5

Inequality of Opportunity in Educational Achievement in Five Latin American Countries

This chapter presents estimates of inequality of opportunity for educational achievement in several Latin American countries, using a technique similar to that in the previous chapter.[1] Inequality of opportunity in the acquisition of education is as important as inequality of opportunity in economic welfare, for several reasons. First, education is one of the main determinants of individual earnings and welfare. Inequality of educational opportunity thus may very well translate into inequality of economic opportunity. Second, education has considerable intrinsic value, and inequality of opportunity in its acquisition may therefore be considered unfair in its own right. Third, education is related to other intrinsically valued individual capabilities, such as participation in political institutions. Finally, through a number of these channels, inequality of educational opportunity may also engender economic and institutional inefficiencies.[2]

Measuring Inequality of Educational Opportunity

This chapter examines inequality of opportunity for educational achievement for 15-year-old children in five Latin American countries (as well as nine European and North American nations). These measures are estimated using internationally comparable data on standardized test scores for reading and mathematics from the Program for International Student Assessment (PISA). Educational achievement measured by test scores is likely to be a better measure of human capital than educational attain-

ment, measured by years of schooling or completed levels of education, because of the considerable heterogeneity in the quality of education across schools.

Methodology

The measures of inequality of opportunity in educational achievement reported in this chapter are based on the same kind of decomposition performed for economic outcomes in chapter 4. Total observed inequality is decomposed into two parts: one resulting from circumstances beyond the control of the individual, and the second related to efforts made in the acquisition of education, as well as luck, measurement error, and those components of innate talent that are uncorrelated with the observed circumstances. The data contain five circumstance variables: the gender of the child, father's and mother's levels of education, father's main occupation, and the type of area where the child's school is located. With the notable exception of race (not available in the PISA data), these are the same variables that were used for the measurement of inequality of economic opportunity.

However, the methodological parallel with chapter 4 is not perfect. An additional difficulty arises when performing these decompositions for education data. The test score variables that measure educational achievement are standardized, so that their mean and standard deviations have arbitrary values (the mean and standard deviation for the set of Organisation for Economic Co-operation and Development [OECD] countries were fixed at 500 and 100, respectively). This standardization implies both a translation of the mean and a rescaling of the dispersion. And no inequality measure is capable of deriving from a distribution so transformed, the inequality of the original distribution.[3] Nevertheless, a measure of inequality of opportunity in achievement, formulated as a share of total inequality, can be constructed and is unaffected by the standardization of test scores. This technique is used for the estimations in this chapter; the functioning and limitations of the technique are explained in more detail in Ferreira and Gignoux (2008).

Caveats

The same potential caveats discussed in chapter 4 apply to the measurement of inequality of educational opportunity. In particular, nonparametric estimates require large samples. Because the PISA samples are not so large, there is a trade-off in the definition of the circumstance categories. More categories would better capture the effects of various circumstances on achievement, but more categories would also imply that some "cells" (groupings of individuals with the same circumstances, or "types") are empty, or contain only a few observations. Cells with few members raise

a problem because the conditional mean outcomes for these types are imprecisely estimated. Partitioning the sample into many cells can therefore bias the estimate of the share of inequality of opportunity upward. The nonparametric measures are, therefore, complemented with the same parametric estimation procedure performed in chapter 4, but for E(2) rather than E(0).[4]

As in chapter 4, the existence of omitted, unobserved circumstance variables requires that the measures of inequality of opportunity be interpreted as lower-bound estimates of the true shares. If some previously unobserved circumstance were to somehow become observable, the share of unequal opportunity accounted for by circumstances might rise, but would never fall. Also as before, the parametric decompositions permit identifying the partial contribution of each individual circumstance variable to inequality of opportunity. Because the sample size is twice as large for reading as for mathematics (see below), the parametric decomposition yields lower estimates of inequality of opportunity than the nonparametric decomposition for achievement in mathematics, but the two sets of estimates are much closer for achievement in reading.

