2.66	4.55
	New Zealand	<b>16.6</b>	52	521	0.09	519	2.53	-0.15
	Norway	8.6	36	503	0.47	487	2.36	<b>-5.03</b>
	Poland	14.8	39	500	-0.28	512	2.86	<b>-3.10</b>
	Portugal	16.5	30	489	-0.32	499	3.79	-0.03
	Slovak Republic	14.6	41	477	-0.09	482	2.70	<b>-5.48</b>
	Slovenia	14.3	39	483	0.07	481	2.78	-0.75
Spain	13.6	29	481	-0.31	491	3.58	-0.58	
Sweden	13.4	43	497	0.33	485	2.57	<b>-2.45</b>	
Switzerland	14.1	40	501	0.08	498	2.90	-0.57	
Turkey	<b>19.0</b>	29	464	-1.16	499	4.02	-0.27	
United Kingdom	13.7	44	494	0.20	488	2.52	0.84	
United States	16.8	42	500	0.17	493	3.01	6.61	
OECD average	14.0	38	493	0.00	494	2.92	<b>-0.95</b>	
Partners	Albania	10.7	31	385	-0.95	416	3.44	2.71
	Argentina	<b>19.6</b>	40	398	-0.62	424	3.90	5.01
	Azerbaijan	7.4	21	362	-0.64	376	3.18	2.26
	Brazil	13.0	28	412	-1.16	445	3.94	6.51
	Bulgaria	<b>20.2</b>	51	429	-0.11	437	3.08	-2.79
	Colombia	16.6	28	413	-1.15	445	4.15	3.23
	Croatia	<b>11.0</b>	32	476	-0.18	482	3.04	-1.88
	Dubai (UAE)	14.2	51	459	0.42	439	2.61	-1.35
	Hong Kong-China	4.5	17	533	-0.80	548	3.42	<b>-3.22</b>
	Indonesia	7.8	17	402	-1.55	428	3.55	2.74
	Jordan	7.9	24	405	-0.57	420	3.30	0.31
	Kazakhstan	12.0	38	390	-0.51	410	2.66	-0.65
	Kyrgyzstan	14.6	40	314	-0.65	341	3.02	7.02
	Latvia	<b>10.3</b>	29	484	-0.13	488	2.75	0.28
	Liechtenstein	8.4	26	499	0.09	497	2.93	-4.38
	Lithuania	13.6	33	468	-0.05	471	2.99	0.39
	Macao-China	1.8	12	487	-0.70	495	2.92	-0.92
	Montenegro	<b>10.0</b>	31	408	-0.24	416	3.09	-1.62
	Panama	18.1	31	371	-0.81	402	4.23	8.20
	Peru	<b>27.4</b>	41	370	-1.31	424	4.18	0.45
	Qatar	4.0	25	372	0.51	360	3.00	-0.97
	Romania	13.6	36	424	-0.34	437	2.93	-0.67
	Russian Federation	<b>11.3</b>	37	459	-0.21	468	2.51	0.23
	Serbia	9.8	27	442	0.07	440	3.17	0.63
	Shanghai-China	12.3	27	556	-0.49	569	3.35	0.79
	Singapore	15.3	47	526	-0.43	547	2.57	2.71
	Chinese Taipei	11.8	36	495	-0.33	507	2.74	1.37
	Thailand	13.3	22	421	-1.31	450	3.72	4.41
Trinidad and Tobago	9.7	38	416	-0.58	441	3.11	6.87	
Tunisia	8.1	19	404	-1.20	426	4.18	2.38	
Uruguay	<b>20.7</b>	37	426	-0.70	453	4.00	1.15	

1. In these columns values that are statistically significantly different from the OECD average are indicated in bold.

2. Values that are statistically significant are indicated in bold.

Source: OECD, PISA 2009 Database, Table II.3.2.

StatLink  <http://dx.doi.org/10.1787/888932343589>

This means that students' scores on the reading scale are, on average in the OECD countries, 38 score points higher for each extra unit on the *PISA index of economic, social and cultural status*. This can be interpreted as showing that a student just within the top 15 percent of the population by socio-economic background would be predicted to score about 38 points higher than an average student or one proficiency level higher than a student just within the bottom 15 percent of the population.

As Figure II.3.2 shows, among OECD countries, the slope of the gradient is relatively gentle in Iceland, Estonia, Spain and Portugal, all with slopes of 30 score points or less. This is also the case in Turkey and Mexico; but in both of these countries, large numbers of students have already left the school system by the time they are 15. By contrast, the slope of the gradient is steep in New Zealand, France, Austria, Hungary, Belgium, Australia and the Czech Republic at over 45 score points. Among the partner countries and economies, the slope of the gradient ranges from more than 45 score points in Bulgaria, Dubai (UAE) and Singapore to less than 20 score points in Macao-China, Indonesia, Hong Kong-China and Tunisia. Where the number of students who no longer attend school in these countries and economies by the time they are 15 is large, these figures cannot necessarily be interpreted as providing evidence of an equitable distribution of educational opportunities and outcomes.

