

# Challenges to quality and equity in educational performance for Latin America, a PISA 2012 perspective

*Desafíos para la calidad y la equidad en el desempeño educativo para América Latina, una perspectiva PISA 2012*

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## Abstract

This paper analyses the educational performance of eight PISA 2012 Latin American countries relative to the OECD focusing on equity in the distribution of outcomes. We consider first the results of those countries in terms of the shares of high and low performing students. Next we study how much those performances depend on the students' family background. We use the data on mathematical competencies in PISA 2012 and compare the results of those students coming from disadvantaged and advantaged families, identified with those in the first and fourth quartiles of the distribution of the index of Economic and Socio-Cultural Status. The main results of this study are: (i) The differences in the educational systems between Latin American countries and the OECD are much larger than suggested by country rankings based on mean performance. (ii) The share of Latin American students exhibiting high performance is extremely thin, particularly among disadvantaged students, whereas low performance is pervasive across all students regardless of family background. (iii) Socio-economic conditions strongly determine high performance, much more than in the OECD.

**Keywords:** PISA; Latin American countries; OECD; high and low performers; advantaged and disadvantaged family

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## Resumen

Este trabajo analiza el rendimiento educativo de ocho países participantes en PISA2012, pertenecientes a América Latina, en relación al foco de OCDE en la equidad de distribución de los resultados. En primer lugar, analizamos los resultados de aquellos países en términos de las acciones de los estudiantes de alto y bajo rendimiento. A continuación, se estudia en cuanto su rendimiento está influenciado por las características del entorno (antecedentes familiares). Utilizamos los datos de competencia matemática en PISA 2012 y comparamos los resultados de los estudiantes procedentes de las familias de diferentes entornos económicos y socioculturales, concretamente los estudiantes del primer y cuarto cuartiles de la distribución del Índice Económico y Sociocultural. Los resultados principales muestran que: (i) Las diferencias entre los sistemas educativos de los países de América Latina y los países OCDE son mucho mayores de las que sugiere la clasificación basada en el rendimiento medio. (ii) La proporción de estudiantes latinoamericanos con alto rendimiento es extremadamente pequeña, sobre todo entre los estudiantes de nivel económico y sociocultural bajo, mientras que el bajo rendimiento es un fenómeno generalizado en todos los estudiantes, independientemente de las condiciones del contexto. (iii) Las condiciones socio-económicas determinan fuertemente el alto rendimiento, mucho más que en los países OCDE

**Palabras clave:** PISA; países América Latina; OECD; alto y bajo rendimiento; contexto familiar.

**Reception  
Date**

2016 May 06

**Approval  
Date**

2016 June 27

**Publication  
Date:**

2016 June 27

**Fecha de  
recepción**

06 May 2016

**Fecha de  
aprobación**

27 Junio 2016

**Fecha de  
publicación**

27 Junio 2016

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The Programme for International Student Assessment (PISA) is a triennial worldwide study, started in 2000 under the coordination of the OECD. The study provides the broadest dataset for the evaluation of competencies of 15-year-old students, their personal background, including characteristics of their schools and families, their learning habits, their attitudes towards studying, and their engagement and motivation. PISA evaluates students' knowledge and skills in three different domains: reading, mathematics and science. PISA aims to help improve educational outcomes by means of international comparisons based on empirical evidence.

PISA establishes six levels of educational proficiency, parameterized in terms of the test scores students achieve for each subject. Each level incorporates a new set of competencies relating to/defined by the types of questions students can answer correctly. The distribution of students into levels of proficiency provides important information on the functioning of educational systems, which is not necessarily reflected in the average scores or the associated ranking of countries.

Two of those levels of proficiency have a special significance, according to the OECD (see OECD (2014, vol. I, Ch. 2)), as they provide goalposts identifying high and low performance. Students performing at Level 5 or above are considered as *high performers* whereas Level 2 is considered as the baseline level of proficiency, meaning those students below Level 2 are identified as *low performers*.

PISA also provides relevant information on students' family and school environment, in particular regarding socio-economic conditions that are summarised in an index of Economic and Socio-Cultural Status (ESCS). The ESCS is a composite measure made of the following variables: the International Socio-Economic Index of Occupational Status (ISEI); the highest level of education of the student's parents converted into years of schooling; the PISA index of family wealth; the PISA index of home educational resources;

and the PISA index of possessions related to "classical" culture in the family home. Combining data on performance with socio-economic conditions, one can evaluate the degree of equity of educational systems. In this context, greater equity implies less dependence on the results of the family environment.