The Data

This study used a set of internationally comparable surveys of educational achievement from PISA, sponsored by the OECD. The data come from the unit-record PISA 2000 surveys, and were collected in five Latin American countries. These five surveys are a subset of the first wave of PISA surveys, which were conducted in 43 countries in all, including 29 OECD countries. The surveys were fielded at schools in Brazil and Mexico (and most other OECD countries) in 2000, and in Argentina, Chile, and Peru in 2001 (table 5.1).

The samples of examinees are representative of the populations of 15-year-olds attending school. The samples are not, therefore, representative of the total population of 15-year-olds in each country because dropouts are not covered. Moreover, children attending the lowest grades

Table 5.1 PISA Survey Dates, Coverage Rates, and Sample Sizes

Indicator	*Argentina*	*Brazil*	*Chile*	*Mexico*	*Peru*
Year of survey	2001	2000	2001	2000	2001
Coverage rate (percent)	77	69	82	45	50
Sample sizes					
Reading	3,983	4,893	4,889	4,600	4,429
Mathematics	2,230	2,717	2,721	2,567	2,460

Source: OECD *Programme for International Student Assessment* (*PISA*).

(below grade 7) were not surveyed in Argentina (excluding 4 percent), Brazil (16 percent), or Peru (10 percent). Coverage rates (expressed as ratios of the population represented by the survey to the total population of 15-year-olds) vary considerably across countries, as shown in table 5.1. Because of this selection issue, the international comparisons of inequalities in observed test scores should be interpreted with care—they are not assessments of the entire educational system, but only of the distribution of achievement conditional on having remained in the system.

In each country, all children in the sample took a test in reading. Additionally, about half of the sample took a test in mathematics, and the other half took a test in science (table 5.1). This chapter considers only reading and mathematics test scores. All surveys contain information on a common set of five circumstances: the gender of the child, mother's and father's education, father's occupation, and the location of the school. Parental education is measured by the highest level of education completed and is coded into three categories: (i) no education, primary education, or unknown level; (ii) lower secondary education or upper secondary; and (iii) college education. Father's occupations are aggregated into three categories: (i) legislators, senior officials and professionals, technicians and clerks; (ii) service workers, craft and related trades workers, plant and machine operators and assemblers; and (iii) skilled agricultural and fishery workers, elementary occupations,[5] or unknown occupation.

School location is not as predetermined (that is, economically exogenous) as place of birth. However, as any migration that takes place between birth and test-taking at age 15 likely reflects the decision of the parent rather than the child, it is reasonable to consider school location exogenous. School location is, therefore, used as a proxy for the person's inherited spatial endowment, and it is recoded using three categories: (i) villages or small towns (less than 15,000 inhabitants); (ii) towns (between 15,000 and 100,000 inhabitants); and (iii) cities (larger than 100,000 inhabitants).[6] School location information was not collected in Peru. As in chapter 4, when presenting the results, the chapter compares the country rankings with those in an alternative set of decompositions in which the school location variable is ignored for all countries.

The test score variables used to measure achievement are constructed from student answers to a series of test items, by means of an adjustment based on item response theory (IRT). Achievement (or cognitive skill) is treated as an unobserved or latent trait. IRT attempts to determine how much of this unobservable trait each examinee possesses. Because this trait cannot be measured directly, IRT seeks to infer it from a set of responses to test items. IRT methods consist of modeling the item responses as the outcome of two sets of independent parameters, one describing the items and the other the examinee's skills. The technical details are discussed in Ferreira and Gignoux (2008).