The slope and the strength of the gradient measure different aspects of the relationship between socio-economic background and performance. Figure II.3.2 illustrates both the strength and the slope of the gradient side by side for all countries and economies. For example, in Austria and Hungary, the slope of the gradient is 48 score points, a relatively steep relationship; but in Austria, differences in socio-economic background explain 17% of the variation in student performance, while in Hungary, socio-economic background explains more than 26% of that variation. This means that in Austria, disadvantaged students are more likely to perform beyond expectations and in Hungary fewer disadvantaged students perform at the level of their advantaged peers. The same occurs among countries with gentler gradients. For example, both Chile and Finland have a gradient slope of 31 score points. In Chile, the strength of the gradient is more than 19% while in Finland it is only 8%. This disparity indicates that while the average performance difference between advantaged and disadvantaged students in Finland and Chile is similar, the likelihood of disadvantaged students performing at levels similar to those of their advantaged peers is much lower in Chile than in Finland.

Where the slope of the gradient is steep and the gradient is strong, the challenges are greatest because this combination implies that students and schools are unlikely to “escape” the close relationship between socio-economic background and learning outcomes. In these countries, this strong relationship also produces marked differences in performance between students from advantaged and disadvantaged backgrounds. Where the slope is steep and the gradient weak, the relationship between socio-economic background and learning outcomes is an average tendency with many students performing above or below what is expected by this general trend.

**The height of the gradient line<sup>5</sup>** measures performance after accounting for socio-economic background. It indicates the performance of a student with a background equal to the average across OECD countries, which has been standardised to a value of 0. In Figure II.3.1, the height of the gradient line is shown by the performance level at which the gradient line crosses the vertical axis depicted at a socio-economic background score of zero. This can be applied to each country individually. The height of the gradient line for individual countries is given in Figure II.3.2.

The height of the gradient line provides an indication of what students' mean performance in an education system would be if the average economic, social and cultural background of its student population were identical to the OECD average. The average performance of students depends on the education system and the overall social, economic and political institutions that influence student performance. This includes, but is not restricted to, government institutions that improve children's material conditions, like housing, nutrition and health care. Thus, these comparisons are limited because differences in these conditions across countries are not taken into account. Figure II.3.5 highlights the difference between the country mean score, as predicted by the socio-economic distribution and the actual mean performance score.

**The length of the gradient line** measures socio-economic differences in the student population. The longer the gradient, the wider the potential disparities between advantaged and disadvantaged students. In countries with large socio-economic disparities among households, even a gentle gradient can indicate large differences in the extent to which socio-economic background affects student outcomes when advantaged and disadvantaged students are compared. Longer gradients imply greater challenges for public policy, since schools and school systems face a socio-economically more heterogeneous student population in these countries.



Figure II.3.1 shows the length of the gradient line. The line is drawn from the 5th percentile to the 95th percentile of the *PISA index of economic, social and cultural status* among the OECD students. It depicts the range of socio-economic scores for the middle-performing 90% of students. Figure II.3.2 shows that some education systems need to cater to students from a wider range of socio-economic backgrounds than others. Across the OECD area, the length of the gradient ranges from less than 2.5 standard deviations on *the PISA index of social, economic and cultural status* in the Czech Republic, Japan, Norway, Australia and Finland to more than 3.5 standard deviations in Mexico, Turkey, Portugal, Chile, Luxembourg and Spain. Among partner countries and economies, the length of the gradient is never less than 2.5 standard deviations, yet is more than 3.5 standard deviations in Uruguay, Brazil, Argentina, Thailand and Indonesia and more than 4.0 in Panama, Peru, Tunisia and Colombia (Table II.3.2).

**The linearity of the gradient line** measures the extent to which the performance difference associated with an advantaged background remains constant across levels of socio-economic background. In Figure II.3.1, the gradient line is almost straight. Figure II.3.2 presents the index of curvilinearity, in which a positive value indicates that the socio-economic gradient becomes steeper for more advantaged socio-economic students. In other words, as socio-economic background increases, there is an increase in the extent to which inequalities in socio-economic background translate into performance differences. A negative value indicates the flattening off of the gradient at higher levels of socio-economic background: as socio-economic background becomes more advantaged, there is a decline in the extent to which inequalities in socio-economic background translate into performance differences.

As Figure II.3.2 shows, the gradient line for many countries is roughly linear. Although the OECD average in the index of curvilinearity is -1 and statistically significant, it can be considered as practically linear. In some countries, however, the gradients are steep at low levels of economic, social and cultural status, and tend to level off at higher status levels, signalling that there is progressively less associated advantage in student performance at higher levels of socio-economic background. This phenomenon is moderate in the Slovak Republic, Norway, Japan, Iceland and Hungary, and is also visible in Finland, Ireland, Poland, Italy, Denmark and Sweden and in the partner economy Hong Kong-China. However, in another group of countries, most notably in the United States and the Netherlands but also in Chile and Canada and the partner countries and economies Panama, Kyrgyzstan, Trinidad and Tobago, Brazil, Argentina, Thailand, Colombia, Indonesia and Tunisia, the gradients are relatively gentle at low levels of socio-economic background, becoming steeper at higher levels (Table II.3.2). In these countries, the greater the socio-economic advantage, the greater the marginal increase observed in student performance, and among students from socio-economically less advantaged backgrounds, there are small differences in performance.

