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Inter-American Development Bank
Social Sector, Education Division

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Inequity in School Achievement in Latin America

Multilevel Analysis of SERCE Results According to the Socioeconomic Status of Students

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Abstract

This document analyzes differences in the academic achievement of Latin American students based on the socioeconomic status of their families. Using the database from the Second Regional Comparative and Explanatory Study (SERCE) conducted in 2006, a significant positive relationship was confirmed between the socioeconomic status of students and SERCE results, both region-wide and for each participating country. If this relationship is broken down into two different levels (within the schools and between the schools), variations in socioeconomic status explain a significant part of the variability in test scores between the schools and, to a lesser degree, the variability within the schools. The result is a high level of socioeconomic segregation between the schools, which, in turn, accentuates the relationship between student socioeconomic status and test results. The poorest students are punished first by their socioeconomic status and then again by studying in schools attended chiefly by children of poor families, thus deepening the inequity in school achievement. Findings suggest several courses of action for public policy, tailored to each country's profiles of educational equity.

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Contents

1. Introduction

For several decades, the literature on education has stressed the importance of the socioeconomic status of families with respect to the academic results of students. The classic study conducted by Coleman (1966), which analyzed the U.S. education system in the 1960s, concluded that, despite the good intentions of administrators and teachers, what chiefly determines the educational success of students is the socioeconomic background of their families. Other empirical studies, particularly the study by Rutter et al. (1980), which analyzed secondary schools in the United Kingdom in the 1970s, counteract this pessimist outlook and reveal that, while these studies did confirm the importance of the socioeconomic status of families, schools were also found to exert a great deal of influence on student achievement levels. The studies by Coleman and Rutter et al. are part of a long history of ongoing research and debates over the importance of socioeconomic variables and their impact on student achievement in schools.

Latin America has not remained outside of this discussion, especially because education has been viewed as a tool that should support several policy goals simultaneously: alleviate poverty, reduce inequality, consolidate democracy and citizen participation, and contribute to improvements in productivity, competitiveness, and economic development. The difference between the debate in Latin America and that of the developed world is that, in the former, there are much fewer empirical studies on the coordination between socioeconomic status and education quality, particularly studies that include comparative data among countries. Analysis of factors associated with educational achievement in some countries in the region has been conducted, and some Latin American countries have participated in international educational performance studies (such as the Trends in International Mathematics and Science Study (TIMSS) in 1994 and 1999, Progress in International Reading Literacy Study (PIRLS) in 2001, and Program for International Student Assessment (PISA) in 2001 and 2006). However, solid empirical data on the region's education sector that has allowed comparative analyses to be conducted on quality and equity has been gathered only in the First International Comparative Study (PEIC) of the Latin American Laboratory for Assessment of the Quality of Education (LLECE) in 1998 (with the participation of 13 Latin American countries) and in the Second

Regional Comparative and Explanatory Study (SERCE) in 2006 (with the participation of 16 Latin American countries).[2]

The SERCE evaluated the performance achieved by Latin American primary school students (third and sixth grade) in the areas of Language, Mathematics, and the Sciences. The SERCE was conducted in 2006 on a representative sample of students in 16 Latin American countries. This study yielded data about roughly 200,000 students, 9,000 classrooms, and over 3,000 schools that were representative of the students in these 16 countries. To assess student performance, the SERCE used tests involving common elements of the official curricula of countries throughout the region and the life skills-based approach advocated by UNESCO. The data set used for this study combines the database of student test results with three other databases, including questions addressed to students and their families about their socioeconomic characteristics and to principals and school teachers about the characteristics of their schools.

The global results of the SERCE tests reveal that the participating countries registered different levels of performance when compared to one another and to the region-wide average. Cuba, Mexico, Costa Rica, and the Southern Cone countries registered scores that were significantly higher than the region-wide average. Peru, Ecuador, and Paraguay, together with the other countries of Central America and the Dominican Republic, registered scores that were significantly lower than the region-wide average. Brazil and Colombia ranked rather close to the regional average. The first SERCE report (LLECE, 2008), widely disseminated throughout the region, presents all these results in detail and a preliminary analysis of the social contexts of the schools.

The goal of this study is to comparatively examine the relationships between educational achievement and equity among Latin American countries. More specifically, what is studied is

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[2] Examples of studies of factors associated with academic achievement in several countries in the region include: in Colombia, see Misión Social (Social Mission)/DNP (1997); in Peru, see UMC/Grade (2001) and UMC (2006); in Argentina, see Cervini (2004); in Chile, see Raczynski and Muñoz (2005); in Uruguay, see Fernández (2007). For an analysis of 1998 LLECE test results, see LLECE (2001); Willms and Somers (2001); Somers, McEwan and Willms (2004).

the relationship between the socioeconomic background of the students and their SERCE test results, the variation in this relationship within the schools and between different schools, and the way this relationship is reflected in the different educational equity profiles of each one of the countries.[3]

One important caveat should be made when discussing the results of this research. This study does not seek to establish a causal relationship between the socioeconomic status of students and achievement. The relationship studied is acknowledged to be complex. It includes other mechanisms that may be correlated with socioeconomic status and hence influence the relationship in the test results, such as the characteristics of the community where the student lives, kinship type, level of parental involvement, type of school selected, the effects of peers, and even the influence of inherited genetic factors. Nevertheless, it is believed that the approach used enables the authors to explore and document the relationship between academic results and social status, and thus allows them to infer important conclusions concerning public policy for education.

This document is divided into four parts. The first part presents SERCE test results according to the socioeconomic status of the students. The second part discusses a disaggregated analysis of the effect of socioeconomic variables within schools and between schools. The third part presents the different education system profiles of each country and suggests directions in the design of public policy aiming to improve equity and quality in education. Finally, the document presents conclusions drawn from the analysis. Statistical Appendices contain additional analytical tables and graphs.

2. Results of the SERCE According to Student Socioeconomic Status

Differences among scores in each country may be associated with several variables. Some are systemic in nature (importance afforded by society to education or how schools are managed and

[3] A parallel study is being conducted, which analyzes the main characteristics of the schools, principals, and teachers affecting student learning achievement, all seen from the perspective of equity, and also using the SERCE database.

funded in each country) and others are school-specific (administrative and teaching resources and teaching methods in the schools and the classrooms), whereas other variables are related to the socioeconomic traits of the students (level of education of parents, characteristics of their housing, and the number of books in their homes), among other factors. This section analyzes the relationship between the socioeconomic status of students' families and the students' SERCE test scores.

The socioeconomic position of the family has been approximated in various ways in the literature. The most conventional method has been using the father's occupation and/or education level. Gradually, the literature has suggested other ways, such as the mother's education level, family income, or some measure of the home's structure. Mayer (2002) discusses the role of household income as a factor that explains a student's performance and supports the importance of introducing adjustments that acknowledge how other characteristics of parents influence the academic achievement of their children. In this study, socioeconomic status is estimated using the Index of Socioeconomic and Cultural Status (ISEC), created by the SERCE, based on parent education level variables, characteristics of housing, access to public services, and family access to cultural assets (especially the presence of books in the home).

Results are obtained through linear regressions that estimate the relationship between the SERCE test scores and the ISEC. The relationship is modeled in a linear fashion as displayed in the equation (1) using the Ordinary Least Squares (OLS) method in a bi-variate regression.

$$Y_i = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 X_i + r_i \ (1)$$

Where:

Y_i: represents the estimated score Y of student i

X_i: represents the socioeconomic index value for the family of student i

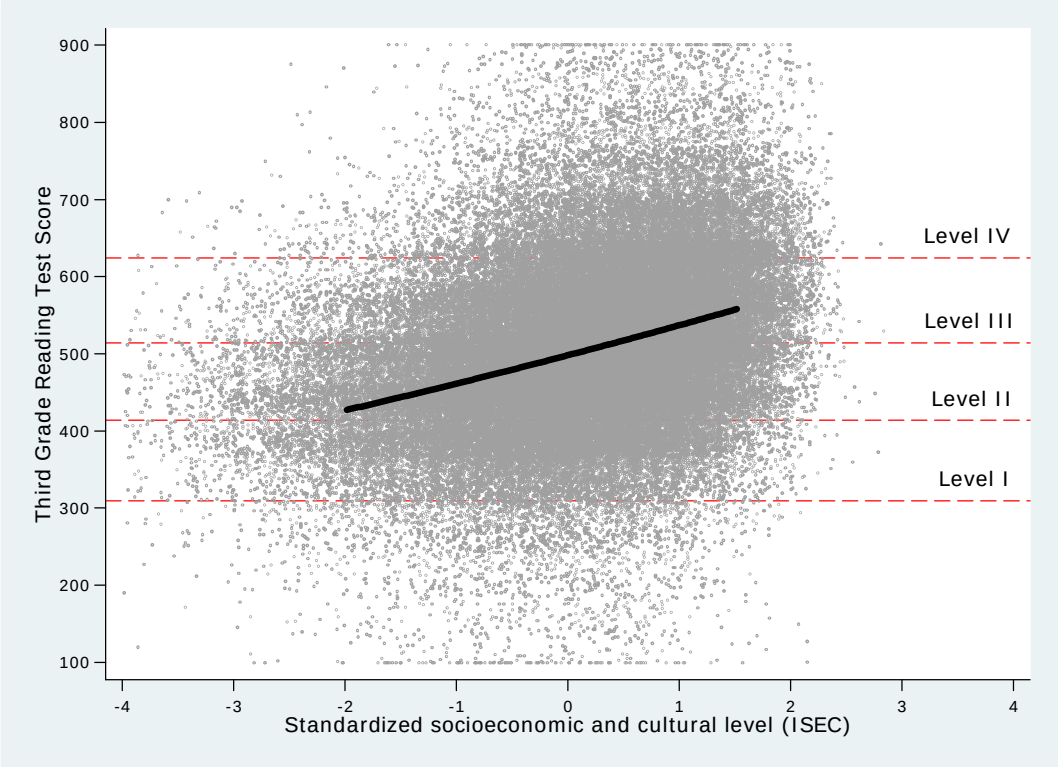
To facilitate interpretation of the results, the ISEC was standardized so that it had a mean of zero and a standard deviation of one. Thus, the value associated with the intercept ($\boldsymbol{\beta}_0$)

represents the estimated score when a student comes from a home of average socioeconomic status, whereas the coefficient of the ISEC (β_1) is interpreted as the change in score of a student within a standard deviation above or below the mean of each sample analyzed region-wide or by country according to the respective case.

Graph 1 shows the relationship between the socioeconomic status of students' families and overall region-wide SERCE test results. Each point on the graph represents a student (there are roughly 85,000 observations, altogether). The left vertical axis represents each student's third grade reading score (centered on 500 points for the region-wide mean, and each standard deviation is equivalent to 100 points). The horizontal axis represents the socioeconomic and cultural status of students based on the ISEC. The ISEC scale indicates the number of standard deviations below or above the average ISEC for Latin America. The right vertical axis shows the cut-off lines for the four performance levels on the reading test, and each level indicates respective student achievement. For the purpose of this study, only children attaining scores above Level III (552 points for third grade reading) have satisfactorily acquired the knowledge and abilities evaluated in the test.[4]

[4] The first SERCE report (LLECE, 2008) provides a detailed explanation of the skills and achievement attained at each test level.

Graph 1
Latin America: Relationship between student socioeconomic status and SERCE results



Comments: Each point represents a student. Total number of observations: 84,467 students. The solid line represents the relationship between performance and socioeconomic status and a quadratic term of this relationship estimated using an OLS regression using clustered and robust errors. The line covers 5-95% of the ISEC range.
Source: SERCE database.
Graph prepared by the authors.

It can be seen here that the relationship between student socioeconomic status and third grade reading test scores is positive and statistically significant (see Table 1). Students from families with higher socioeconomic status tend to score higher on these scores. For each standard deviation in the ISEC, there is a 37-point change in scores on the third grade SERCE reading test. The socioeconomic status of students' families (estimated by the ISEC) explains 15% of the many factors accounting for test score variability.

The socioeconomic gradient is practically a straight line, indicating that any increase in score is proportionately the same for any change in socioeconomic status[5] [6]. As revealed in other

[5] Emphasis on the magnitude of the relationship does not say much about whether it may cause changes in specific distribution points vis-à-vis social status. Willms (2003) suggests that the relationship between

international test analyses (see the results of PISA 2006 in OECD, 2007), the relationship between student scores and the ISEC is not deterministic: the gradient's large number of points above and below the gradient reveals that there is a considerable range of performance on the test at each of the socioeconomic levels. That is, despite low socioeconomic status, some students score high and vice-versa.

Table 1 shows this same relationship between student performance on the third grade reading test and their ISEC disaggregated by countries. Results correspond to a student's performance regressed on its ISEC using an OLS regression as described in equation (1). The difference between gradient levels (intercept) shows the difference of average scores between the different countries. Note the range of values both in the slopes of the socioeconomic gradient indicating a higher or lesser intensity in the relationship between the score and the ISEC, and in the percentage of the variance explained, which indicates how much of the variability in scores is explained by student socioeconomic status. In Brazil, Colombia, and Peru, there is a high level of disparity in student performance related to socioeconomic status, as explained by high ISEC-associated coefficient values (the slope of the gradient) and high score variance percentages explained by the ISEC. In Chile, Uruguay, and Costa Rica, even though variations in the ISEC cause significant changes in scores (high slopes of gradients), socioeconomic status explains a small portion of the total variation (5%, 9%, and 11%, respectively). In all of the countries, the relationship between socioeconomic status and student performance is positive and statistically significant. It should be pointed out that countries with higher scores (Cuba and Chile) exhibit a weaker relationship between test results and the socioeconomic characteristics of students. These two cases suggest that the highest levels of performance are not necessarily attained at the expense of equity.