Inequality of Opportunity in Educational Achievement

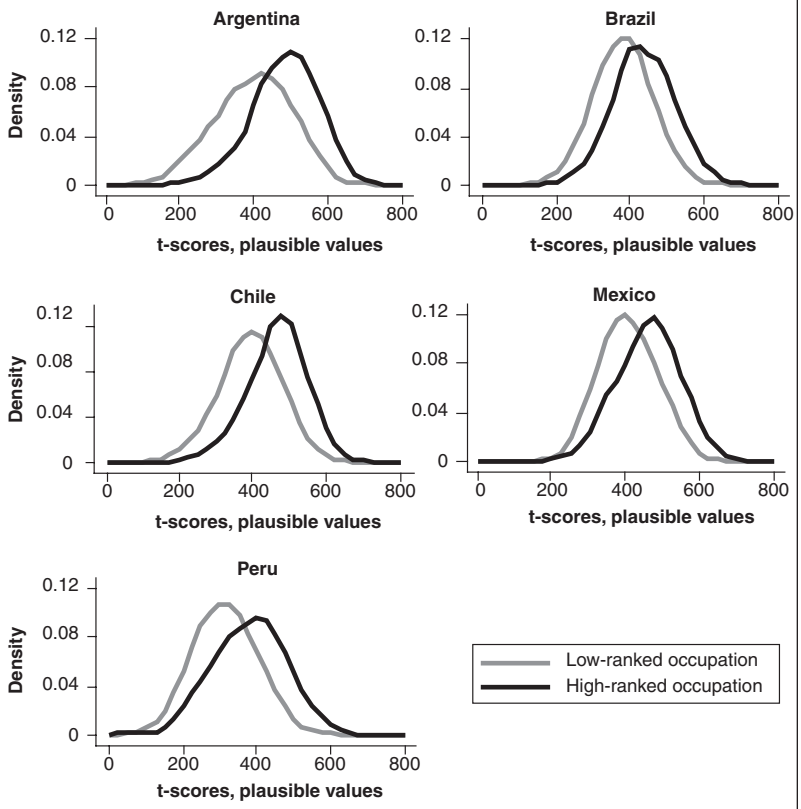
Inequality in both access to and attainment of education in Latin America, whether measured by years of schooling or completed levels of education, has been amply documented.[7] However, inequality in educational achievement, as measured by student performance on comparable tests, has traditionally received less attention, largely because of data scarcity.[8] Although standardized test score data pose challenges for the measurement of total inequality in education, because of the lack of a metric for achievement, they provide insight into the extent of inequality of opportunity in the acquisition of education.

The distributions of test scores for reading, conditional on father's occupation (figure 5.1) and school location (figure 5.2), are obtained using nonparametric kernel density estimates, and provide a disaggregated description of the link between these two circumstances and achievement. Groups of children from more privileged family backgrounds have significantly higher densities at high achievements (figure 5.1), and students in larger cities have significantly higher densities at high achievements (compared with students in rural areas and small towns) in Mexico and to a lesser extent in Chile (figure 5.2). This exploratory analysis suggests that differences in achievement associated with parental occupation are strong in all five countries, and that differences associated with school location, an imperfect proxy for place of residence, vary across countries and are more pronounced in Mexico.

Although informative, a comparison of conditional density functions does not provide a synthetic measure of inequality of opportunity in the acquisition of education. Figure 5.3, by contrast, decomposes total inequality in achievement in reading scores into the share accounted for by the five circumstance variables analyzed, and a second share accounted for by effort, skill, or luck. The first set of bars on the left side of figure 5.3 gives the nonparametric estimate of the share of inequality of educational opportunity within total inequality for Argentina (28 percent), Brazil (22 percent), Chile (24 percent), Mexico (27 percent), and Peru (23 percent). However, these estimates are not as precise as the estimates of the extent of inequality of economic opportunity: on the basis of bootstrapped standard errors, there are no significant differences in these shares across the five countries. When excluding the school location variable estimates for countries where this information is available (all but Peru), the results are Argentina (23 percent), Brazil (18 percent), Chile (22 percent), and Mexico (21 percent). The differences between these estimates are not statistically different either.