The finding that across countries gradients tend to be roughly linear, or only modestly curved, across the range of economic, social and cultural status, has an important policy implication. Many socio-economic policies are aimed at providing more resources to the most disadvantaged students, either through taxation or by targeting benefits and socio-economic programmes for certain groups. The results from PISA suggest that, in many countries, it is not easy to establish a particular level of economic, social and cultural status below which performance declines sharply. If such a status is taken as a surrogate for parents' decisions and actions aimed at providing a richer environment for their children (such as taking an interest in their school work) then these findings suggest that there is room for improvement at all levels of the socio-economic continuum. But difficulty in determining such a level of socio-economic disadvantage does not imply that differentiated student support is unwarranted. As discussed in Chapter 6, education policy can also take the form of performance-targeted policies. In this respect, and from an equity perspective, it is useful to identify students not proficient at Level 2 on the PISA reading scale (see Chapter 1 of this volume), as the future education, occupation and social careers of these students are at risk.

## A COMPARATIVE PERSPECTIVE ON SOCIO-ECONOMIC GRADIENTS

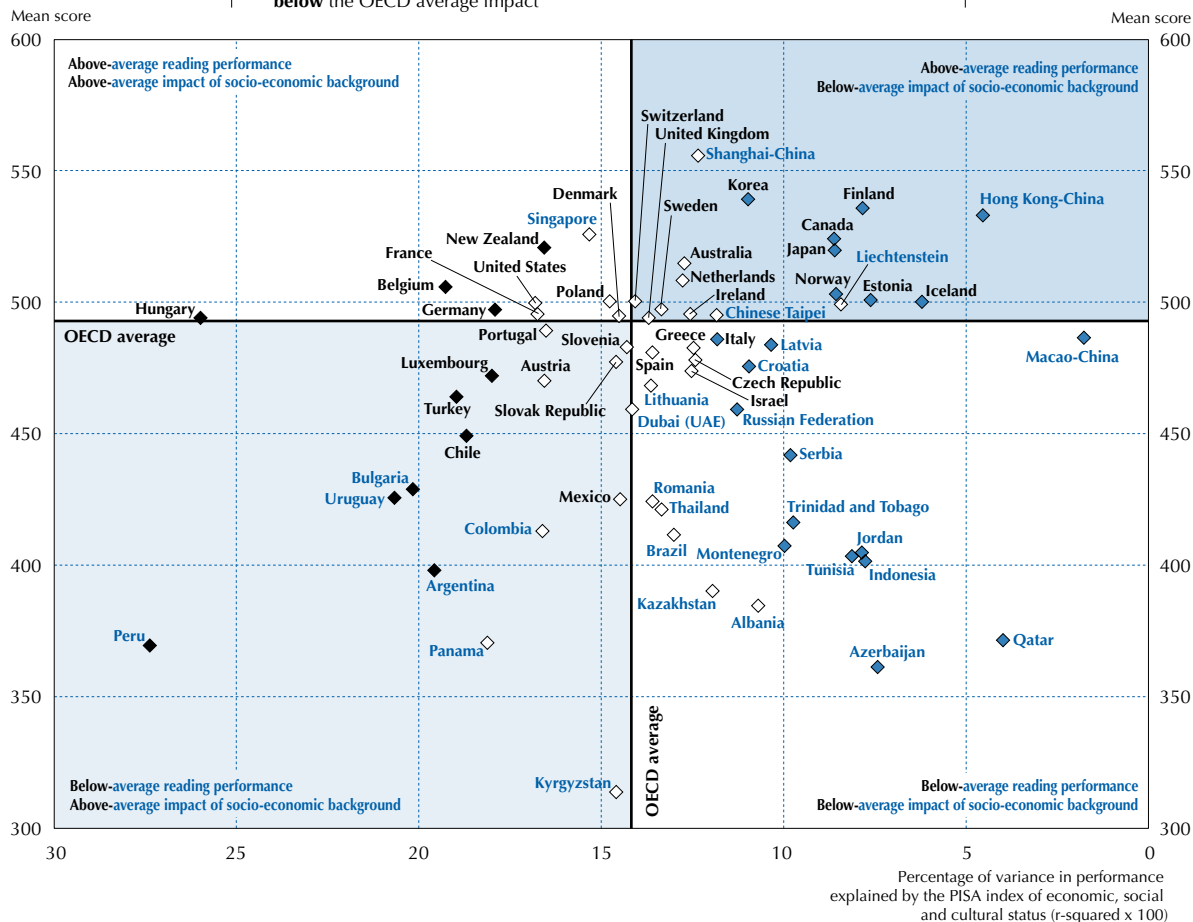
Countries differ not just in their overall performance, but also in the extent to which they are able to moderate the association between socio-economic background and performance. PISA suggests that maximising overall performance and securing similar levels of performance among students from different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

Figure II.3.3 contrasts average performance in reading (on the vertical axis) with the strength of the relationship between socio-economic background and reading performance used as an indicator of equity in the distribution of learning opportunities (on the horizontal axis). Figure II.3.4 provides a similar perspective, but with the slope of the socio-economic gradient on the horizontal axis.