The OECD offers several measures of the degree of equity of educational systems, linking average scores with family characteristics (e.g. the so-called *socio-economic gradient* or the share of *resilient* students). Yet the distribution of the students among proficiency levels by social groups has not been systematically reported in the institutional analysis of equity.

Our aim here is twofold: on the one hand one could argue that the comparison in terms of average scores hides very relevant information about the extent of differences between countries. The analysis of the distribution across levels of performance provides a much more vibrant picture of the state of affairs. On the other hand, one can analyse how students' achievement in terms of performance levels depends on the socio-economic characteristics of their families. This is a conventional issue addressed by the PISA reports and by many researchers. It has been established that the family environment affects students' outcomes, at least since the Coleman's report in the mid 1960s (see for instance Willms (2006), Lefranc, Pistolesi & Trannoy (2009), Chechi & Peragine (2010), Ferreira & Gignoux (2011a, b), Gamboa & Waltenberg (2011, 2012), Carvalho, Gamboa & Waltenberg (2015), Tansel (2015), or Villar (2016)). More specifically, the aim is to study how high and low performers are distributed among students coming from disadvantaged and advantaged families, defined as those in the first and fourth quartiles of the distribution of the index of Economic and Socio-Cultural Status (ESCS) in each country. Thus, in our approach the comparison will be made in terms of elementary measures of discrimination within each country. Furthermore, the analysis is purely descriptive. In this study, we focus on the results for the

eight Latin American countries participating in PISA 2012 (Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay). Educational performance refers to the results in the field of mathematics, which is the main subject in PISA 2012 (the latest available results).

The comparison lies in the evaluation of those Latin American countries with the average OECD values. The reason to make such a comparison is threefold. First and most obvious, because the OECD is the institution which leads and coordinates the study. Second and more importantly, because in a progressively globalised world, it is important to achieve a global perspective of regional achievements. And third, because in our approach low performance is a key element of the PISA evaluation and has been identified in the United Nations Sustainable Development Goals as a key measure, namely “the percentage of girls and boys who master a broad range of foundational skills, including in literacy and mathematics by the end of secondary schooling cycle.”

The paper is organised as follows: Section 2 presents the distribution of high, medium, and low performers in each Latin American countries, as compared with the mean OECD values. Section 3 studies how those distributions vary within countries as a function of socio-economic conditions. It also presents for each country a simple measure of discrimination by examining the shares of advantaged and disadvantaged students within the total of high and low performers. Section 4 looks at the proportion of the 15-year-old cohort covered by PISA 2012 in each country and analyses the implications of this coverage for the results presented here. A few final words in Section 5 provide a closing of the work.

### High and low performers

PISA considers Level 2 as the baseline of proficiency at which students begin to demonstrate the skills that will enable them to participate effectively and productively in

society<sup>1</sup>. Students below Level 2 are considered as *low performers*. On the opposite side, students with performance at Level 5 or above are regarded as *high performers*.

Table 1 describes the correspondence between levels of proficiency and scores of the test (see PISA 2014, Ch. 15). We adopt the convention of calling *medium performers* to those students in levels 2, 3 and 4. The table also provides the percentage of students within each cell, for the OECD as a whole. Here we take OECD average values as the reference token to evaluate the performance of Latin American countries.

**Table 1: High and Low performers in mathematics (PISA 2012)**

Categories	High performers	Medium performers	Low performers
Scores	> 607	607 - 420.1	< 420.1
OCDE students (%)	12.6	64.4	23

According to the PISA report, “At Level 2, students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of the results.” There is evidence, particularly from longitudinal studies developed in Australia, Canada, Denmark and Switzerland, showing that students who perform below Level 2 often face severe disadvantages in their transition into higher education and the labour force in subsequent years. Consequently, “the proportion of students who perform below this baseline proficiency level thus indicates the degree of difficulty countries face in providing their populations with a minimum level of

<sup>1</sup> This convention is not universal, though. Some authors adopt level 3 as the baseline (e.g. Nonoyama-Tarumi & Willms (2010).

competencies.” (cf. OECD, 2014, vol. I, p. 68).