The second set of bars gives the parametric estimates, computed using the same set of five circumstance variables. These estimates are approximately 20–30 percent lower than the nonparametric estimates in most

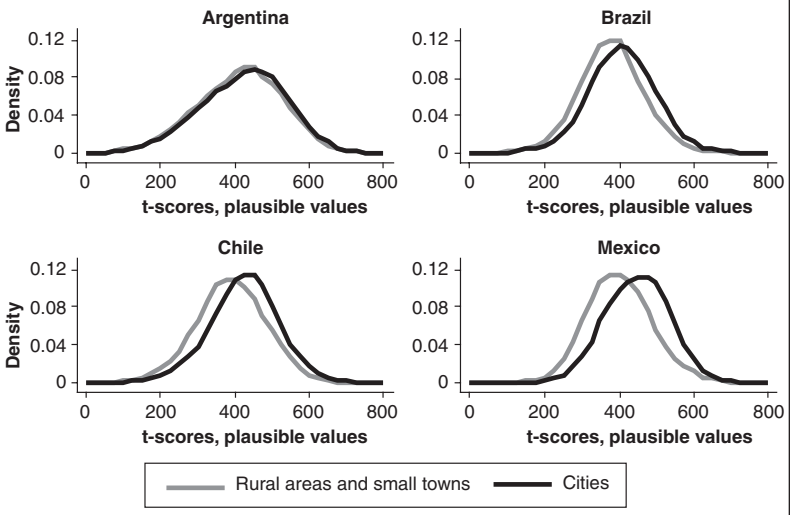
Figure 5.1 Distributions of Reading Test Scores Conditional on Father's Occupation



Source: PISA 2000 surveys; authors' computation of kernel density estimates.

cases. The difference can be the result either of problems with the functional form assumptions inherent in parametric estimation (which might reduce its ability to capture between-group inequalities), or of small-sample biases that increase spurious sampling variation in nonparametric decompositions. Thus, the parametric measures might be interpreted as reasonable "lower-bound" estimates of the plausible shares of inequality related to these five circumstances, while the nonparametric estimates might be seen as reasonable "upper-bound" estimates. In short, the data suggest that between 14 percent and 28 percent of inequality in reading achievement in a group of five Latin American countries can be accounted for by the set of five circumstances: gender, education level of mother and of father, father's occupation, and geographic location of school.

Figure 5.2 Distributions of Reading Test Scores Conditional on School Location

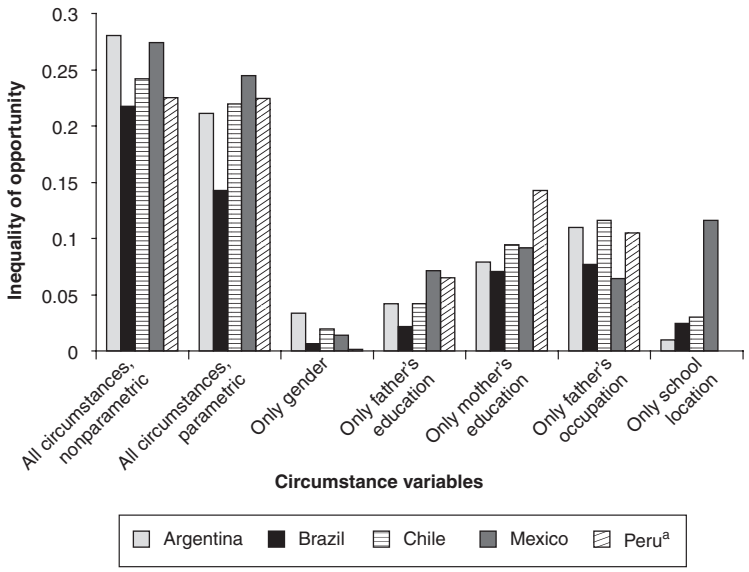


Source: PISA 2000 surveys; authors' computation of kernel density estimates.