■ Figure II.3.3 ■

**Strength of the socio-economic gradient and reading performance**

- ◆ Strength of the relationship between performance and socio-economic background **above** the OECD average impact
- ◇ Strength of the relationship between performance and socio-economic background **not statistically significantly different** from the OECD average impact
- ◆ Strength of the relationship between performance and socio-economic background **below** the OECD average impact



Source: OECD, *PISA 2009 Database*, Table II.3.2.  
StatLink <http://dx.doi.org/10.1787/888932343589>

In the upper-right quadrant of both Figures II.3.3 and II.3.4 appear Canada, Finland and Korea, among OECD countries together with the partner economy Hong Kong-China. Japan is also in this quadrant in Figure II.3.3, as is the partner economy Shanghai-China in Figure II.3.4. These countries display high student performance in reading and, at the same time, a below-average impact of economic, social and cultural status on student performance. With mean performance closer to the OECD average, Estonia and Iceland also appear among the countries with relatively gentle and weak relationships between socio-economic background and performance, while in Norway the relationship is also weak but the slope of the gradient is close to the OECD average. These school systems can be considered worthwhile cases for analysis inasmuch as they succeed in having both high levels of equity and high levels of performance. Volume IV, *What Makes a School Successful?*, delves into the organisational characteristics of these successful school systems.

In contrast, the lower-left quadrant of Figure II.3.3 displays the OECD countries Chile, Turkey and Luxembourg together with the partner countries Peru, Argentina, Uruguay and Bulgaria with below-average student performance in reading and an above-average strength in the relationship between socio-economic background and performance. Of this group, only Bulgaria remains in Figure II.3.4 and it is joined by Austria, Israel and the Czech Republic,



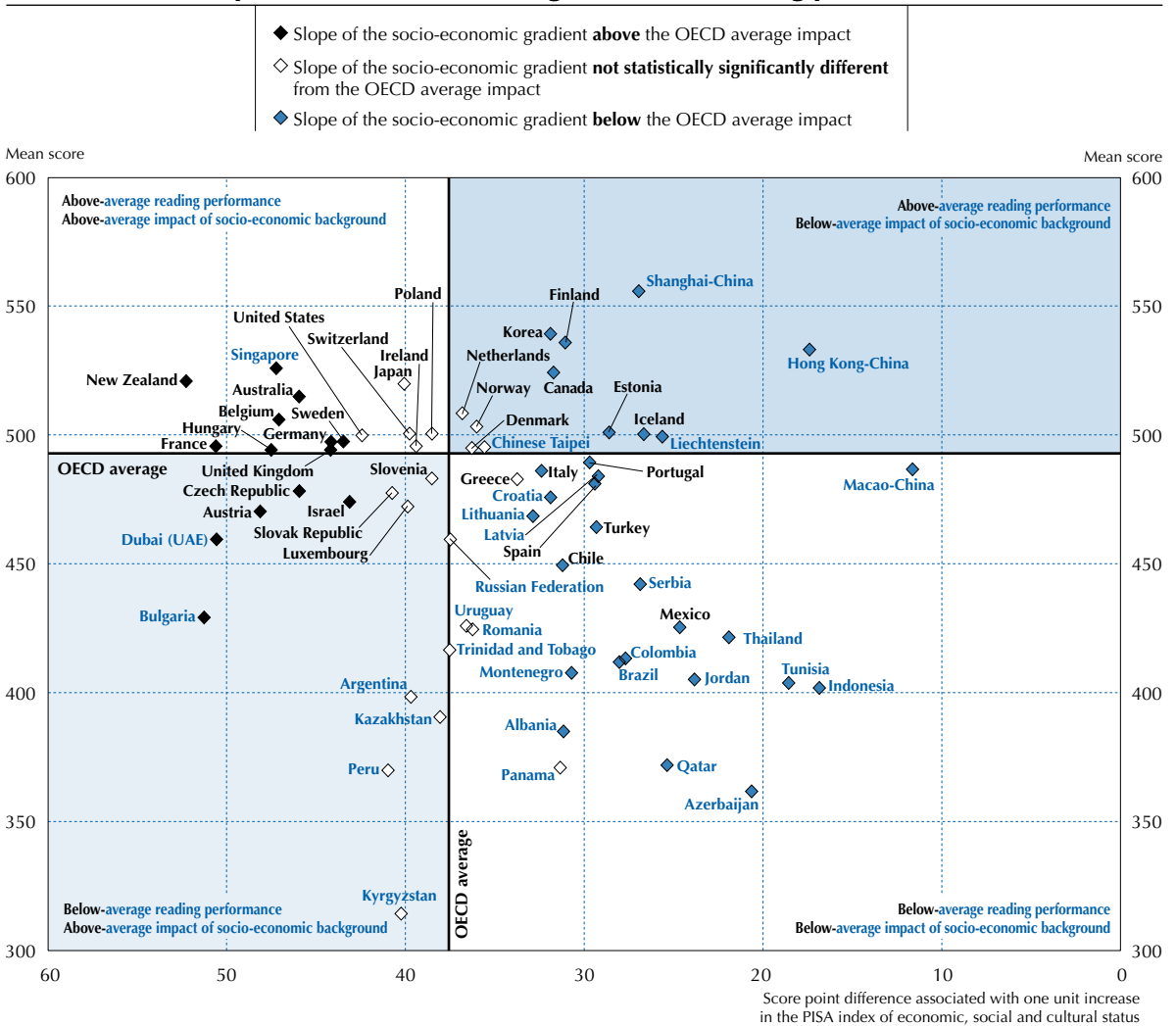


among OECD countries, and the partner economy Dubai (UAE). In these countries, educational policy faces the greatest challenge of raising the average performance and providing more equal educational opportunities for disadvantaged students.