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socioeconomic status and achievement may be understood as a gradual relationship and that it increases at different points along the socioeconomic status continuum. Hence, he proposes using the idea developed from the literature on health regarding the relationship between income and living conditions and the health results of individuals (Deaton, 2002; Marmot et al., 1991). The main point is that the relationship should be considered as a more or less equitable gradient based on the behavior of its components (the level, slope, and force of the relationship).

[6] The index of curvilinearity is positive (Table 1), 1.03 units, though it is not significant, indicating that there are practically no variations in the slope of the gradient as the ISEC level rises.

Table 1
Relationship between student socioeconomic status and SERCE results in third grade reading

	Curvilinear Model							
	Level of the Gradient		Slope of the Gradient		Curvilinear Effect		Percentage of Variance Explained
Latin America	498.0	***	37.8	***	1.0		15.0
Argentina	484.9	***	33.0	***	7.5	*	9.0
Brazil	505.5	***	45.1	***	-5.3	*	18.0
Colombia	510.1	***	39.7	***	3.9		18.0
Costa Rica	539.7	***	38.2	***	5.9	***	11.0
Cuba	627.1	***	16.3	**	-4.5		1.0
Chile	537.4	***	48.8	***	-10.7	***	8.0
Ecuador	452.8	***	33.3	***	-1.4		10.0
El Salvador	510.5	***	34.2	***	4.3	**	12.0
Guatemala	471.6	***	26.7	***	1.8	*	13.0
Nicaragua	478.6	***	12.2	***	-0.2		4.0
Panama	461.6	***	34.7	***	5.4	***	15.0
Paraguay	474.2	***	21.9	***	4.0	**	5.0
Peru	483.2	***	35.8	***	1.5		21.0
Dominican Republic	395.8	***	26.7	***	5.7	*	6.0
Uruguay	496.4	***	53.0	***	-8.1	***	10.0

Significance levels: *** p<.001; ** p<.01; * p<.05
Source: SERCE database.
Table prepared by the authors.

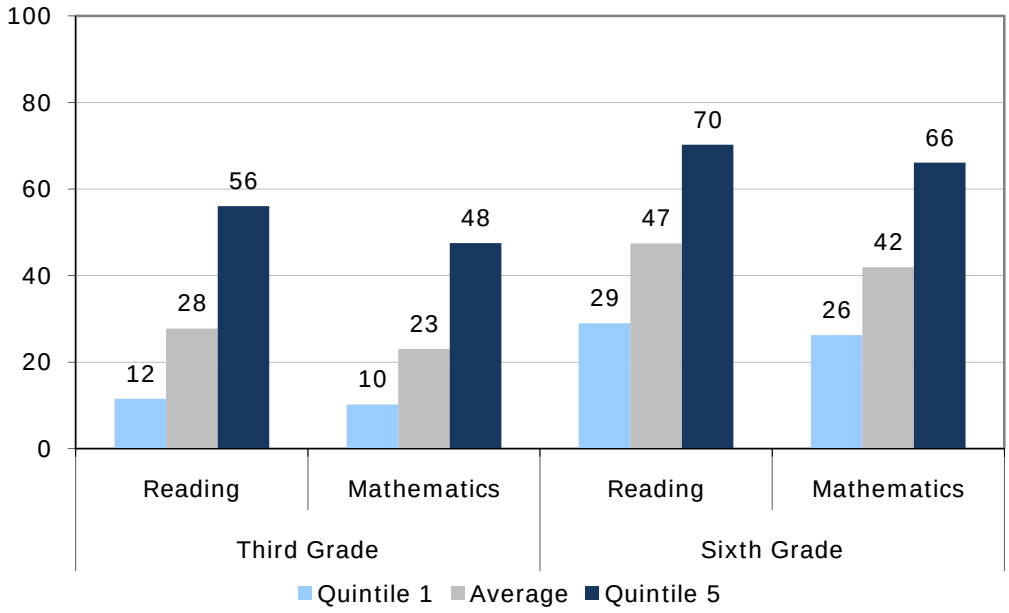
Calculations on the relationship between socioeconomic characteristics and the SERCE test results for third grade mathematics and sixth grade reading, mathematics, and science reveal trends similar to those described earlier. Region-wide, in third grade mathematics, for example, a 32-point increase is registered for each standard deviation in the ISEC; in sixth grade reading and mathematics, increases are 37 and 34 points, respectively. Due to space limitations and in order to avoid repetition, the corpus of this text only presents results on third grade reading. The results for the other areas and grade levels appear in Statistical Appendix 1a, 1b, and 1c.

The results obtained in this section align with those obtained by other authors who have analyzed this issue. White (1982) and Sirin (2005) conducted meta-analyses of the literature on socioeconomic status and academic achievement. In their research, covering a period of almost 70 years, they explore a series of multidisciplinary studies, various ways of measuring

socioeconomic status and academic achievement, and the role of potential mediating characteristics. The results of these meta-analyses also show that the average correlation between the socioeconomic status and academic achievement variables is positive and significant.

Another way to present the relationship between academic achievement and socioeconomic status is by analyzing the probability for students of different socioeconomic levels to achieve different test performance levels. Graph 2 shows the probability for students to achieve at least Level III on the tests (considered in this study as the tests' minimum satisfactory level) for third and sixth grade reading and mathematics for students grouped into quintiles according to their ISEC (quintile one with the lowest ISEC and quintile five with the highest ISEC). Probabilities were calculated based on a logit regression model, taking as a dependent variable whether the student achieves a satisfactory score, controlling through the variables of student gender and age.

Graph 2
Probability of attaining satisfactory SERCE 2006 performance according to ISEC levels



Comment: Satisfactory performance means attaining level III and IV results on SERCE 2006 tests. Probability reported is adjusted for student gender, age and correct registration of age.
Source: SERCE database
Graph prepared by the authors

Various aspects of Graph 2 stand out. First, it demonstrates that a substantial percentage of students are failing to achieve a satisfactory score in reading and mathematics. This fact is very concerning, particularly for third grade, because it shows that a considerable number of Latin American children have not firmed up basic reading, writing, and mathematical skills during kindergarten and primary school, which constitute the foundation for the complete future development of these children throughout the education system. Second, observation of the data for students grouped according to ISEC quintiles reveals a great achievement gap between the poorest and the richest quintile and the critical situation of the children in the poorest quintile. The probability for a third grade student in this quintile to achieve a satisfactory score in reading is 12%, compared to 57% for a student in the richest quintile; in mathematics, it is 10%, compared to 48%. Third, in sixth grade, the probability for achieving satisfactory test scores improves moderately (29% of the poorest quintile, compared to 71% of the richest quintile for reading; and 27%, compared to 67% for mathematics), but gaps among quintiles continue to be wide and the percentage of students who fail to achieve this level continue to be cause for concern. The size of the gaps between quintiles reveals great inequity in achievement among socioeconomic groups. The results, disaggregated for each country, and displayed in Table 2 and in Statistical Appendix 2, confirm these trends and show that differences among students of different socioeconomic levels are even more conspicuous in some countries in the region.

Table 2
Probability of attaining satisfactory SERCE test performance by country according to student socioeconomic status (third grade)

	Reading			Mathematics		
	Quintile 1	Average	Quintile 5	Quintile 1	Average	Quintile 5
Latin America	0.12	0.28	0.56	0.10	0.23	0.48
Argentina	0.21	0.32	0.50	0.17	0.26	0.43
Brazil	0.14	0.29	0.62	0.12	0.26	0.59
Colombia	0.12	0.29	0.57	0.14	0.19	0.42
Costa Rica	0.42	0.57	0.73	0.27	0.38	0.56
Cuba	0.66	0.72	0.77	0.72	0.72	0.74
Chile	0.39	0.55	0.74	0.20	0.33	0.54
Ecuador	0.02	0.11	0.32	0.07	0.12	0.20
El Salvador	0.14	0.26	0.47	0.06	0.13	0.27
Guatemala	0.07	0.10	0.34	0.07	0.08	0.22
Nicaragua	0.10	0.14	0.24	0.14	0.09	0.12
Panama	0.04	0.17	0.36	0.12	0.09	0.20
Paraguay	0.15	0.19	0.34	0.23	0.22	0.26
Peru	0.04	0.17	0.41	0.02	0.11	0.29
Dominican Republic	0.03	0.04	0.12	0.00	0.01	0.04
Uruguay	0.25	0.34	0.63	0.28	0.37	0.61

Source: SERCE database.
Table prepared by the authors.

3. SERCE results according to student socioeconomic status, analyzing between-school and within-school effects

The analysis just mentioned explores student-level relationships but does not consider that the results may be influenced because students share a connection by being in the same school or classroom. The idea that students belong to aggregated units is associated with the concept of multilevel hierarchical structure analysis. A practical consequence of this situation is that estimates could be skewed by leaving out the fact that the responses (and the errors) of similar students could be correlated and, therefore, the units of analysis would not be independent, thus violating one of the OLS regression assumptions. A more technical explanation suggests that standard errors tend to be underestimated, raising the possibility of accepting a hypothesis as valid when it should be rejected. Another strategy consists of flattening

the data at the next higher level (e.g., schools). However, this solution is not recommended because it disregards student groupings.

To overcome such limitations, educational researchers have resorted to hierarchical linear modeling (Raudenbush and Bryk, 2002). This form of analysis provides two advantages. First, it allows to distinguish the variability in performance due to student characteristic-related factors from the effects attributable to the characteristics of higher hierarchy units. Second, it allows to separate out how much of the variability in student academic performance may be attributed to each level of analysis, that is, to differences among students within each school or differences due to variability between schools.[7]

Following the latter methodology, this section examines the breakdown of the variability of results at the level of the student and the school, and how much of such variability at each level is associated with socioeconomic variables.[8] As mentioned above, multilevel models allow to make comparisons on different levels of analysis, such as schools and students, for example, taking into account errors in measurement and sampling. The initial step consists of estimating a null model with the test score obtained as a dependent variable and without controls. This meets three objectives: estimating the average score value (intercept); establishing a baseline upon which to make comparisons with more complex models; and decomposing the score variation in two parts, one attributable to student level and the other to school level.[9]

The null model is estimated as follows:

At Level 1,

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7 This approach has been used by the OECD to analyze PISA 2000 and 2006 data (see OECD, 2001 and 2007).

8 In this paper, analysis was conducted using HLM multilevel analysis software v. 6.02 (Raudenbush et al., 2004). To confirm the magnitude of the differences with another program, the same analyses were estimated using the xtmixed routine Stata MP program v. 10.2. The coefficients associated with the estimated scores reveal differences oscillating between 1 and 3 units, while standard error differences are below 1%. Hence, we decided to stick with the results estimated in HLM.

9 Given that the SERCE also gathered classroom-level information, analysis including this level was considered. However, with the limited number of classrooms per school, in most cases only one, a decision was made to omit this level from the analyses. This decision may overestimate the variance of the level directly below and above (Cervini and Dari, 2008).

$$Y_{ij} = \beta_{0j} + r_{ij} \quad (2)$$

At Level 2,

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (3)$$

Replacing (3) in (2) yields the expanded model

$$Y_{ij} = \gamma_{00} + u_{0j} + r_{ij} \quad (4)$$

Assumptions:

$\varepsilon_{ij} \sim$ NID (0, σ^2)

$U_{0j} \sim$ NID (0, τ_{oo})

Cov(ε_{ij}, U_{0j}) = 0

Where:

Y_{ij}: student performance i in school j

γ_{00}: the global intercept (global average, performance for all the schools)

β_{0j}: the intercept of school j, average performance of all students in school j

r_{ij}: the residual of student i in school j [differential performance, random component, error term]

u_{0j}: distancing (residual) of the average performance of school j with respect to the global intercept [differential effect of school j regarding all of the schools with the same characteristics]

According to the assumptions, the variance of the student's residuals, Var(r_{ij}), is the between-school variance. The variance of the school variations compared to the grand mean, Var(u_{0j}) is the between-school variance.

From (4) it follows that:

$$\text{Var}(Y_{ij}) = \text{Var}(u_{0j} + r_{ij}) \quad (5)$$

$$\text{Var}(Y_{ij}) = \text{Var}(u_{0j}) + \text{Var}(r_{ij})$$

$$\text{Var}(Y_{ij}) = \tau_{oo} + \sigma^2$$

Where:

τ_{oo} o τ_0^2 : Between-school variance

σ^2 : Within-school variance

Variance decomposition in SERCE test results

Using SERCE data and the equations just described, this section analyzes the variation in SERCE test scores by means of the variance observed within the schools and between the schools.

Table 3 presents the results of the estimated variance in the third grade reading test. For all of Latin America, of the total variance in test results, 58% is explained by variability in student performance within the school, attributed to variables such as student interest and dedication, parent participation, and the socioeconomic status of the students, among other factors. The remaining 42% of the variance is explained by school (or between-school) characteristics, such as management and funding type, student selection and admission policies, school resources, and the school's average socioeconomic status, among other factors. This variation is high and consistent with findings from the 2001 PEIC (see Willms and Somers, 2001).[10] It should be noted that countries such as Chile, Nicaragua, or Uruguay reveal that the variability attributable to students is roughly 80% of the total variability, a much higher percentage than the regional average. In countries such as Peru, Cuba, Brazil, Guatemala, Colombia, and Argentina, over one-third of the changes in scores is influenced by between-school variations. In all cases, the data indicate that the specific characteristics of schools play a decisive role in student achievement and confirm the importance that must be afforded to all education policy designed to improve quality in schools. These results align with empirical

[10] See Statistical Appendix 3 for a comparison among the variance attributable to the level of schools in both studies. In another study, Murillo (2007), researchers estimate that the magnitude of the variance of a school adjusted to two levels for tests in Mathematics and Language reaches approximately 29%.

studies conducted over the last 30 years, which stress the key role that the institutional and pedagogical arrangements of schools play in education quality.[11]

Table 3
Variance decomposition in SERCE results in third grade reading

	Null Model	
	Student-Level Variance	School-Level Variance
Latin America	58.0%	42.0%
Argentina	66.7%	33.3%
Brazil	63.3%	36.7%
Colombia	65.5%	34.5%
Costa Rica	73.5%	26.5%
Cuba	60.1%	39.9%
Chile	81.3%	18.7%
Ecuador	72.3%	27.7%
El Salvador	75.8%	24.2%
Guatemala	60.7%	39.3%
Nicaragua	79.5%	20.5%
Panama	68.1%	31.9%
Paraguay	65.6%	34.4%
Peru	56.5%	43.5%
Dominican Republic	77.0%	23.0%
Uruguay	81.1%	18.9%

Remarks: Decomposition based on an unconditional multilevel model.
Source: SERCE database.
Table prepared by the authors.