Figure 5.4 provides the corresponding estimates for achievement in mathematics; the nonparametric estimates of the opportunity shares are Argentina (29 percent), Brazil (24 percent), Chile (23 percent), Mexico (27 percent), and Peru (17 percent). Once again, no cross-country differences are statistically significant, except for Peru, which is not fully comparable because of the lack of information on school location in this country. When excluding the school location variable, the estimates are Argentina (23 percent), Brazil (19 percent), Chile (19 percent), and Mexico (21 percent), with all differences insignificant. The differences with the parametric estimates are somewhat larger in this case, which is explained by the smaller samples available for achievement in mathematics. The results suggest that the range for the share of inequality in achievement accounted for by gender, family background, and spatial location is between 17 percent and 29 percent in these Latin American countries.

Figure 5.4 also gives the partial shares of inequality in achievement accounted for by each circumstance variable considered separately. These are estimated parametrically, and capture inequality of opportunity attributable to each individual variable while controlling for the others. The results are very similar for achievement in reading and mathematics. The main result is that family background variables, particularly father's occupation and mother's education, are the most important, and are associated with between 5 percent and 14 percent of total inequality in outcomes for educational achievement.

Figure 5.3 Overall Inequality of Opportunity in Reading Achievement: Share of Inequality of Opportunity and Partial Shares for Each Circumstance Variable



Source: PISA 2000 surveys and authors' calculations.

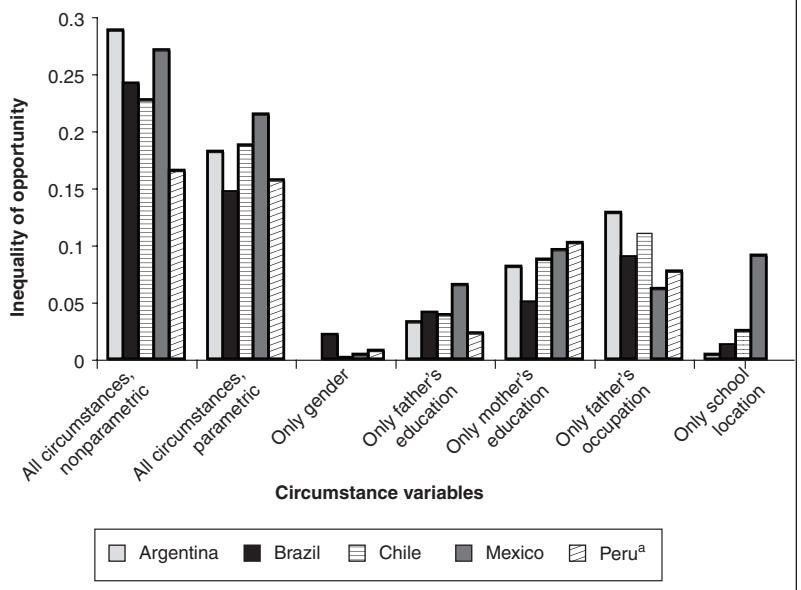
a. The information on school location is not available for Peru.

The ranking of these variables differs across the five countries. Mother's education explains a significantly higher share of inequality in Chile, Mexico, and Peru than in the other two countries, while father's occupation explains a significantly higher share in Argentina and Chile than in Mexico. The shares of inequality accounted for by gender and school location are generally less important, accounting for less than 3 percent of total inequality. An important exception is Mexico, where school location accounts for a larger share of inequality of opportunity than in any other country, accounting for as much as 12 percent of inequality in reading and 9 percent in mathematics.