“At Level 5, students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insights pertaining to these situations. They begin to reflect on their

work and can formulate and communicate their interpretations and reasoning.” (OECD, 2014, vol. I, p. 63).

Table 2 provides information regarding the distribution of high, medium and low performers in the Latin American countries participating in PISA 2012. We have also included in the last column the percentage that the average scores, the mean value of the students’ tests for each country, represent with respect to the OECD average. This is simply the mean score for each country divided by the average performance across OECD countries, which stands at 494 score points in mathematics for PISA 2012.

**Table 2: Distribution of High, Medium and Low performers<sup>2</sup> in Latin American countries and normalised average scores**

<b>Countries</b>	<b>High performers</b>	<b>Medium performers</b>	<b>Low performers</b>	<b>Relative average scores, OECD = 100%</b>
<b>Argentina</b>	0.27%	33.24%	66.48%	78.6%
<b>Brazil</b>	0.72%	30.99%	68.29%	78.6%
<b>Chile</b>	1.58%	46.88%	51.54%	85.5%
<b>Colombia</b>	0.30%	25.88%	73.82%	80.7%
<b>Costa Rica</b>	0.56%	39.56%	59.87%	82.4%
<b>Mexico</b>	0.63%	44.66%	54.71%	83.7%
<b>Peru</b>	0.57%	24.85%	74.58%	77.8%
<b>Uruguay</b>	1.37%	42.84%	55.78%	82.9%
<b>OECD</b>	12.85%	64.63%	22.52%	100.0%

<sup>2</sup> These percentages correspond to students with valid estimates for socioeconomic background so as to be comparable with the figures in the following tables.

The data in Table 2 clearly indicates that average scores do not reflect properly on the existing differences between countries regarding the distributions by levels of proficiency. Take for instance the case of Peru, the Latin American country that occupies the last position in the ranking. Looking at the average scores we observe that Peru is some 22% below the educational achievements of the OECD. Yet, looking at the data regarding the distribution of low and high performers it is hard to conclude that there is such a small difference of achievements between Peru and the OECD.

It is important to note that knowing the true extent of the differences in educational achievements helps mobilise the correct amount of resources to obtain a sizable improvement. In this respect, in OECD member countries, the share of low performers is about twice that of high performers. In Latin American countries, the percentage of high performers ranges between 2% and 12% of the corresponding value of OECD member countries. The shares of low performers in Latin America are much larger than the OECD average, between two or three times the OECD value. Those numbers may sound less impressive but one should bear in mind that they apply to a much higher share.

### **The impact of socio-economic conditions**

Comparing the distribution of high and low performers, as presented in Table 2 tells us about the different performance of Latin American educational systems with respect to the OECD. The next step is to analyse the relationship between the distribution of levels of proficiency and socio-economic characteristics of the population, within each country. Ideally, the level of proficiency achieved by a student should be independent to his or her family environment. This principle is associated to the notion of *equality of opportunity*, developed by Arneson (1989), Cohen (1989), and Roemer (1993, 1998), among others. The idea is that school should compensate for differences in social status so that socio-economic characteristics should not

play a relevant role in determining the students' achievements. PISA tests students at the end of compulsory education for most of the participating countries. This is, therefore, an instance in which equality of opportunity is very important, it reflects not only their experience in secondary education but rather the whole yield of knowledge and skills they have accumulated up to that point in their careers at school and beyond.

PISA highlights important challenges for Latin America in achieving equal opportunity. Socioeconomically disadvantaged students have higher chances of being low performers than their socioeconomically advantaged peers<sup>3</sup> and much lower chances of being high performers. How do Latin American countries fare when it comes to equal opportunity in education in comparison with OECD member countries?

We will focus here on the distribution of high and low performing schoolchildren coming from disadvantaged families vis a vis those coming from advantaged families. We identify disadvantaged families as those corresponding to the first quartile of the distribution of the index of Economic and Socio-Cultural Status (ESCS) (the bottom 25%). Advantaged families are defined here as those corresponding to the fourth quartile of the ESCS (top 25%).

The data shows that, on average across the OECD, almost 40% of students coming from disadvantaged families do not reach the baseline level of proficiency and less than 5% achieve the highest levels. In other words, disadvantaged students are four times more likely to have competencies that put them at risk for their future participation in the labour market and society more broadly. In contrast, advantaged students are 5 times more likely than their disadvantaged peers to enjoy competencies that give them much better chances for the future.