Breakdown of the relationship between socioeconomic status and SERCE scores (between-school and within-school effect)

After examining how the variability decomposes at different levels, this section analyzes how much of this variability is associated with socioeconomic variables at each level. While a positive and significant relationship between student socioeconomic status and test results has been previously reported (Table 1), this relationship ignores the impact of the multilevel structure that students are a part of. To determine how much of the relationship between the scores and the ISEC

[11] From the aforementioned study conducted by Rutter et al. in the 1970s until the entire effective schools movement, one of the key elements stressed in education policy was the school institution. See Levin and Lockheed (1993) and Dalin (1994) as examples of studies from the 1990s that underscored the importance of the characteristics of school institutions in the academic achievement of students.

is attributable to the socioeconomic characteristics of the students and how much to the schools, this section estimates a multilevel model that controls simultaneously by the socioeconomic status of the students and the socioeconomic status of the schools. The latter is approximated by the aggregated average value of the level of the students in each school.

Formally, the relationship is expressed as follows;

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X^{*}_{ij}) + r_{ij} \quad (6)$$

Where:

$$\beta_{0j} = Y_{00} + Y_{01}(\overline{X}^{*}_{\bullet j}) + U_{0j} \quad (7)$$

$$\beta_{1j} = Y_{10} + U_{1j} \quad (8)$$

Whereby the equation may be re-expressed as:

$$Y_{ij} = Y_{00} + Y_{10}(X^{*}_{ij}) + Y_{01}(\overline{X}^{*}_{\bullet j}) + r_{ij} + U_{0j} + U_{1j} \quad (9)$$

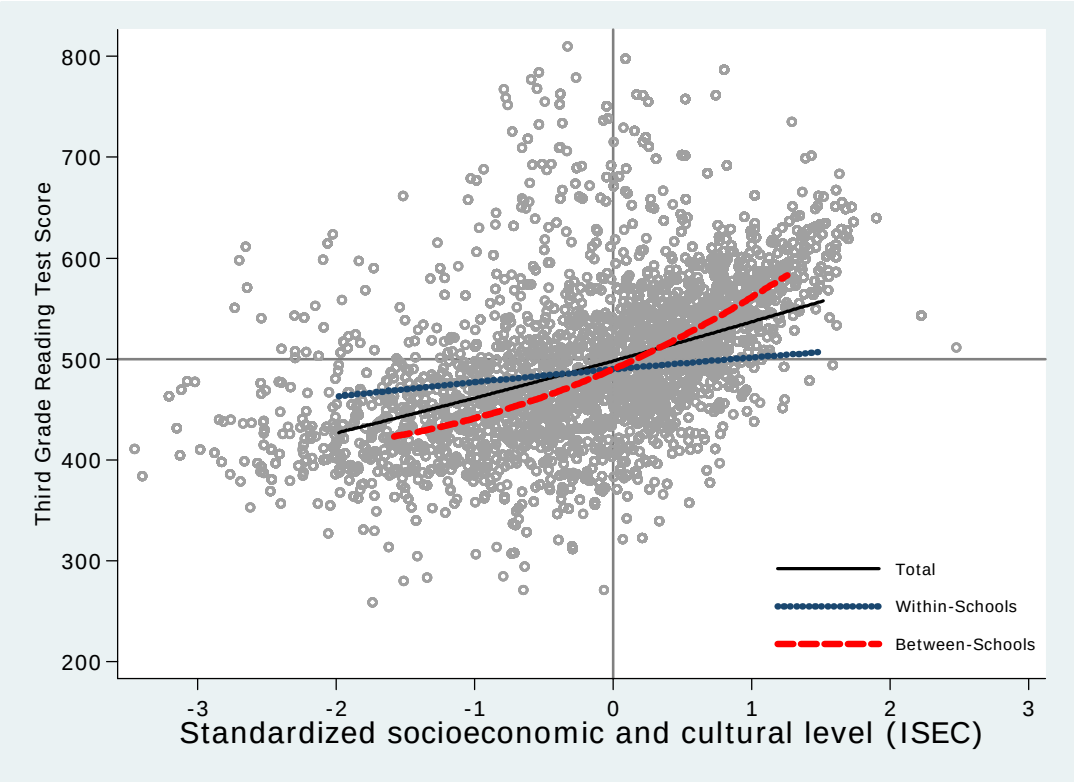
The literature on multilevel models recommends centering the variable representing student socioeconomic status (X_{ij}) to facilitate interpretation of the results. The level of grouping decided for centering influences interpretation of estimated results.[12] To estimate intra- and between-school effects, the student socioeconomic status indicator is used, centered around the school's mean. Thus, the coefficient associated with student socioeconomic status (Y_{10}) is interpreted as the part that can be explained by differences within the schools, or within-school

[12] For a discussion on the consequences of the method of centering variables, see Kreft, de Leeuw and Aiken (1995).

effect, and the coefficient associated with the average socioeconomic status for the school (Y_{01}) as the part of the difference explained by the between-school effect.

Graph 3 and Table 4 present the results of the breakdown of the variance for aggregated data on Latin America (excluding Mexico, the data of which contain no ISEC information). Unlike Graph 1, on which each point represented a student, each point on Graph 3 represents a school. In addition to the known gradient of the relationship between the socioeconomic status of students and their scores, shown as a continuous thicker line (identical to the one in Graph 1), two other gradients are shown: one for the relationship between test results and student socioeconomic status within the school (within-school effect) corresponding to the dotted line; and the other for the relationship between test results and the socioeconomic status of the school (between-school effect) corresponding to the dashed line. The vertical axis indicates each school's scores on third grade reading tests. The horizontal axis is the socioeconomic variable of the school (the average of the school's student ISEC values).

Graph 3
Latin America: Relationship between student socioeconomic status and SERCE results
Total effect and within-school and between-School breakdown



Remarks: Each point represents one school. The line labeled "Total" comes from an estimate obtained from an OLS regression. The "Intra-School" and "Inter-School" lines are the result of an estimate using a multilevel regression. Both estimates include adjustments by quadratic terms. The lines cover 5 to 95% of the ISEC range.
Source: SERCE database.
Graph prepared by the authors.

The dotted line represents the within-school effect; it is almost horizontal and indicates little variation in student scores within schools associated with variations in student socioeconomic status. On average, within each school, the change of one standard deviation in student ISEC is associated with an 11.6 point variation in third grade reading scores.[13] It should be noted that the student ISEC explains only 1.7% of all of the variance within a school. These results suggest that the variance in scores within the schools tends to be associated with factors other than student ISEC values.

The dashed line represents the between-school effect. Note that its slope is greater than that of the within-school effect and that of the student socioeconomic gradient, indicating that the

[13] Within-school effects are statistically significant for the region's data set and for all countries individually to 1%, except for Panama (to 5%) and Ecuador and Nicaragua (to 10%).

average school score is more susceptible to variations in the schools' average level for socioeconomic status. For each increment of the standard deviation of the school's ISEC value, the average school test score rises 47.1 points. The variance explained by the ISEC of the between-school effect indicates that half (49.2%) of the changes in average school scores are associated with variations in schools' average ISEC values.[14] The high correlation between socioeconomic status and SERCE test scores between schools is consistent with the results of other studies for similar tests, such as PEIC or PISA (see Willms and Somers, 2001 and OECD, 2001 and 2007).

Table 4
Breakdown of the relationship between student ISEC values and within-school and between-school third grade reading test results

	Model with Within and Between School Effects					
	Total Effect	Within-School Effects	Percentage of Variance Explained (%)	Between-School Effects	Percentage of Variance Explained (%)	Exclusion Index (rho)
Latin America	35.4	11.6 ***	1.7	47.1 ***	49.2	0.67
Argentina	27.3	11.6 ***	1.4	34.2 **	26.1	0.70
Brazil	46.8	16.1 ***	2.9	68.1 ***	78.9	0.59
Colombia	36.2	8.2 ***	0.5	52.3 ***	70.6	0.64
Costa Rica	38.6	16.4 ***	1.1	57.2 ***	59.6	0.54
Cuba	12.3	17.9 ***	2.1	3.5	-0.6	0.39
Chile	22.6	9.1 ***	0.9	37.9 ***	37.6	0.47
Ecuador	29.3	4.9 *	0.4	51.7 ***	56.4	0.52
El Salvador	24.0	7.9 ***	0.9	39.1 ***	55.3	0.52
Guatemala	18.5	4.8 ***	0.5	25.9 ***	34.6	0.65
Nicaragua	9.5	3.1 *	0.1	15.9 ***	18.9	0.50
Panama	22.8	7.0 **	1.3	28.9 ***	44.4	0.72
Paraguay	12.3	7.2 ***	0.7	14.8 **	6.8	0.67
Peru	31.2	7.4 ***	0.8	45.3 ***	60.0	0.63
Dominican Republic	19.1	10.9 ***	0.9	27.0 **	16.7	0.51
Uruguay	44.5	22.0 ***	2.5	91.9 ***	76.6	0.32

Significance levels: *** p<.001; ** p<.01; * p<.05
Remarks: Estimates based on multilevel models of random components.
Source: SERCE database.
Table prepared by the authors.

[14] The percentage of the variance in scores of schools associated with the school ISEC value is slightly lower in the third and sixth grade mathematics test: 33% and 40%, respectively. In sixth grade reading, it is slightly higher: 53% (see Statistical Appendix 4).

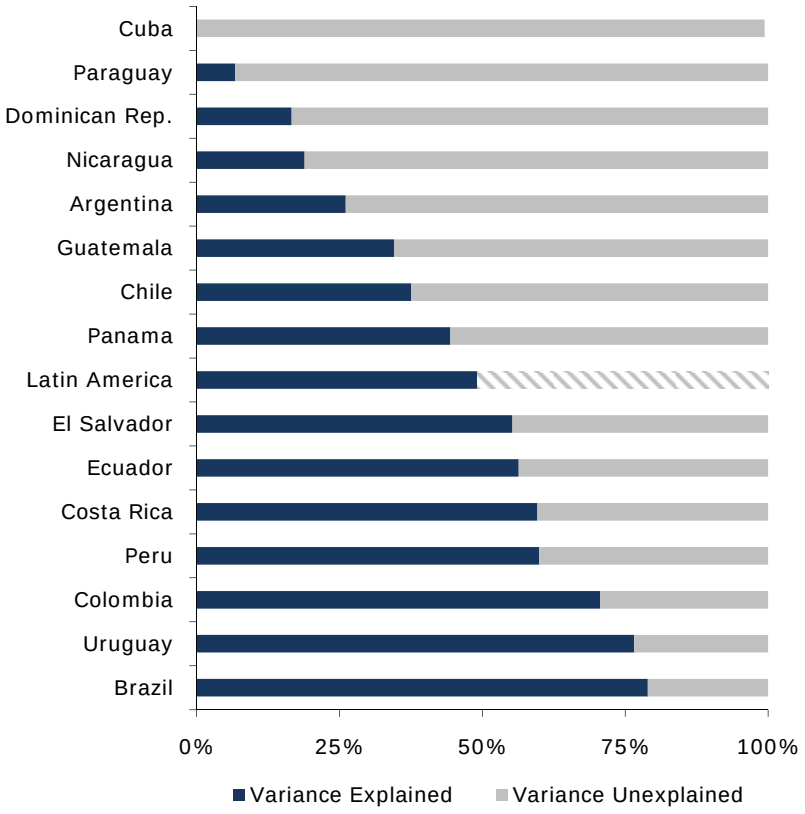
Table 4 shows the results of the breakdown of within-school and between-school effects according to individual countries. In Uruguay, Cuba, Costa Rica, and Brazil, the within-school effect tends to be greater than the region-wide average (that is, there are greater changes in student scores within schools associated with the differences in their families' ISEC values). In all of the other countries, both the size and the variance explained in the within-school effects are minimal.

On the other hand, differences in the average scores of schools associated with ISEC levels (between-school effect) are high in all of the countries, with the exception of Cuba and Paraguay. The cases of Uruguay and Brazil stand out with striking changes in the third grade reading test scores associated with a difference of one standard deviation in the schools' average socioeconomic status: 92 and 68 points, respectively. If we take into account the fact that a difference of approximately 90 points on the SERCE third grade reading test means passing from one skill level to the next, in Uruguay and Brazil the impact of the between-school effect implies passing from one level to the next on the test. In Costa Rica, Ecuador, Colombia, and Peru, the relationship between the ISEC and a school's average score is roughly 50 points, that is, a little bit more than half a level in achievement on the test. For all of the countries, the percentages of variance of the between-school effect explained by the ISEC, unlike the within-school effects, are high: in Brazil and Uruguay, almost 80% of the entire variation between schools is associated with changes in the ISEC, while the figure in Colombia, Costa Rica, Ecuador, and Peru is 60%. Conversely, in Paraguay, the variance between schools is explained by low ISEC values (7%) and, in Cuba, it is practically non-existent.