Only New Zealand and Belgium show high average performance and large socio-economic inequalities. Figure II.3.3 shows no other countries with above-average performance levels and a comparatively strong relationship between performance and socio-economic background. Germany and Hungary both show a greater-than-average strength of the socio-economic gradient and a mean performance very close to the OECD average. When the slope, instead of the strength, of the gradient is used, as Figure II.3.4 shows, these OECD countries are joined by Australia and the partner country Singapore among those with steeper-than-average socio-economic gradients and above-average performance. France, Sweden and the United Kingdom all have steeper-than-average socio-economic gradients and a mean performance around the OECD average.

In the lower-right quadrant of Figures II.3.3 and II.3.4, the partner countries and economies Azerbaijan, Qatar, Indonesia, Tunisia, Jordan, Montenegro, Serbia and Croatia show below-average performance and below-average impact of socio-economic background on performance (this group also includes Trinidad and Tobago and the Russian Federation, but only in Figure II.3.3, and Lithuania, Thailand, Colombia, Brazil and Albania, but only in Figure II.3.4).

■ Figure II.3.4 ■  
**Slope of the socio-economic gradient and reading performance**



Source: OECD, PISA 2009 Database, Table II.3.2.  
 StatLink <http://dx.doi.org/10.1787/888932343589>

Italy and the partner countries and economies Latvia and Macao-China also show weaker-than-average gradients, but their mean performance is 10 points or less below the OECD average. In the lower-right quadrant of Figure II.3.4, among OECD countries, Italy is joined by Chile, Mexico, Spain, Portugal and Turkey as countries with gentler-than-average slopes and lower-than-average performance, although Portugal and Italy are less than 10 score points below the OECD average. Although some of these countries show that below-average performance in reading is associated with an average impact of socio-economic background, in some cases only a portion of 15-year-olds in these countries are enrolled in school (see Table A2.1). Since PISA only surveys 15-year-olds that are in school, the impact of socio-economic background on the reading performance of 15-year-olds may be underestimated where enrolment rates are low.

Comparing the relationship between socio-economic background and student performance, it is important to take into account the marked differences in the distribution of socio-economic characteristics between countries. Figure II.3.2 presents each country or economy's mean socio-economic score. Among OECD countries, students in Mexico and Turkey have a mean socio-economic background of more than one standard deviation below the average OECD student. In Chile, the average student has a socio-economic index that lies more than half a standard deviation below the OECD average, and in Spain and Portugal, mean socio-economic background is about 0.3 of a standard deviation below the OECD average.

Among the partner countries and economies, the mean socio-economic background across students is generally below the OECD average. In Indonesia, Peru, Thailand, Tunisia, Brazil and Colombia the mean socio-economic background is more than one standard deviation below the OECD average. As discussed above, in some of these countries, large numbers of students, particularly students who are disadvantaged and perform poorly, are no longer in the school system. This will have an impact on the inferences drawn from the PISA data on the issue of equity.

The socio-economically disadvantaged background of the average student in Hong Kong-China (0.8 of a standard deviation below the OECD average) Shanghai-China and Singapore (0.5 below the average) makes their high performance all the more impressive. At the same time, the socio-economically disadvantaged background of the average student in other countries and economies helps explain their observed below-average performance, where students have fewer home advantages than the average student in OECD countries.