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<sup>3</sup> See the recent study on low-performing students in OECD (2016).

Table 3 highlights the large proportion of low performance across Latin American countries, even among those coming from advantaged families. As startling as the small proportions of high performers are, the large proportions of low performers among the advantaged families are even more shocking. About one out of every four 15 year old students from advantaged families in Chile and

Uruguay are low performers, and as many as one in every two in Colombia and Peru, compared with one in every ten across OECD countries.

Table 3 provides detailed information about the distribution of the students by levels of performance and socio-economic status.

**Table 3: High, medium and low performers by quartiles of the ESCS index in Latin American countries**

		<i>High performers</i>	<i>Low performers</i>
<b>Argentina</b>	Q1	0,00%	82,42%
	Q4	0,85%	43,05%
<b>Brazil</b>	Q1	0,03%	84,97%
	Q4	2,59%	44,92%
<b>Chile</b>	Q1	0,08%	74,96%
	Q4	4,98%	24,85%
<b>Colombia</b>	Q1	0,00%	88,29%
	Q4	1,05%	53,79%
<b>Costa Rica</b>	Q1	0,00%	80,45%
	Q4	1,88%	34,65%
<b>Mexico</b>	Q1	0,12%	70,72%
	Q4	1,78%	36,62%
<b>Peru</b>	Q1	0,02%	94,54%
	Q4	2,14%	50,57%
<b>Uruguay</b>	Q1	0,03%	77,44%
	Q4	4,73%	26,70%
<b>OECD average</b>	Q1	4,63%	37,16%
	Q4	24,68%	9,51%

To summarize the equality of opportunity in Latin American countries relative to the OECD member country average, we present in Table 4 two simple ratios that approximate what can be regarded as measures of discrimination from “above” and from “below”. The first column of Table 4, discrimination from above, gives the percentage of high performing students that come from advantaged families<sup>4</sup>. Across the

OECD, on average, this value is around one half whereas perfect equality would require it to be one fourth. Latin American countries present values between 71% in Mexico up to 94% in Peru.

by four times the proportion of high performers in the country. Intuitively, “discrimination from above” represents the probability that a high performer picked at random comes from a socioeconomically advantaged family. “Discrimination from below” is defined in analogous terms for low performance and socioeconomic disadvantage.

<sup>4</sup> Discrimination from above is the proportion of high performers for each country in Q4 from Table 4 divided

The second column of Table 4, discrimination from below, provides the percentage of low performing students coming from disadvantaged families. Here it becomes clear that Latin American countries do better than the OECD in relative terms. Yet the

reason is that the quartiles have been computed separately within each country so the differences in the means and the distributions of socio-economic characteristics between countries are not taken into account.

**Table 4: Discrimination “from below” and “from above” in Latin American countries**

	<i>Discrimination from above</i>	<i>Discrimination from below</i>
<b>Argentina</b>	79%	31%
<b>Brazil</b>	90%	31%
<b>Chile</b>	79%	36%
<b>Colombia</b>	88%	30%
<b>Costa Rica</b>	84%	34%
<b>Mexico</b>	71%	32%
<b>Peru</b>	94%	32%
<b>Uruguay</b>	86%	35%
<b>OECD</b>	48%	41%

Discrimination from above is, therefore, much more important than discrimination from below in the Latin American context. And yet, this findings does not indicate that Latin American countries are performing well, rather it suggests that low performance is pervasive and affects very large shares of the population (between 50% and 75% of the 15-year old students), including many in the middle class. In this case there is little difference between the first quartile and the average. The share of high performers is both very small and highly concentrated in the advantaged families. This is bad news for social mobility as future opportunities depend heavily on the level of human capital accumulated. That is to say, most high performers come from advantaged families and will most likely get the better jobs and the most prominent positions in social life, thus reproducing the point of departure.

### **The participation bias**

By age 15 many students have left the education system in low and middle income countries, particularly in Latin America. Table 6 presents the estimated coverage in PISA 2012. This is an important caveat to keep in mind when looking at results for Latin American countries in PISA 2012 and the data presented here. Some students may still attend primary school, but PISA only covers 15 year olds attending school at grade 7 or above.