Graph 4 shows the variance decomposition in each country net of the ISEC effect. This graph can be contrasted with results from an unconditional decomposition as shown in Table 3. The horizontal bars represent the total variance at the level of schools, and the darkest portion indicates the variance that is explained when the average school ISEC value is introduced into the analyses. The case of Brazil is interesting because it registers a high variation between schools (36.7% according to Table 3) with a high portion of this variation associated with the school ISEC (78.9% according to Table 4). In Paraguay, the variance in the test between schools

is similar to that of Brazil (34.4% according to Table 3) but, by contrast, it is barely associated with the average school ISEC value (6.8% according to Table 4). Uruguay, Costa Rica, and the Dominican Republic register variances between schools that are close to the region-wide average; however, while in Uruguay and Costa Rica, the school ISEC value explains an important part of the variations, in the Dominican Republic, it only explains a small portion of them.

Graph 4
Variance in third grade reading explained at the level of schools by student ISEC values



Source: SERCE database.
Graph prepared by the authors.

The breakdown in the relationship between ISEC and academic results confirms one of the most characteristic features of education in Latin America: the socioeconomic segregation of schools. It also indicates that schools tend to be more socioeconomically segregated than families

and that this segregation has a substantial impact on student achievement: Schools do not attenuate the socioeconomic effect of families, but instead tend to deepen it.[15]

Double and Triple Jeopardy of Compositional Effects

The results of the between-school effect suggest that the following situation may be occurring in Latin America: students from low-income families tend to perform poorly in school due to their families' circumstances, but, by also being segregated into schools with low average ISEC, their performance tends to be even worse. On the other hand, the greatest slope and upward curve of the between-school gradient indicates that, for the segment of schools with above average ISEC, those catering to more socioeconomically favored families, scores tend to be higher than expected according to the socioeconomic status of the students attending this segment of schools.

This may be better observed by analyzing what some authors call the "compositional effect" of school ISEC (Willms, 2006 and 2003), which in the case of Latin American schools would appear to be negative in terms of equity. Willms (2006:46), based on previous work, argues in favor of distinguishing between two types of impacts: compositional and contextual. The former results from aggregating various student factors (such as demographic characteristics, for example), while the latter represents the environmental effects typically produced by the classrooms and schools where teaching and learning processes take place.[16] The compositional effect of schools is also termed "double and triple jeopardy."

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[15] Statistical Appendix 5 presents the index of socioeconomic exclusion of schools for SERCE participant countries (for third and sixth grades), which estimates the probability that students of the same socioeconomic status, i.e., the same ISEC value, will attend the same school. The high indices of exclusion between schools observed in most countries in Latin America and in the region-wide average (0.69) are even more striking when contrasted with those found in PISA for OECD countries (0.24).

[16] Following Willms (2006), contextual effects involve the environment in which teaching processes develop: school infrastructure and resources, school culture, education materials, pedagogical resources and libraries, interaction among students, student/teacher relations, and climate of discipline of the school, among other factors. The models that include contextual effects attempt to model the impact of the macro processes on the individual-level variables beyond the effects of any other individual variable that is operating (Blalock, 1984). In the education research, these effects are expressed as the magnitude to which the collective properties of the student body affect performance beyond the scope of the individual characteristics of students (Hutchison, 2007). The usual method of including contextual effects implies using variables that represent a macro or collective property with no individual-level counterpart and the

Double jeopardy is the change (reward or punishment) in terms of scores that an average ISEC student would undergo when transferring into a richer or poorer school as measured by the average socioeconomic status of the students in attendance there. Operationally, double jeopardy is calculated using the equation (9), but, unlike the within-school and between-school effect, the average school ISEC value is centered with respect to the entire sample ($\overline{X}_{\bullet\bullet}$), so that student socioeconomic status centered around the grand mean goes on to be represented by the term X_{ij}^{**} and is equal to $X_{ij} - \overline{X}_{\bullet\bullet}$. Formally, equation (9) would be re-expressed as:

$$Y_{ij} = Y_{00} + Y_{10}(X_{ij}^{**}) + Y_{01}(\overline{X}_{\bullet j}^{**}) + r_{ij} + U_{0j} + U_{1j} \quad (10)$$

Where:

Y_{01} represents double jeopardy.

Triple jeopardy captures the crossed interaction between the socioeconomic status of students' families and the socioeconomic makeup of the school measured by the average socioeconomic status of the students enrolled there. To estimate this effect, a term is added to equation (8) that captures this interaction:

$$\beta_{1j} = Y_{10} + Y_{11}(\overline{X}_{\bullet j}^{**}) + U_{1j} \quad (11)$$

And thus, equation (9) is re-expressed as follows:

$$Y_{ij} = Y_{00} + Y_{10}(X_{ij}^{**}) + Y_{01}(\overline{X}_{\bullet j}^{**}) + Y_{11}(X_{ij}^{**})(\overline{X}_{\bullet j}^{**}) + r_{ij} + U_{0j} + U_{1j} \quad (12)$$

Where:

Y_{11} Represents triple jeopardy.

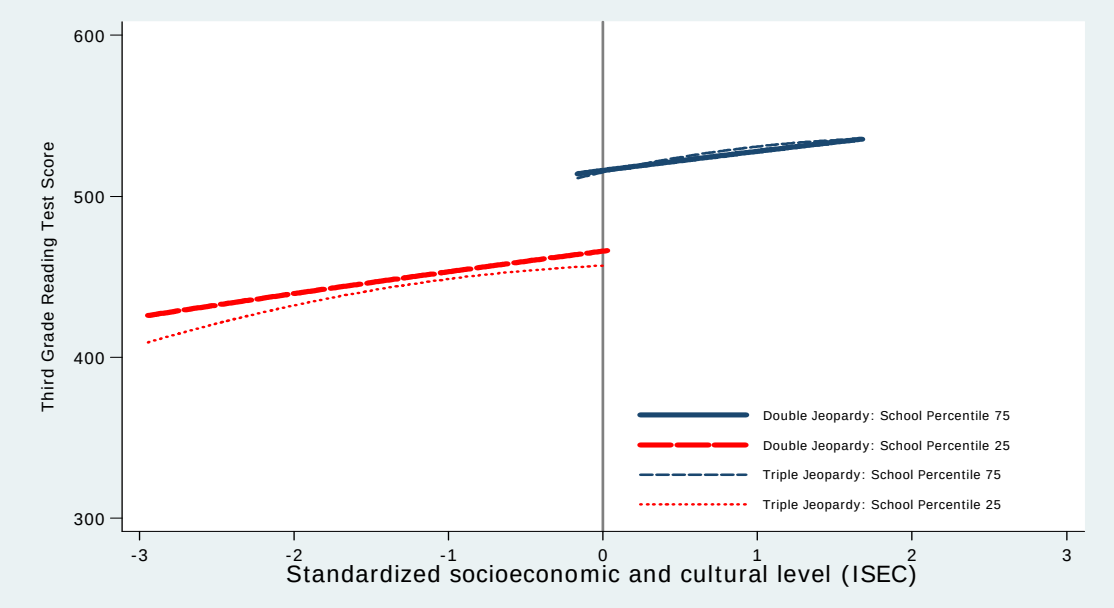
---

use of variables aggregated based on a subset of individuals, generally a group. Analysis of the contextual effects on individual conduct includes the study of the exogenous characteristics of the group as well as the (endogenous) conduct of the group to which the individual belongs. The latter is usually the main objective when studying peer-effects (Boozer and Cacciola, 2001). In this study, only the compositional effects of the average school ISEC are analyzed.

The interaction affects the coefficient associated with student socioeconomic status. If the coefficient associated with this interaction is statistically significant, the triple effect is present.

To illustrate the notion of double and triple jeopardy, we can graphically analyze differences in the scores attained by a student who attends a school in percentile 25 of the average socioeconomic status distribution compared to the scores of a student attending a school in percentile 75. Graph 5 presents the results of such a comparison. The darkest lines represent scores expected in schools with a high socioeconomic makeup, defined as schools whose aggregate ISEC is in percentile 75 or higher of the distribution in Latin America. The clearest lines represent the counterpart of the poorest schools and correspond to schools with a low socioeconomic makeup, ranked in percentile 25 or lower in the aggregate ISEC distribution. The ranges of the lines make up 5 to 95% of ISEC variable distribution at the student level. The solid lines represent estimates based on the double jeopardy resulting from the social makeup of the school, while the dotted lines represent a possible triple effect.

Graph 5
Latin America: Double and triple jeopardy of compositional effects



Remarks: Estimates based on multilevel regressions with intercepts and random coefficients adjusted by a quadratic term of the student ISEC value. The lines cover 5 to 95% of the range of the ISEC of students enrolled in each type of school.

Source: SERCE database.Graph prepared by the authors.

Graph 5 can lead us to the following conclusions. First, it reveals that the double jeopardy hypothesis is positive. On average in Latin America, a student whose socioeconomic status is close to the region-wide average (ISEC = zero) and who attends a school where the socioeconomic makeup of its students is lower (ISEC percentile 25 or less) will achieve performance that is 49 points lower than a student of equal socioeconomic status who attends a "richer" school (percentile 75 or higher). Second, when considering the possibility of triple jeopardy (i.e., that the effect of student socioeconomic status varies along with changes in school ISEC values), we find that the difference for the same average student increases to 57 points, that is, the student is awarded or penalized eight (8) additional points. The triple jeopardy of the compositional effect, estimated by means of the line's slope, though significant, does not reveal a differentiated impact among the students attending the "richest" schools, while the impact does turn out to be more striking and negative among those attending "poorer" schools. In other words, in the "poorest" schools, children with lower ISEC tend to attain poorer results. Third, the reduced overlap of students of the same socioeconomic status who attend schools with a different socioeconomic makeup is an expression of the acute social segregation in these schools.[17] In Latin America, the probability of finding students with different socioeconomic profiles attending schools with a different socio-demographic makeup is very low.

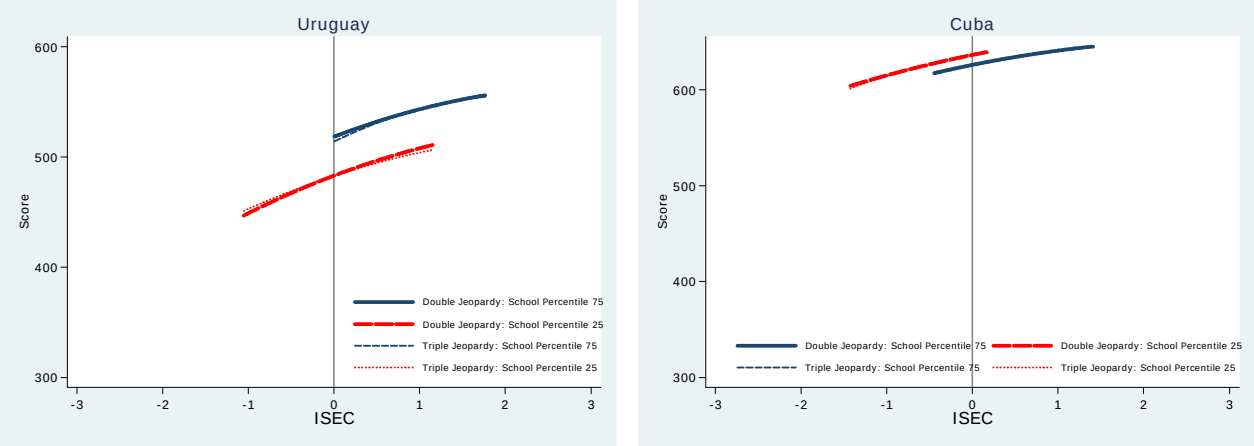
Thus, analysis of the compositional effects of a school's ISEC shows that Latin American students not only have unequal learning opportunities arising from the socioeconomic inequities of the families from which they come, but that these inequities also tend to accentuate themselves when the students attend schools of low socioeconomic status, chiefly affecting the poorest segments of the student body.