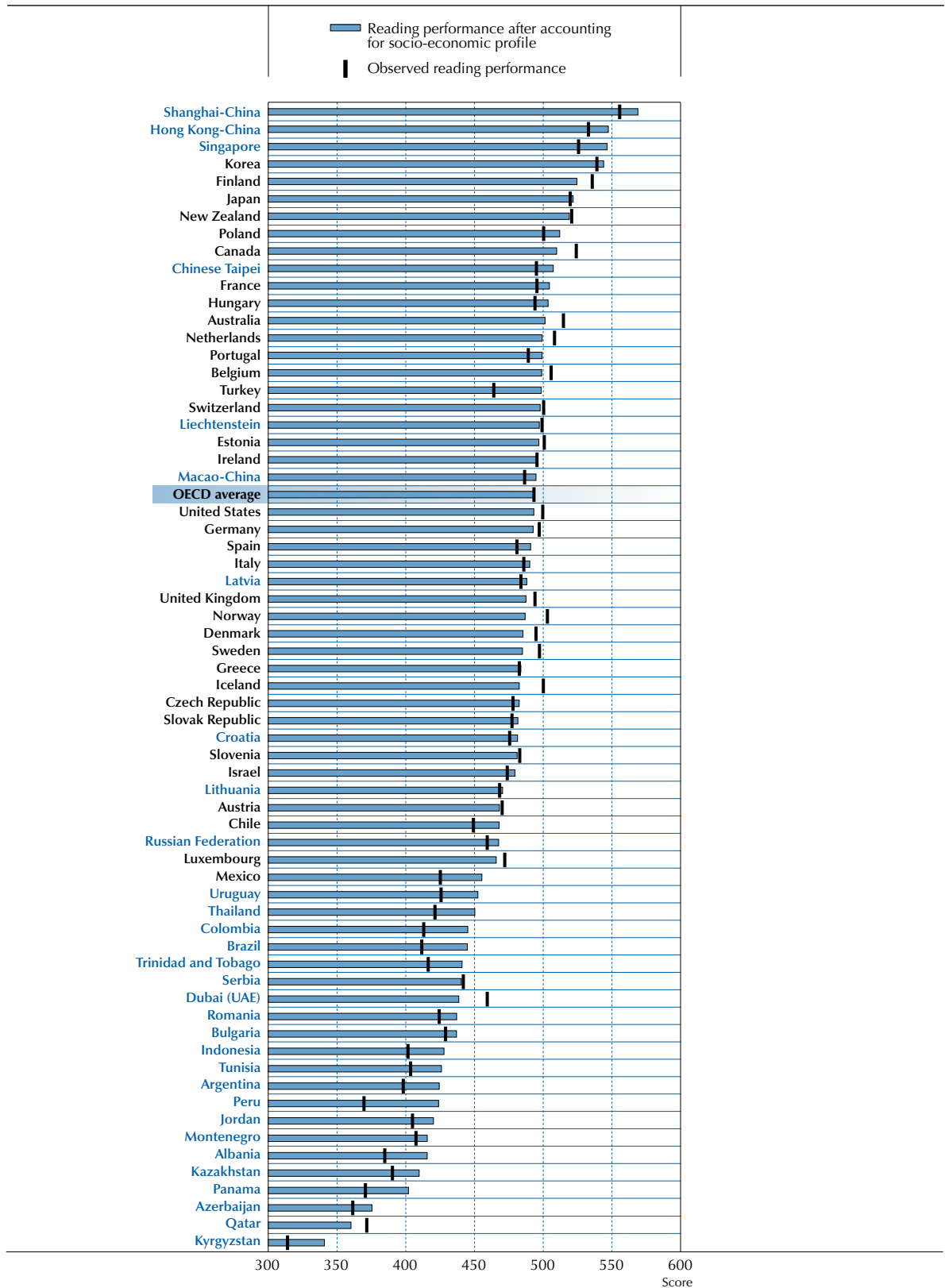
Figure II.3.5 shows the average scores before and after accounting for countries' socio-economic profile. This hypothetical adjustment, also referred to as the height of the gradient line, assumes that all countries have the same average *PISA index of economic, socio-economic and cultural status*, equal to that of the OECD average. This change in the socio-economic profile of countries would result, for example, in an increase in Turkey's performance from 464 to 499 score points and Portugal's from 489 to 499 score points, higher than the OECD average performance. With such an adjustment, Spain and Italy would move from a below-average unadjusted score to an adjusted score around the OECD average. Similarly, the partner economy Macao-China would also improve its score to a level above the OECD average. The adjustment also improves scores for Mexico by 30 score points and reduces Iceland's mean performance from 500 to 483 score points. Among the partner countries and economies, the adjustment raises the performance score by more than 25 score points in Thailand, Kyrgyzstan, Uruguay, Indonesia and Argentina; more than 30 score points in Brazil, Colombia, Panama and Albania; and more than 50 score points in Peru. The score for Dubai (UAE) decreases by 21 score points and that of Qatar by 12 score points. These differences between the observed performance and the adjusted performance reflect the extent to which performance differences are driven by the average socio-economic background of the student population. The fact that adjusted scores still differ across countries provides evidence that socio-economic differences across countries explain only part of the differences in systems' reading performance (Volume IV, *What Makes a School Successful?*, delves deeper into the organisational characteristics that may explain these differences across school systems).

Such an adjustment is obviously entirely hypothetical: countries operate in a global marketplace where actual rather than adjusted performance in cognitive skills and abilities – and non-cognitive skills beyond PISA's measure – is all that counts. Also, the adjustment does not take into consideration the complex social, cultural and institutional context of each educational system. However, in the same way that comparisons of school quality focus on the added value that schools provide, accounting for the socio-economic intake of schools when interpreting results, those who use cross-country comparisons need to bear in mind the economic, social and educational differences among countries.



■ Figure II.3.5 ■

### Countries' mean reading performance, observed and after accounting for socio-economic profile



Countries are ranked in descending order of the reading performance after accounting for socio-economic profile.

Source: OECD, PISA 2009 Database, Table II.3.2.

StatLink <http://dx.doi.org/10.1787/888932343589>

The heterogeneity in socio-economic characteristics within each system should also be considered. Figure II.3.2 reports the socio-economic range in which 90% of the students can be found (the length of the gradient). In fact, many of the countries with below-average socio-economic backgrounds, most notably Mexico, Turkey and the partner countries Peru, Tunisia, Colombia, Brazil, Thailand and Indonesia, also show significant heterogeneity in the socio-economic backgrounds of 15-year-olds.