The coverage varies considerably across participating countries in the region. Argentina and Chile have the highest coverage indices, above 80% and close to what is typically observed among OECD member countries. In contrast, in Costa Rica only half of the 15 year old population participates in the assessment, while 63% do so in Mexico and Colombia.

**Table 5: Participation rates in Latin American countries (PISA 2012)**

	<b>PISA coverage index</b>	<b>Total population of 15 year olds</b>
<b>Argentina</b>	80%	684 879
<b>Brazil</b>	69%	3 574 928
<b>Chile</b>	83%	274 803
<b>Colombia</b>	63%	889 729
<b>Costa Rica</b>	50%	81 489
<b>Mexico</b>	63%	2 114 745
<b>Peru</b>	72%	584 294
<b>Uruguay</b>	73%	54 638

Out of school 15 year olds are likely to come from socioeconomically disadvantaged backgrounds. They are also likely to have low performance in PISA. Therefore, if anything the estimates provided in former sections are likely to be overly optimistic for Latin American countries, particularly for those with high proportion of 15 year olds not included in the PISA tests. These numbers suggest caution should be exercised when comparing the results of each country within the region with one another, and yet they stress even more the key conclusions for the region, namely that inequalities are a significant challenge beyond ensuring access to schooling and better quality for the average student. The next section reviews the key messages of the evidence presented here.

### **Final remarks**

We have presented a descriptive analysis of the differences between the distributions of students by levels of proficiency and by family status, in eight Latin American countries. The data show that those distributions are extremely different between Latin American countries and the average OECD member country. Those differences are not well captured by the average scores of the PISA tests. We have also observed that larger differences are found in the tails of the distributions, i.e. those corresponding to the shares of high and low performers. Not all

students are included in the test, and the exclusions pose a challenge for cross-country comparisons within the region.

We have provided simple but powerful measure of the impact of socio-economic conditions on those distributions, by comparing the shares of advantaged and disadvantaged students in high and low performers. The degree of dependence between outcomes and socio-economic conditions is extremely sizeable when focussing on high performance and varies a substantially among countries. There is little discrimination for low performers because of the extent of low performance, which affects between one half to three quarters of the 15-year old students.

Unfortunately, the situation is worse than we are able to measure because we are only computing the results of those 15-year olds who attend the school. In some countries the share of those young people who have already left the school is very large. Even without information on the outcomes or socioeconomic status of those who left school prematurely, a good guess is that they could be matched with low performers and disadvantaged families.

Be as it may, the relatively low coverage rates reinforce the key messages for participating countries in Latin America, which can be summarised as follows:



- (i) The differences in educational systems between Latin American countries and the OECD are much larger than those depicted by average scores. This is so because averaging the results hides the differences in the distributions between levels of proficiency.
- (ii) The share of Latin American students exhibiting high performance is extremely slight (between 2% and 12% of the OECD mean), whereas low performance is pervasive (between two and three times that of the OECD).
- (iii) Socio-economic conditions strongly determine the achievement of high performance, much more so than in the average OECD member country, which implies that the social patterns tend to reproduce.

Reducing the proportion of low performers and ensuring baseline levels of performance for all is clearly the main priority of any educational policy in Latin American countries. While the region has made significant progress in terms of access to schooling, clearly the next step in improving education system has to focus on quality and equity. The notion of “no one left behind” in the Sustainable Development Goals is translated, regarding education, into the need of ensuring that 100% of 15-year old students achieve at least a level 2 of proficiency in all countries by 2030.

Enhancing the share of high performers is also necessary, but it seems fairly clear that this can only come as a result of the reduction of low performance if improvements in quality and equity are to take place at the same time. Finally, equality of opportunity needs a serious kick to promote social mobility. To conclude, it is important to stress that achieving those goals is possible, as illustrated by the experiences reported in a recent study by the OECD (2016, ch. 5). Many countries in other regions, among OECD member countries and beyond, show that it is indeed possible to pursue improvements in quality and equity at the same time. Latin American countries can

learn a lot from the experience of countries in regions with similar contexts and those with very different backgrounds.

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### Note

Thanks are due to anonymous referees for helpful comments.

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**Revista ELectrónica de Investigación y EValuación Educativa**  
*E-Journal of Educational Research, Assessment and Evaluation*

[ISSN: 1134-4032]

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