The results for Latin America as a whole conceal variations at the level of each country, which is why the same exercise is repeated with information broken down for selected countries (Graph 6). Among the countries selected, we find substantial differences reflecting the

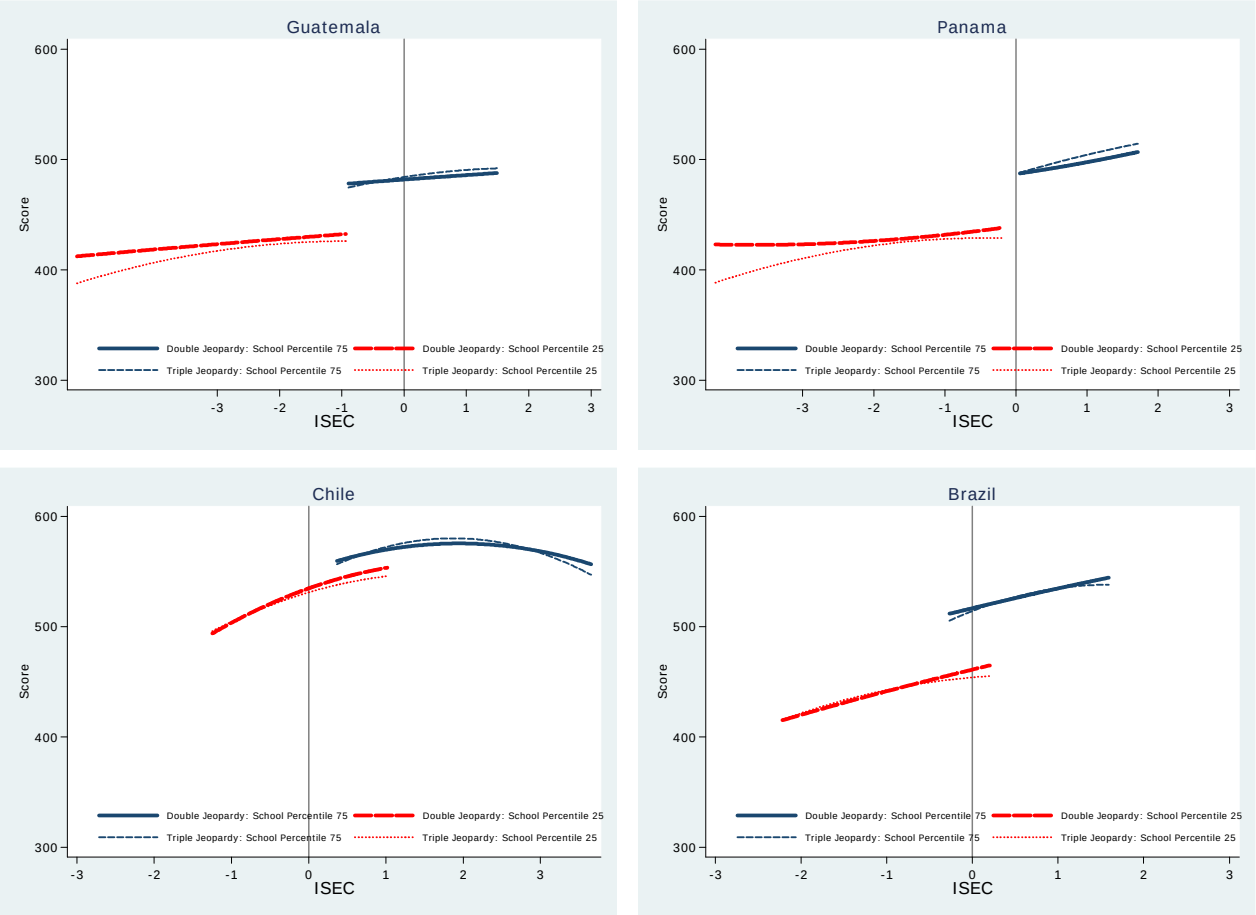
[17] In the data from PISA 2003 for OECD countries, the overlap ranged from -1.3 to +0.5 of the school socioeconomic index. In the SERCE database, the overlap occurs only between -0.10 to +0.08 of the school ISEC. See Willms, 2006.

characteristics of their education systems and social structures. Overall, it may be asserted that the differences between double and triple jeopardy are not pronounced except among the poorest schools of some countries. In Uruguay and Cuba, a relatively substantial proportion of the countries' students overlapped in terms of the schools that they attend, but with rather dissimilar results in performance. In Uruguay, double and triple jeopardy is lower than the regional level, but it is significant; in Cuba, on the other hand, differences are minimal, favoring the poorest schools. Conversely, in Guatemala and Panama, the overlap of students of different socioeconomic status is almost non-existent; nevertheless, the gap between the poorest schools and the least poor is wide. Chile and Brazil are interesting to comment on. In the case of Chile, a gap much narrower than the regional gap between poor and rich schools can be observed (the second most narrow after Cuba), whereas Brazil shows the widest gap in the region: about 60 points. At the same time, in Chile, the impact of the socioeconomic status of families on academic achievement has perhaps been compensated for to a degree by the academic institution, whereas, in Brazil, the compositional effect of the school ISEC value tends to magnify this impact.[18] (For details on the other countries, see Statistical Appendix 6).

Graph 6
Double and triple jeopardy of the compositional effects on selected countries in third grade reading



18 In the triple jeopardy simulations for Brazil, while a student with an ISEC level of zero (average for Latin America) when transferring to a rich school would be awarded 60 points (on the third grade reading score), in that same school the award for a student with an ISEC level of -1 would only be 32 points and, for a student with an ISEC level of +1, this award would be 79 points (see Statistical Appendix 7).



Remarks: Estimates based on multilevel regressions with intercepts and random coefficients adjusted by a quadratic term of the student ISEC value. The lines cover 5 to 95% of the range of the ISEC of students enrolled in each type of school.
Source: SERCE database.
Graph prepared by the authors.

4. Between-school and within-school effects of student socioeconomic status on SERCE results according to countries

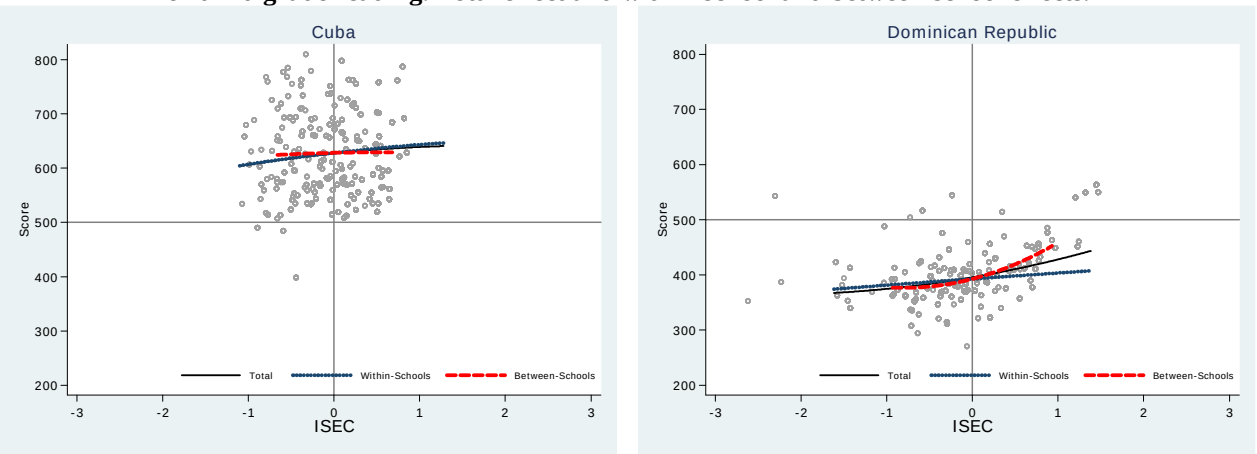
The characteristics of socioeconomic gradients (total, within-school and between-school) provide interesting information for designing policies aimed at the elusive goal of simultaneously improving quality and equity. The slopes and the intensity of the relationship between socioeconomic variables and academic achievement measured by the percentage of the variance explained are crucial data for defining the specific type of interventions in each country. This analysis makes it possible to answer questions concerning education policy such as: Under what

conditions should systemic or universal policies be adopted?; When should focused policies be preferred?; Should the focus be shifted onto the students (conditional cash transfers or scholarships) or onto the schools?; In a context of strict social segregation between schools, as is the case in most Latin American countries, should the development of selective schools be encouraged or should there be a shift toward more comprehensive schools? The answers to these questions can only be provided by taking into account the most complex problems of each country's education systems. It is important to note that there are no general solutions. The graphs below show a country-by-country breakdown of the relationship between student socioeconomic status and SERCE results following the model described in Section 2(b), and they suggest some policy recommendations.

Cuba and the Dominican Republic

Graph 7 compares the case of Cuba, the country with the best SERCE test results, with that of the Dominican Republic, the country with the lowest test scores.

Graph 7
Cuba and the Dominican Republic. Relationship between student socioeconomic status and SERCE results for third grade reading. Total effect and within-school and between-school effects.



Source: SERCE database.
Graph prepared by the authors.

While, in Cuba, almost all of the schools in the sample have SERCE test scores placing them above the regional average, in the Dominican Republic, the exact opposite is true. Even

schools with high ISEC averages tend to attain low test scores in the Dominican Republic. The slopes of the gradients in both countries are almost horizontal, revealing that the relationship between student socioeconomic status and test results is weak. However, in Cuba, they are at the 600-point level, whereas, in the Dominican Republic, they are in the 400s. This indicates that, on average, children in the latter country tend to have achievement equivalent to two levels below the SERCE scale for third grade reading. In other words, Cuban students place in Level III or higher (having satisfactorily acquired the knowledge and skills for the subject), whereas Dominicans tend to barely reach Level I, indicating serious problems in the teaching of the most important subjects in the initial grades of primary school. While, in Cuba, the gradient of the between-school relationship is slightly less flat than the student ISEC gradient, in the Dominican Republic (as is the case with these data throughout Latin America), the gradient of the between-school relationship is skewed upward for schools catering to families that are economically better off. This implies that the higher the ISEC is, the more pronounced its relationship is to test results. Cuba presents the regional case of high- achievement with high equity levels.[19] The Dominican Republic presents the case of low achievement distributed similarly at all socioeconomic levels.

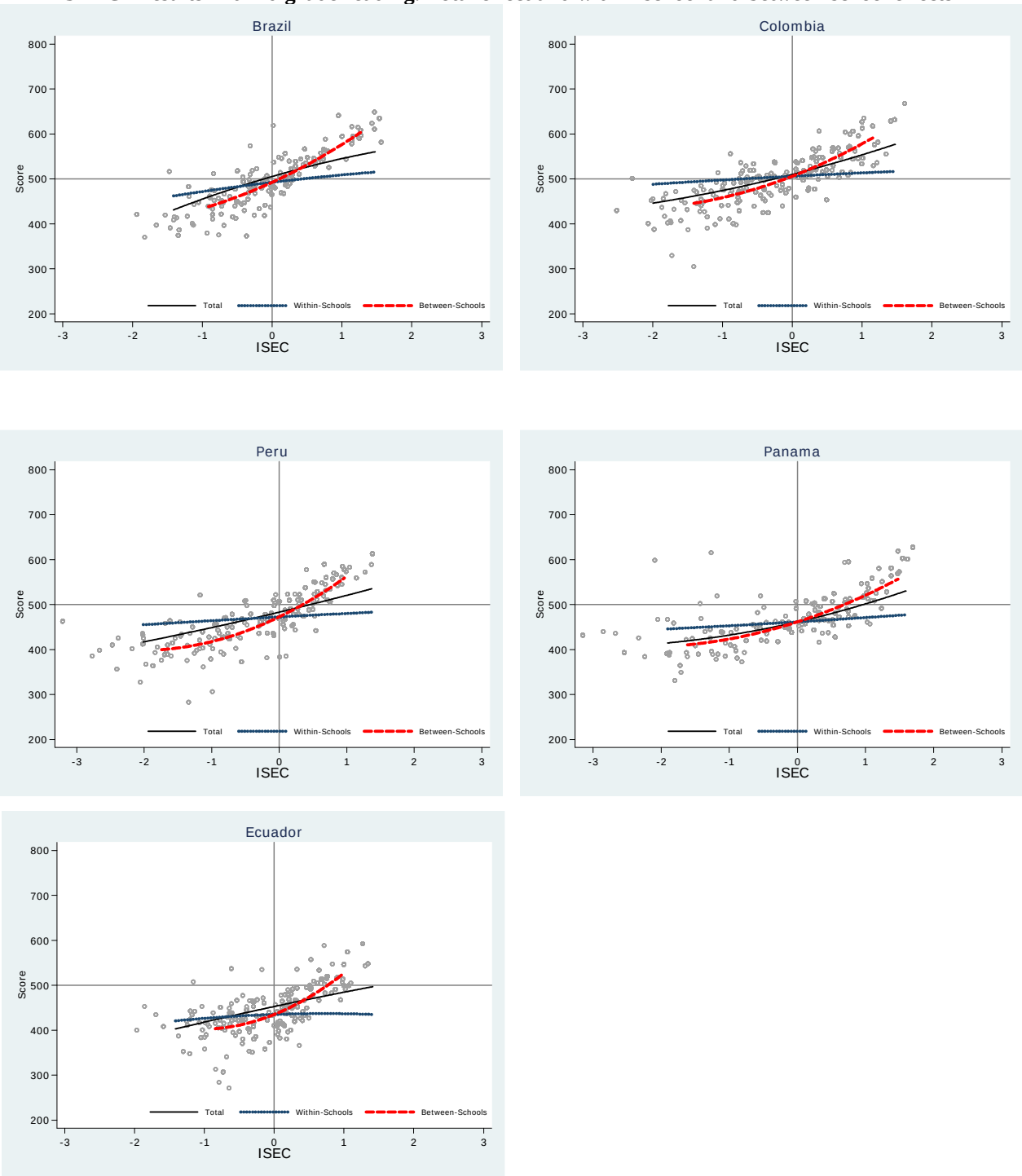
This result allows to conclude that, in countries with low performance values across all socioeconomic levels, with a weak relationship between school ISEC and average school performance—and where the within-school effect is minimal, as is the case in the Dominican Republic—policies focused on poor students may only attain modest results, since students with low performance levels are observed at all socioeconomic levels. In this case, more systemic policies with interventions specifically aimed at improving teaching in basic subjects may have a greater probability of making an impact on students' achievement.

[19] For an analysis of SERCE results in Cuba, see Carnoy, 2008.

Brazil, Colombia, Ecuador, Panama, and Peru

Great differences can be observed in scores associated with student socioeconomic status in the five countries in this section, unlike the cases of Cuba and the Dominican Republic. They have steep slopes and explicative force in the gradients of family ISEC and between-school effects, and they have similar within-school effects (Graph 8). The fact that the between-school effect gradients have greater slopes than those of the family ISEC—together with the results of the analysis of compositional double and triple jeopardy, which reveal wide gaps between rich and poor schools (see Statistical Appendices 6 and 7)—indicates that the poorest students tend to be adversely affected. This is due not only to the close association between the student ISEC and their academic achievement, but also to the fact that they attend schools with low ISEC levels, which tend to register poorer results. Thus, the schools of the poorest students intensify the negative relationship between a low student ISEC level and poorer test results. The high degree of social segregation in the schools tends to heighten the inequity in academic results. Policy interventions should target improvements in school-level characteristics rather than exclusively targeting the poorest students, given that the within-school gradient is almost flat. This indicates that the within-school student ISEC level does not greatly affect students' test scores, and that there is a strong relationship between the average school ISEC value and average school performance.