Socio-economic gradients with similar slopes will have a much larger impact on the performance gap in countries whose student populations are highly heterogeneous than in countries that have more socio-economically homogeneous student populations. For example, in Norway and Uruguay, a given socio-economic difference is associated with a similar difference in performance. However, since the distribution of socio-economic characteristics is much more heterogeneous in Uruguay than in Norway, the performance gap among students in the top and bottom quarters of the *PISA index of economic, social and cultural status* is much larger in Uruguay than in Norway.

For countries whose average socio-economic background is relatively disadvantaged, and which have a large dispersion of socio-economic characteristics, it is particularly difficult to meet the needs of disadvantaged students: not only are there many disadvantaged students, but many disadvantaged students show very low levels of socio-economic background. For example, in Mexico, Turkey and the partner countries Brazil and Colombia, more than half of all students come from a socio-economic background below that of the least-advantaged 15% of students in the OECD countries (as indicated by one standard deviation below the OECD average), while in Indonesia, Peru and Thailand, more than 60% of students do so. In contrast, in Norway, Australia, Iceland, Canada and Finland, less than 5% of students have a socio-economic background below that of the least advantaged 15% of students in the OECD countries (Table II.3.2).

### STUDENT RESILIENCE IN PISA: THE PROPORTION OF DISADVANTAGED STUDENTS WHO SUCCEED IN PISA

While many of the students who perform poorly in PISA are from socio-economically disadvantaged backgrounds, a large number of disadvantaged students excel in PISA (OECD, 2010b). These students and their school systems show that overcoming socio-economic barriers to achievement is possible.

Resilient students are those who come from a disadvantaged socio-economic background and perform much higher than would be predicted by their background. To identify these students, first, the relationship between performance and socio-economic background across all students participating in the PISA 2009 assessment is established. Then the actual performance of each disadvantaged student is compared with the performance predicted by the average relationship among students from similar socio-economic backgrounds across countries. This difference is defined as the student's residual performance. A disadvantaged student is classified as resilient if his or her residual performance is found to be amongst the top quarter of students' residual performance from all countries.<sup>6</sup> While the prevalence of resilience is not the same across educational systems, it is possible to identify substantial numbers of resilient students in practically all OECD countries.

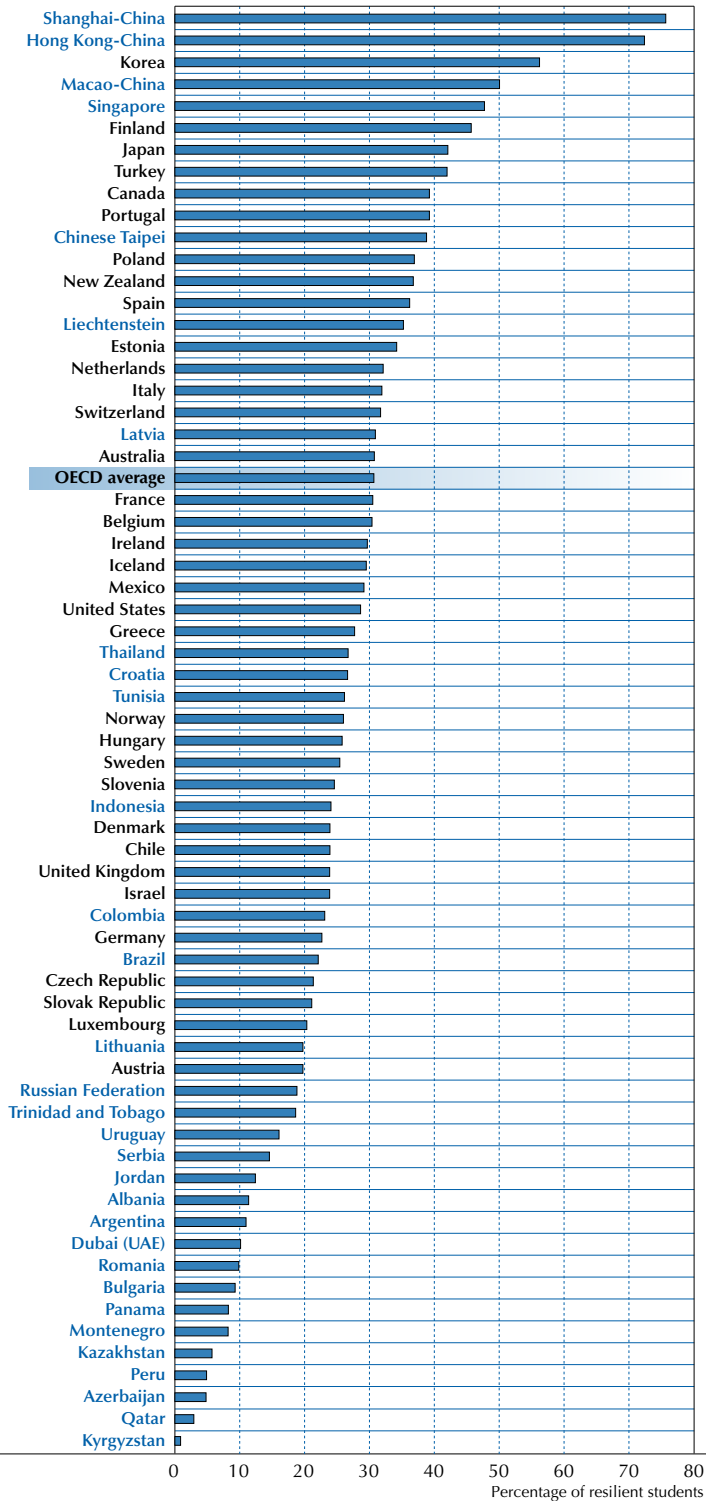
Figure II.3.6 shows that on average across the OECD, 31% of disadvantaged students are resilient. The figure shows that more than half of all disadvantaged students in Korea can be considered resilient. In the partner economies Shanghai-China and Hong Kong-China, the percentage of disadvantaged students that are resilient students is higher than 70% and in Macao-China it is 50%. This percentage is also higher than 35% in Finland, Japan, Turkey, Canada, Portugal, Poland, New Zealand, Spain and in the partner countries and economies Singapore, Chinese Taipei and Liechtenstein.