Graph 8
Brazil, Colombia, Ecuador, Panama, and Peru. Relationship between student socioeconomic status and SERCE results in third grade reading. Total effect and within-school and between-school effects

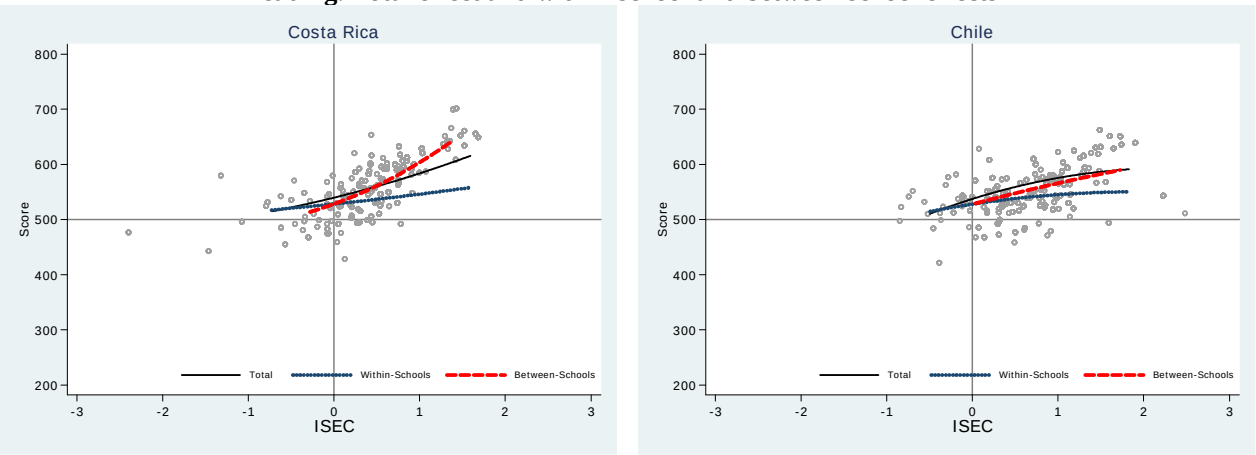


Source: SERCE database.
Graph prepared by the authors.

Chile and Costa Rica

Following Cuba, Chile and Costa Rica attained the best SERCE third grade reading test results. As illustrated in Graph 9, the schools in the samples from both countries are distributed similarly: few schools are below both the average region-wide score and region-wide average ISEC values. However, the gradients tell different stories. The student ISEC gradient is slightly greater in Chile (48 points on the test for each standard deviation of the ISEC compared with 38 points in Costa Rica), although the strength of the relationship between ISEC and test results is slightly higher in Costa Rica (11% in comparison with 8% in Chile [Table 1]). This indicates that, although a change in the ISEC value in Chile has a stronger relationship with test scores, this variable has less explicative force to change the score. The gradients have different curvatures. In Chile, as the ISEC rises, the positive association with scores tends to flatten out, whereas, in Costa Rica, it tends to rise (the curvilinearity effect in Chile is -10.6 and in Costa Rica is +5.9, significant in both cases at 1%). This indicates that in Costa Rica there is a stronger relationship between ISEC and test scores at higher levels of student socioeconomic status. The relationship between ISEC and between-school scores is also higher in Costa Rica than in Chile (57 and 38 points, respectively [Table 4]) with differing curvilinear effects. In Costa Rica, there is greater socioeconomic segregation of schools in terms of academic achievement (greater slope), which increases as the average school ISEC rises. In Chile, the relationship is rectilinear, similar to the student ISEC, and the between-school gap between rich and poor is narrower, as mentioned in the section on double and triple jeopardy. The data indicates that, although the test results are high in both countries, in Chile this occurs in a context of relatively greater socioeconomic equity in the schools, which would indicate that the sustained efforts of recent governments in Chile toward improving quality and equity in the schools are beginning to yield positive results.

Graph 9
Chile and Costa Rica. Relationship between student socioeconomic status and SERCE results in third grade reading. Total effect and within-school and between-school effects



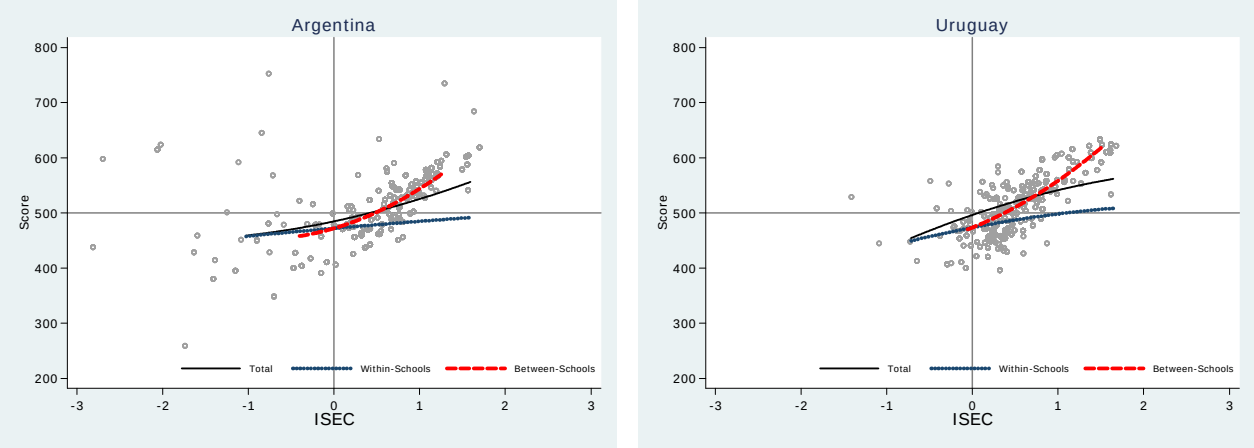
Source: SERCE database.
Graph prepared by the authors.

Argentina and Uruguay

Argentina and Uruguay stand out in Latin America for achieving universal basic education; they have high secondary education coverage and education indicators consistently above the mean for Latin America. As for the relationship between socioeconomic status and SERCE results, we can see in Graph 10 and in Tables 1 and 4 that both countries share similar characteristics: there are high slopes for student ISEC gradients (33 and 53 points, respectively, for each standard deviation in the ISEC), the percentage of variance explained by the ISEC is lower than the region-wide average (close to 10%), and, as is the case throughout the entire region, there is little variation within the schools that is attributable to student ISEC variations (slight within–school effect). The relationship between ISEC and between-school scores is equally similar: the gradient indicates high levels of socioeconomic segregation between schools, which are reflected in academic results. This is more pronounced in Uruguay than it is in Argentina. Uruguay has one of the highest between-school gradients in the region (with 92 points in variation for each standard deviation in school ISEC according to Table 4) and one of the highest levels of association between variance in scores and school ISEC values (69%), revealing a high level of between-school segregation. In Argentina, the slope of the between-school gradient is similar to the region-wide slope (approximately 34 points), and the variance explained is much lower than it is in Uruguay (26%).

The results of the multilevel analysis in both countries suggest the need for interventions focused on improving teaching conditions in schools with lower ISEC values, as the current government in Uruguay is doing in its Full-Time Schools program for the poorest groups of its population, or as planned in the policy of education equity improvement in Argentina, which puts priority on investment in schools attended by students from low-income families. In both countries, it would appear that existing policies are heading in the right direction, and positive results should be forthcoming shortly.

Graph 10
Argentina and Uruguay. Relationship between student socioeconomic status and SERCE results in third grade reading. Total effect and within-school and between-school effects



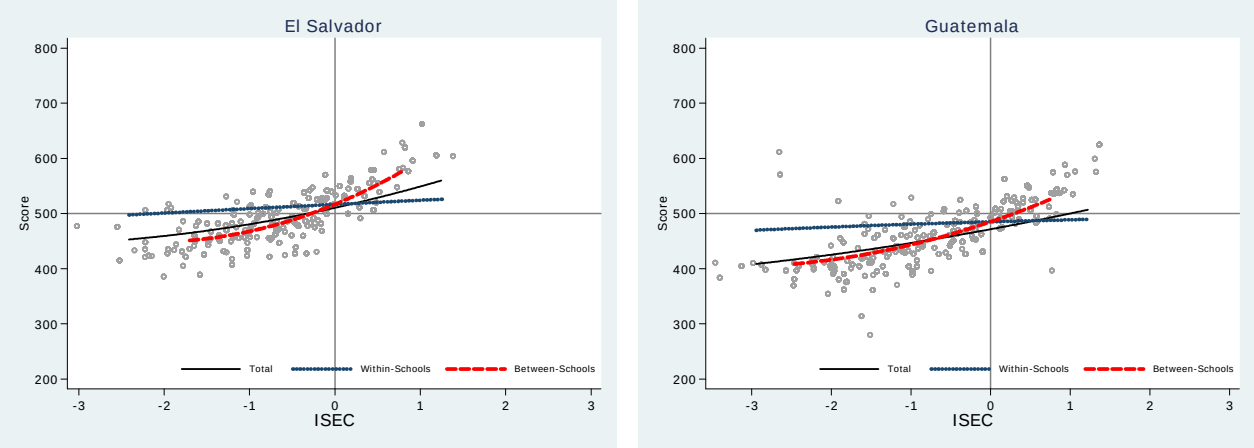
Source: SERCE database.
Graph prepared by the authors.

Central America and Paraguay

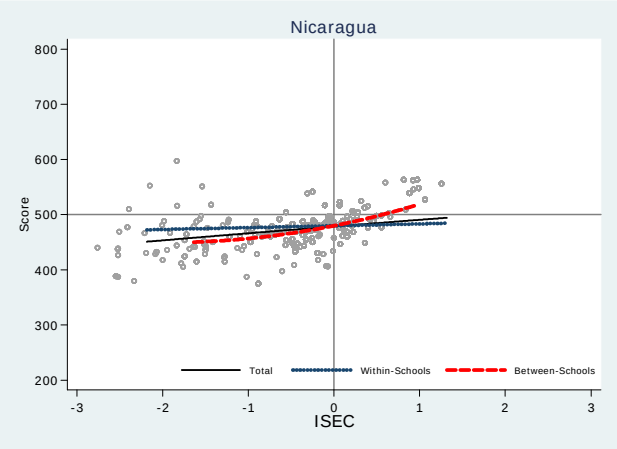
In the remaining set of countries (Paraguay, El Salvador, Guatemala, and Nicaragua), a high proportion of schools are placed in the lower-left quadrant of the graphs, that is, below the region-wide mean both in test scores and in ISEC values (Graph 11). The variance in test scores explained by student ISEC is below the region-wide average, which, being associated with the lower scores in each country, indicates a systemic problem of quality. The slopes of the between-school gradients are higher than the region-wide average, indicating high between-school segregation. The curvilinear effect is generally positive (and statistically significant) meaning that, if the school ISEC value is higher, the relationship between the ISEC and the scores is more pronounced. The following two different phenomena can be observed. In schools with higher

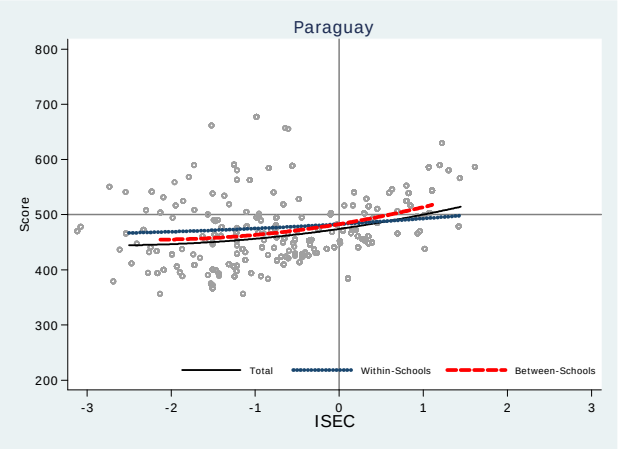
school ISEC values, a closer relationship is observed between test scores and ISEC values, which is even higher than the estimates made if only student socioeconomic status is taken into account. On the other hand, in schools with lower ISEC values, the gradient tends to be less pronounced and average scores are low, but differences between scores of the schools associated with changes in school ISEC values tend to be smaller.[20] In this group of countries, education systems have challenges that are twice as complex as they are in the countries already discussed, to the extent that it is necessary to make interventions aimed at improving the overall quality of the system and at the same time further programs to improve the situation in schools catering to the poorest sectors of the population.

Graph 11
Central America and Paraguay. Relationship between student socioeconomic status and SERCE results in third grade reading. Total effect and within-school and between-school effects



20 Paraguay exhibits slightly different behaviors: there is an important group of schools with low average ISEC values but with high performance on the tests (note the significant number of schools in the upper-left quadrant of the graph), and there is a weak relationship between the between-school ISEC and achievement (2.5%).





Source: SERCE database.
Graph prepared by the authors.

5. Conclusions

The need for improvement in quality and equity are two of the most important challenges facing education in Latin America. The SERCE 2006 database offers a unique opportunity to conduct an analysis comparing the quality of education (test results) with the socioeconomic status of students among the countries of Latin America. This study carried out a comparative examination of the relationship between academic achievement and equity in Latin America. More specifically, it analyzed the relationship between student socioeconomic status and SERCE test score results, as well as the within-school and between-school variation of this relationship.

The first conclusion of the analysis is that there is a strong relationship between the test results and student socioeconomic status, as measured by the ISEC. This relationship is important and statistically significant. On average region-wide, a change of one standard deviation of the ISEC is associated with a 38-point change in the test scores, and the ISEC values of students explain 15% of the variance in student performance for reading in the third grade.

Second, there is a striking inequity in achievement according to student socioeconomic status in Latin America. Whereas close to 50% of the third grade students in the richest ISEC quintile have satisfactorily acquired the required knowledge and abilities in reading and

mathematics for this grade, only 10% of the third grade students in the poorest quintile have done so. Similar inequities are observed in the sixth grade.

Third, socioeconomic variables are associated differently with test results when the relationship is broken down within schools and between schools. The relationship between students' socioeconomic status and test scores between-schools is more pronounced (47 points) than it is within the schools . Furthermore, student socioeconomic status explains a greater proportion of the variance in scores between schools (49.2%) than it does within schools. In contrast, the relationship between student socioeconomic status and variations in scores within-school is weaker (a difference of 11 points on the test), that is, student socioeconomic status explains a very small proportion of the total variance in scores within schools (1.7%).

Fourth, schools play a very important role in student performance. Over two-fifths (42%) of the score variations are associated with the schools that students attend, and half of these variations are associated with the average socioeconomic status of the students in the schools. Given the extreme socioeconomic segregation observed in the region's schools in the vast majority of Latin American countries, policy interventions aimed at improving quality and equity in education should be mainly focused on the schools and not on the students.

Fifth, there is a high level of socioeconomic segregation in the schools, which further deepens the relationship between the students' socioeconomic status and test results. The poorest students are penalized, first because of their socioeconomic status and then again by studying at schools attended mostly by students from poor families. The richest students, on the other hand, tend to be rewarded since the context of a school with a wealthy student body increases the possibility of attaining better academic achievement (double and triple jeopardy of compositional effects). Hence, a conclusion is arrived at that is similar to those found in other analyses: Latin American students have unequal learning opportunities stemming from the socioeconomic

inequities with which they come into the school system and which are reinforced by the unequal learning conditions at the schools they attend.[21]

Sixth, as other studies have pointed out (OECD, 2007 and Willms and Somers, 2001), SERCE shows that it is possible to achieve simultaneously high academic performance and equity in learning outcomes. In the two countries with the highest SERCE scores, Cuba and Chile, good results have been achieved in a relatively consistent fashion (more so in Cuba than in Chile) in schools with all types of socioeconomic backgrounds. In these countries, socioeconomic differences among students and schools are only slightly associated with academic achievement.

There are no uniform regional fixes to improve the quality and equity of education in Latin America. Any policy proposal should be rooted in each country's specific context. However, the analysis of the relationship between equity and quality presented in this document suggests that certain elements should be taken into account in the design of national interventions. Among them, the following stand out: (i) without explicit policies aimed at improving the educational opportunities of children from families with low socioeconomic status and the schools they attend, it is not possible to diminish the learning gap revealed through learning tests among different socioeconomic groups; (ii) no easy solutions exist for improving quality and equity of education, but no goal should be achieved at the expense of the other; (iii) the initial grades of primary school should be given priority when implementing interventions aimed at correcting inequities in achievement since the skills and knowledge that define academic success or failure later on are consolidated in these grades; and (iv) although the emphases of each country's interventions vary, the results of this study suggest that schools should be the focus of corrective actions in almost every country.

Finally, according to this analysis, the school plays a crucial role in the relationship between educational equity and quality in Latin American countries. Given this fact, it is

[21] See Reimers, 2000 and Cueto, 2006.

necessary to promote empirical research studies aimed at detecting and measuring school characteristics that wield a greater impact on the performance of students from families of low socioeconomic status. Only when there are robust results on this front can specific interventions for each country be defined with greater precision.

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Statistical Appendices

Appendix 1a
Latin America: Relationship between student socioeconomic status and SERCE results in third grade mathematics

	Curvilinear Model						
	Level of the Gradient		Slope of the Gradient		Curvilinear Effect		Percentage of Variance Explained
Latin America	498.8	***	33.2	***	1.9		12.0
Argentina	489.6	***	29.4	***	6.1		8.0
Brazil	507.0	***	46.8	***	-3.3		17.0
Colombia	495.7	***	26.5	***	7.0	**	10.0
Costa Rica	522.6	***	29.8	***	4.6	***	9.0
Cuba	649.7	***	6.1		-5.2		0.0
Chile	506.8	***	47.4	***	-10.2	***	8.0
Ecuador	473.8	***	18.9	***	1.4		4.0
El Salvador	493.1	***	26.1	***	4.2	***	9.0
Guatemala	475.8	***	17.4	***	0.8		8.0
Nicaragua	472.6	***	0.7		1.1		0.0
Panama	459.4	***	16.8	***	4.6	***	5.0
Paraguay	491.5	***	10.3	**	2.5		1.0
Peru	483.0	***	28.0	***	0.9		15.0
Dominican Republic	405.8	***	16.8	***	4.2	**	4.0
Uruguay	518.1	***	47.6	***	-7.5	***	8.0

Significance levels: *** p<.001; ** p<.01; * p<.05
Source: SERCE database.
Table prepared by the authors.

Appendix 1b
Latin America: Relationship between student socioeconomic status and SERCE results in sixth grade reading

	Curvilinear Model						
	Level of the Gradient		Slope of the Gradient		Curvilinear Effect		Percentage of Variance Explained
Latin America	508.9	***	37.3	***	0.1		12.0
Argentina	478.8	***	41.9	***	10.0	**	10.0
Brazil	519.2	***	39.4	***	-0.9		11.0
Colombia	521.1	***	31.2	***	1.1		11.0
Costa Rica	544.5	***	38.1	***	3.7	***	10.0
Cuba	600.5	***	20.4	***	-5.3		2.0
Chile	526.6	***	51.9	***	-11.9	***	9.0
Ecuador	449.6	***	37.6	***	-0.8		13.0
El Salvador	496.3	***	38.0	***	7.2	***	13.0
Guatemala	474.6	***	34.0	***	2.6	*	18.0
Nicaragua	480.7	***	10.1	***	-0.9		3.0
Panama	470.2	***	43.2	***	3.7	**	21.0
Paraguay	466.2	***	36.4	***	5.8	***	12.0
Peru	494.9	***	38.2	***	-2.8		24.0
Dominican Republic	420.0	***	22.0	***	6.5	*	4.0
Uruguay	516.1	***	50.7	***	-1.3		10.0

Significance levels: *** p<.001; ** p<.01; * p<.05
Source: SERCE database.
Table prepared by the authors.

Appendix 1c
Latin America: Relationship between student socioeconomic status and SERCE results in sixth grade mathematics

	Curvilinear Model						
	Level of the Gradient		Slope of the Gradient		Curvilinear Effect		Percentage of Variance Explained
Latin America	497.2	***	34.7	***	1.5	*	11.0
Argentina	491.8	***	35.2	***	9.3	**	9.0
Brazil	497.9	***	39.2	***	0.8		12.0
Colombia	496.6	***	24.4	***	2.4		8.0
Costa Rica	533.8	***	32.8	***	2.0		7.0
Cuba	640.5	***	7.0		-4.6		0.0
Chile	501.6	***	46.3	***	-10.9	***	6.0
Ecuador	461.8	***	29.3	***	1.0		8.0
El Salvador	483.5	***	30.5	***	5.1	***	10.0
Guatemala	473.7	***	27.1	***	2.5	***	12.0
Nicaragua	462.8	***	5.9	**	-0.2		1.0
Panama	448.7	***	30.9	***	4.7	**	12.0
Paraguay	478.1	***	25.2	***	4.0	*	6.0
Peru	510.9	***	44.5	***	-1.5		23.0
Dominican Republic	415.7	***	13.0	***	3.2		2.0
Uruguay	555.5	***	50.9	***	-2.9		8.0

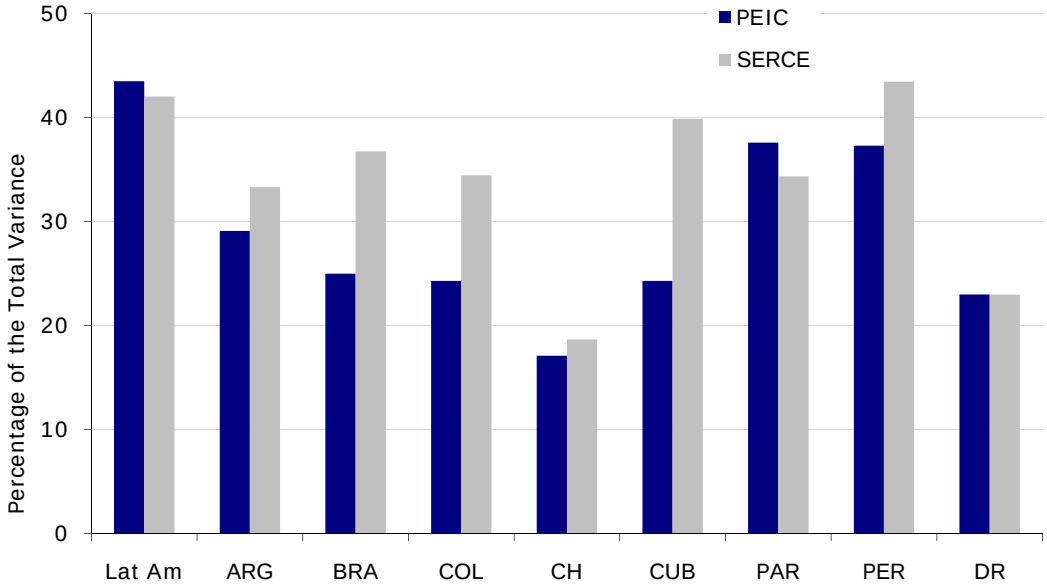
Significance levels: *** p<.001; ** p<.01; * p<.05
Source: SERCE database.
Table prepared by the authors.

Appendix 2
Probability of attaining satisfactory SERCE test performance according to student socioeconomic status country-by-country (sixth grade)

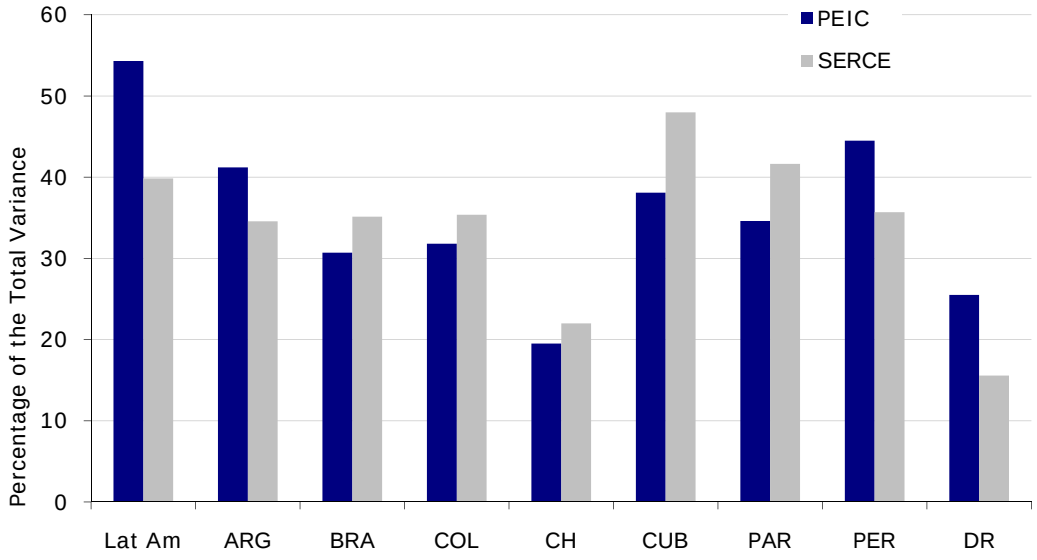
	Reading			Mathematics		
	Quintile 1	Average	Quintile 5	Quintile 1	Average	Quintile 5
Latin America	0.29	0.47	0.70	0.26	0.42	0.66
Argentina	0.28	0.46	0.61	0.37	0.51	0.63
Brazil	0.43	0.54	0.77	0.31	0.43	0.72
Colombia	0.32	0.50	0.70	0.25	0.40	0.58
Costa Rica	0.65	0.74	0.86	0.58	0.65	0.78
Cuba	0.69	0.76	0.78	0.76	0.78	0.81
Chile	0.47	0.63	0.80	0.35	0.51	0.70
Ecuador	0.08	0.20	0.41	0.12	0.24	0.44
El Salvador	0.23	0.35	0.58	0.18	0.28	0.45
Guatemala	0.07	0.20	0.49	0.12	0.22	0.44
Nicaragua	0.22	0.28	0.40	0.19	0.22	0.29
Panama	0.10	0.33	0.56	0.10	0.21	0.39
Paraguay	0.17	0.26	0.51	0.22	0.30	0.45
Peru	0.08	0.32	0.58	0.12	0.40	0.62
Dominican Republic	0.07	0.09	0.22	0.06	0.07	0.14
Uruguay	0.47	0.58	0.80	0.67	0.74	0.86

Source: SERCE database.
Table prepared by the authors.

Appendix 3
Percentage of variance attributable to between-school differences according to PEIC 1998 and SERCE 2006.
Third and Fourth Grade Reading



Third and Fourth Grade Mathematics



Source: SERCE database and Willms and Somers, 2001.
Table prepared by the authors.