The analyses of this chapter provide an overview of how socio-economic background is related to reading performance. Although this relationship is present in all countries and economies, countries vary in the strength, steepness and length of the socio-economic gradient, with different proportions of disadvantaged students overcoming the odds and succeeding in school. These cross-country differences in the socio-economic gradient pose different policy challenges for countries. These are discussed in greater detail in the policy implications section of this volume.




■ Figure II.3.6 ■

### Percentage of resilient students among disadvantaged students



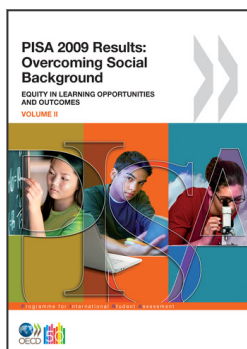
Note: A student is classified as resilient if he or she is in the bottom quarter of the PISA index of economic, social and cultural status (ESCS) in the country of assessment and performs in the top quarter across students from all countries after accounting for socio-economic background. The share of resilient students among all students has been multiplied by 4 so that the percentage values presented here reflect the proportion of resilient students among disadvantaged students (those in the bottom quarter of the PISA index of social, economic and cultural status).

Source: OECD, *PISA 2009 Database*, Table II.3.3.

StatLink  <http://dx.doi.org/10.1787/888932343589>

## Notes

1. The socio-economic gradient has become a fixture of the PISA analysis of equity in education systems (OECD, 2001, 2004, and 2007b). The first application of socio-economic gradients to PISA data was developed by Douglas Willms for the last chapter of the PISA 2000 international report (Chapter 8).
2. While this is true for the OECD as a whole, it will not be so for each member country individually.
3. More formally, it is the  $R^2$  of a regression with reading performance as the dependent variable and the *PISA index of economic, social and cultural status* as predictor. Hauser (2010) argues for using a different measure to evaluate the relationship between socio-economic background and performance that is related to the explained variance used here, the error variance.
4. It is also possible that the measures of socio-economic background are weaker approximations to socio-economic status in these countries and therefore the observed relationship with performance is weaker and/or the slope is gentler.
5. As shown in Figure II.3.2 and Table II.3.2, the unadjusted mean score for the OECD average is 493 score points, and the height of the gradient line is 494, even though the OECD average *PISA index of economic, social and cultural status* is 0.0. The discrepancy between the unadjusted mean score and the height of the gradient line is due to rounding error. In strict terms, the OECD average *PISA index of economic, social and cultural status* is 0.0013 producing a small difference between the unadjusted OECD average (493.45) and the OECD average height of the gradient line (493.88).
6. For an internationally comparable definition of resilient students, students were defined as disadvantaged and non-disadvantaged within each country relative to distribution of socio-economic background in this country. Disadvantaged students are those with a *PISA index of socio-economic background* in the bottom quarter of the distribution within their country. Performance level categories were defined in an internationally comparable fashion as follows. Performance thresholds were calculated by regressing student performance on their socio-economic background, more precisely, on the *PISA index of economic, social and cultural status* (with its square term to allow for non-linearities). Student performance levels were then defined by dividing regression residuals into equal quarters. In other words, students were divided into groups of successful (top quarter), low-performers (bottom quarter) and the rest, by looking at their performance in comparison with peers sharing similar socio-economic background across countries. The analysis was conducted on the pooled sample of students from all countries, so performance was compared among students from all countries (weighting countries equally). Students were defined as resilient or internationally successful disadvantaged students, if they were disadvantaged students who performed in the top quarter of students from all countries after accounting for their socio-economic background. Similarly, a disadvantaged student whose performance after accounting for socio-economic background lies in the lowest quarter was defined as a disadvantaged low achiever. Shares of students in these two groups were then compared across countries to study where disadvantaged students were more likely to be among top performing students sharing a similar socio-economic background from all countries.



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