Appendix 4a
Decomposition of the within- and between-school effects of socioeconomic conditions on third grade mathematics

	Model with Within and Between School Effects					
	Total Effect	Within-School Effects	Percentage of Variance Explained (%)	Between-School Effects	Percentage of Variance Explained (%)	Exclusion Index (rho)
Latin America	27.9	10.0 ***	1.6	36.8 ***	33.4	0.67
Argentina	20.6	12.5 ***	1.5	24.1	14.5	0.70
Brazil	46.6	15.3 ***	2.4	68.5 ***	72.8	0.59
Colombia	17.0	5.3 **	0.4	23.7 ***	22.5	0.64
Costa Rica	28.8	13.9 ***	1.0	41.4 ***	49.1	0.54
Cuba	3.1	15.5 ***	1.1	-16.6	-0.1	0.39
Chile	19.8	7.1 **	1.0	34.1 ***	29.7	0.47
Ecuador	13.9	3.1	0.0	23.8 ***	19.0	0.52
El Salvador	16.1	5.6 ***	0.4	26.0 ***	40.3	0.52
Guatemala	13.2	3.2 *	1.2	18.6 ***	23.8	0.65
Nicaragua	-3.8	-1.0	2.8	-6.6	0.2	0.50
Panama	0.7	3.7 *	0.7	-0.4	-0.8	0.72
Paraguay	3.0	7.7 ***	1.5	0.7	-0.7	0.67
Peru	23.9	5.1 **	1.3	35.1 ***	50.0	0.63
Dominican Republic	11.3	6.6 ***	0.2	15.8 **	18.0	0.51
Uruguay	38.9	16.2 ***	1.1	86.9 ***	70.1	0.32

Significance levels: *** p<.001; ** p<.01 ; * p<.05
Remarks: Estimates based on multilevel models of random components.
Source: SERCE database.
Table prepared by the authors.

Appendix 4b
Decomposition of the within- and between-school effects of socioeconomic conditions on sixth grade reading

	Model with Within and Between School Effects					
	Total Effect	Within-School Effects	Percentage of Variance Explained (%)	Between-School Effects	Percentage of Variance Explained (%)	Exclusion Index (rho)
Latin America	38.3	12.6 ***	1.3	49.9 ***	52.9	0.69
Argentina	41.0	19.2 ***	1.6	50.4 ***	37.7	0.70
Brazil	39.4	15.6 ***	1.7	58.8 ***	65.7	0.55
Colombia	27.4	9.5 ***	0.7	39.7 ***	65.1	0.59
Costa Rica	37.2	14.6 ***	1.5	52.7 ***	62.4	0.59
Cuba	17.6	24.0 ***	3.2	7.7	-0.8	0.39
Chile	29.2	11.5 ***	0.7	60.5 ***	53.2	0.36
Ecuador	35.2	10.3 ***	2.1	57.5 ***	55.5	0.53
El Salvador	24.0	7.0 ***	0.4	37.2 ***	56.9	0.56
Guatemala	25.4	6.8 ***	0.5	32.5 ***	64.2	0.72
Nicaragua	10.1	1.3	0.1	16.6 ***	22.8	0.58
Panama	36.3	15.7 ***	2.1	42.1 ***	64.6	0.78
Paraguay	20.9	9.0 ***	2.6	28.0 ***	25.6	0.63
Peru	41.2	7.8 ***	0.5	57.7 ***	85.5	0.67
Dominican Republic	19.8	4.3	0.3	35.2 ***	40.3	0.50
Uruguay	49.3	21.0 ***	1.9	94.8 ***	83.5	0.38

Significance levels: *** p<.001; ** p<.01 ; * p<.05
Remarks: Estimates based on multilevel models of random components.
Source: SERCE database.
Table prepared by the authors.

Appendix 4c
Decomposition of the within- and between-school effects of socioeconomic conditions on sixth grade mathematics

	Model with Within and Between School Effects					
	Total Effect	Within-School Effects	Percentage of Variance Explained (%)	Between-School Effects	Percentage of Variance Explained (%)	Exclusion Index (rho)
Latin America	32.3	11.4 ***	1.0	41.8 ***	39.4	0.69
Argentina	35.3	14.1 ***	0.8	44.4 ***	33.3	0.70
Brazil	40.2	15.4 ***	1.7	60.5 ***	64.6	0.55
Colombia	18.6	7.3 ***	0.7	26.4 ***	45.0	0.59
Costa Rica	34.0	15.4 ***	1.3	46.6 ***	49.7	0.59
Cuba	1.7	25.2 ***	2.1	-34.7 *	1.8	0.39
Chile	24.9	6.7 **	1.0	57.0 ***	45.2	0.36
Ecuador	22.9	1.0	0.1	42.4 ***	40.0	0.53
El Salvador	19.8	5.8 ***	0.3	30.8 ***	54.9	0.56
Guatemala	19.1	4.6 *	1.2	24.8 ***	55.5	0.72
Nicaragua	4.0	1.7	0.3	5.6	2.3	0.58
Panama	18.6	14.0 ***	2.2	20.0 ***	29.5	0.78
Paraguay	14.7	7.4 **	2.0	19.0 ***	12.8	0.63
Peru	44.0	9.4 ***	0.4	61.0 ***	74.4	0.67
Dominican Republic	10.6	4.1	0.2	17.1 **	20.5	0.50
Uruguay	47.0	19.4 ***	1.2	91.5 ***	68.9	0.38

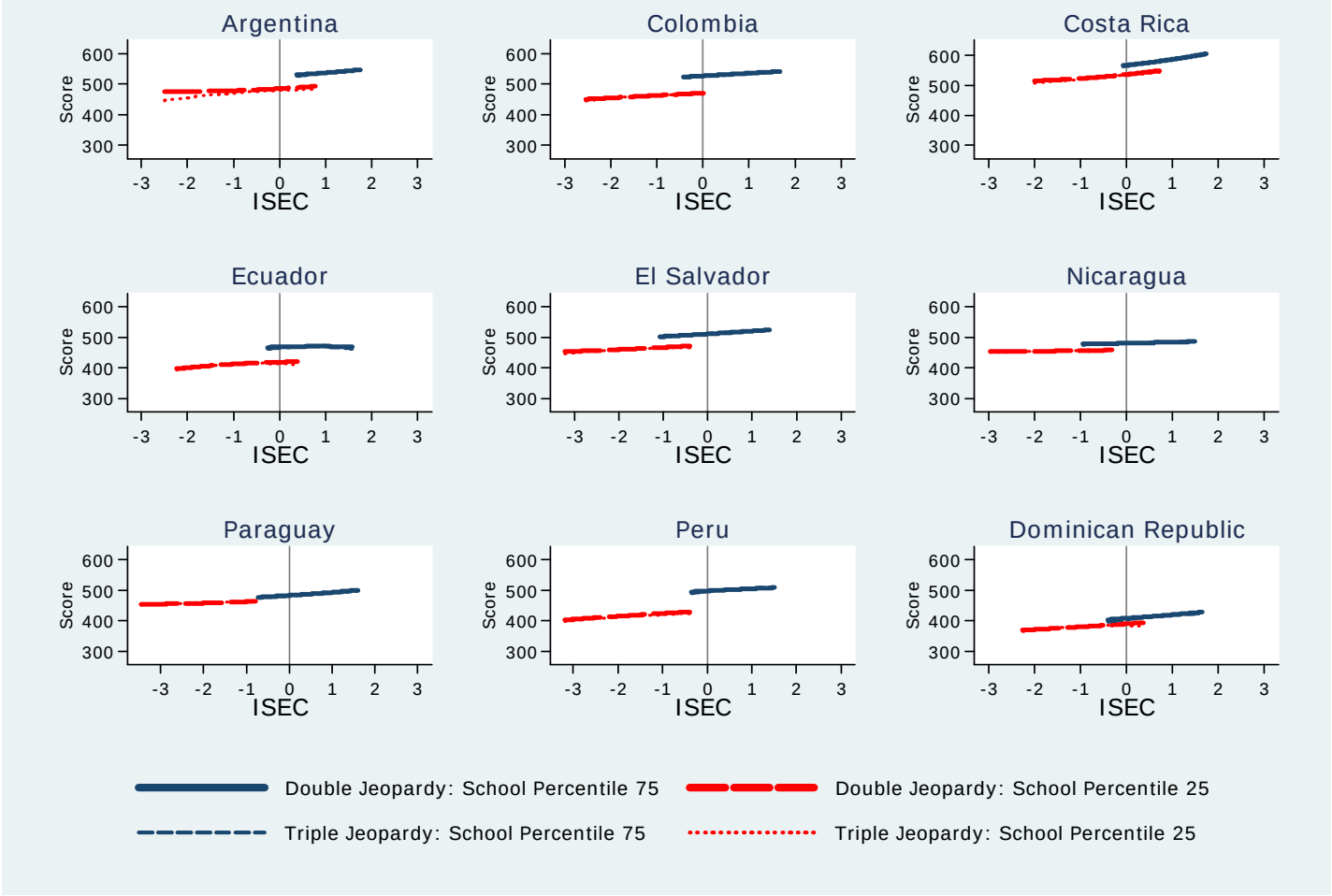
Significance levels: *** p<.001; ** p<.01 ; * p<.05
Remarks: Estimates based on multilevel models of random components.
Source: SERCE database.
Table prepared by the authors.

Appendix 5
Index of Socioeconomic Exclusion in Latin American Schools
(Intra-Class Correlation Index - ICC)

	Third Grade Sample	Sixth Grade Sample
Latin America	0.67	0.69
Argentina	0.70	0.70
Brazil	0.59	0.55
Colombia	0.64	0.59
Costa Rica	0.54	0.59
Cuba	0.39	0.39
Chile	0.47	0.36
Ecuador	0.52	0.53
El Salvador	0.52	0.56
Guatemala	0.65	0.72
Nicaragua	0.50	0.58
Panama	0.72	0.78
Paraguay	0.67	0.63
Peru	0.63	0.67
Dominican Republic	0.51	0.50
Uruguay	0.32	0.38

Remarks: Estimates based on multilevel models.
The ICC is the proportion of the variance in the Index of Socioeconomic and Cultural Status (ISEC) that is attributed to the school level.
Values close to 1 indicate higher between-school segregation according to socioeconomic and cultural status.
Source: SERCE database.
Table prepared by the authors.

Appendix 6
Compositional double and triple jeopardy: Selected countries



Remarks: Estimates based on multilevel regressions with intercepts and random coefficients adjusted by a quadratic term of the student ISEC value. The lines cover 5 to 95% of the ISEC range of students attending each type of school.
Source: SERCE database.Graph prepared by the authors.

Appendix 7
Simulation of the double and triple jeopardy involved in changes in socioeconomic status of the student and of the school

Latin America

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	453	503	50	449	489	40
-0.5	459	510	50	454	503	50
0.0	466	516	50	457	515	58
0.5	472	522	50	458	524	67
1.0	478	528	50	457	531	74

Argentina

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	479	521	42	471	491	20
-0.5	482	524	42	477	506	29
0.0	486	528	42	480	518	38
0.5	490	532	42	483	529	46
1.0	496	538	42	484	538	54

Brazil

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	441	497	55	443	474	32
-0.5	451	507	55	449	496	47
0.0	461	516	55	454	514	60
0.5	470	526	55	456	527	71
1.0	479	534	55	456	534	79

Colombia

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	463	519	56	465	515	50
-0.5	468	523	56	467	520	53
0.0	472	528	56	468	526	58
0.5	476	532	56	467	531	64
1.0	480	536	56	464	535	71

Costa Rica

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	523	553	31	521	543	22
-0.5	528	559	31	527	553	26
0.0	536	567	31	534	564	29
0.5	545	576	31	541	575	33
1.0	556	586	31	549	586	37

Cuba

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	615	604	-10	614	607	-7
-0.5	626	616	-10	627	617	-10
0.0	636	626	-10	637	626	-11
0.5	644	634	-10	644	634	-11
1.0	651	641	-10	649	640	-9

Chile

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	503	520	17	504	494	-10
-0.5	521	537	17	519	521	2
0.0	535	551	17	531	543	13
0.5	545	562	17	540	560	21
1.0	553	570	17	545	572	27

Ecuador

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	412	462	50	412	443	31
-0.5	416	466	50	415	456	42
0.0	419	469	50	413	465	52
0.5	420	470	50	409	469	61
1.0	421	470	50	401	469	68

El Salvador

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	467	503	36	465	500	35
-0.5	471	507	36	466	507	40
0.0	475	511	36	467	512	45
0.5	480	516	36	466	517	50
1.0	485	520	36	464	520	55

Guatemala

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	432	478	45	426	473	47
-0.5	434	480	45	426	479	53
0.0	436	482	45	424	484	60
0.5	438	484	45	422	488	66
1.0	440	486	45	419	490	72

Nicaragua

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	456	478	22	456	475	19
-0.5	457	479	22	455	478	22
0.0	459	481	22	454	480	26
0.5	460	482	22	452	483	31
1.0	462	484	22	450	485	35

Panama

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	432	479	47	428	466	38
-0.5	435	483	47	429	477	48
0.0	440	487	47	428	487	59
0.5	445	492	47	426	496	70
1.0	451	498	47	423	504	81

Paraguay

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	463	476	13	462	473	11
-0.5	467	479	13	464	477	13
0.0	471	483	13	465	481	16
0.5	475	488	13	467	486	20
1.0	481	493	13	468	492	24

Peru

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	424	490	65	420	476	55
-0.5	429	494	65	423	487	64
0.0	433	498	65	425	496	72
0.5	437	502	65	426	503	77
1.0	440	506	65	426	508	82

Dominican Republica

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	380	398	18	381	382	1
-0.5	385	403	18	384	394	10
0.0	390	408	18	384	404	19
0.5	396	414	18	382	412	30
1.0	402	420	18	377	418	41

Uruguay

	Double Jeopardy			Triple Jeopardy		
Student ISEC	School Percentile 25	School Percentile 75	Difference [p75]-[p25]	School Percentile 25	School Percentile 75	Difference [p75]-[p25]
-1.0	449	485	36	453	467	15
-0.5	467	503	36	469	493	24
0.0	483	519	36	483	514	31
0.5	496	532	36	494	531	37
1.0	508	543	36	504	544	40

Source: SERCE database. Table prepared by the authors.