Comparing Inequality of Opportunity in Latin American and OECD Countries

While the numbers presented in the previous section are themselves interesting and policy relevant, comparisons with other countries could shed further light on inequality of educational opportunity in LAC. Are the

Figure 5.4 Overall Inequality of Opportunity in Mathematics Achievement: Share of Inequality of Opportunity and Partial Shares for Each Circumstance Variable



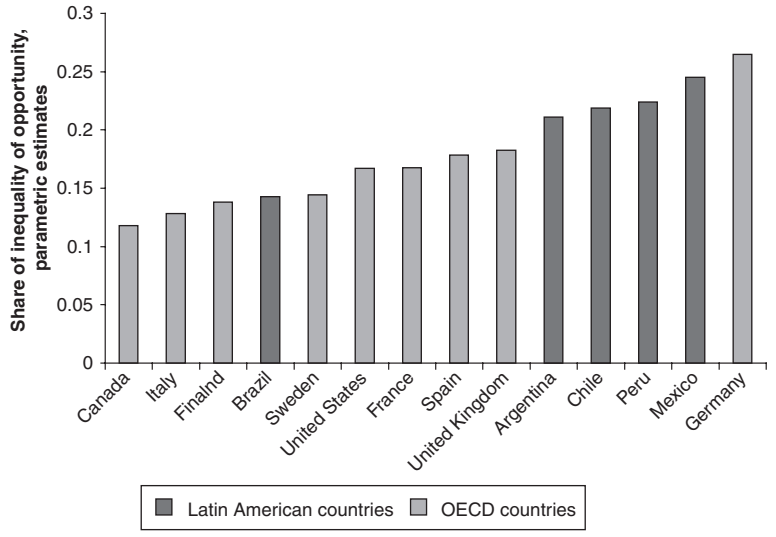
Source: PISA 2000 surveys and authors' calculations.

a. The information on school location is not available for Peru.

effects of family background variables, gender, and geography larger in Latin America than in Europe or North America? Very little evidence is available to answer this question, in large part because the specifics of each country's educational system make cross-country comparisons difficult.[9] The internationally comparable PISA surveys, which took place in five Latin American nations and 38 other countries, including the United States, Canada, and most of Europe, offer unique conditions for such an international comparison. All these surveys applied the same methodology, and the same information on family background and location was collected in all participating countries.

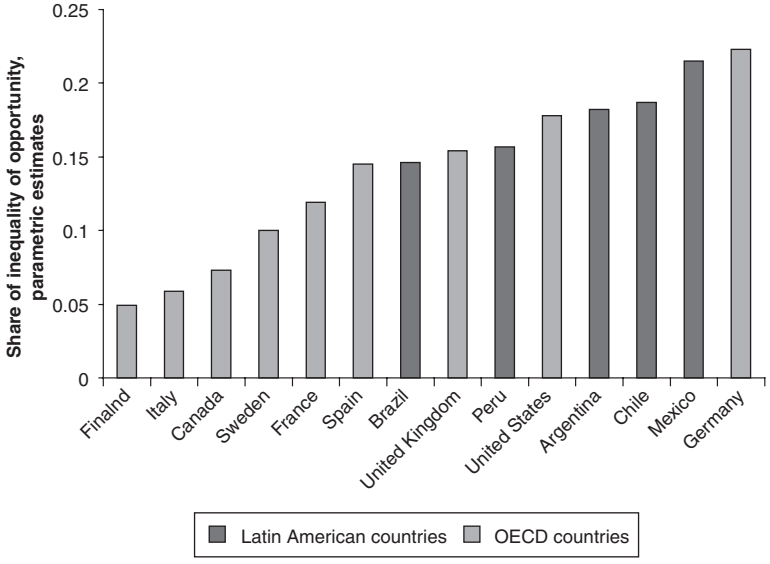
These data were used to estimate the level of inequality of opportunity for education for a set of nine European and North American countries—Canada, Finland, France, Germany, Italy, Spain, Sweden, the United Kingdom, and the United States—for the purpose of comparison with Latin America.[10] Using a parametric decomposition, the share of inequality in achievement in reading accounted for by circumstance is estimated to range from 12 percent in Canada to 27 percent in Germany (figure 5.5),

Figure 5.5 Inequality of Opportunity in Reading Achievement, LAC and OECD Countries



Source: PISA 2000 surveys and authors' calculations.

Figure 5.6 Inequality of Opportunity in Mathematics Achievement, LAC and OECD Countries

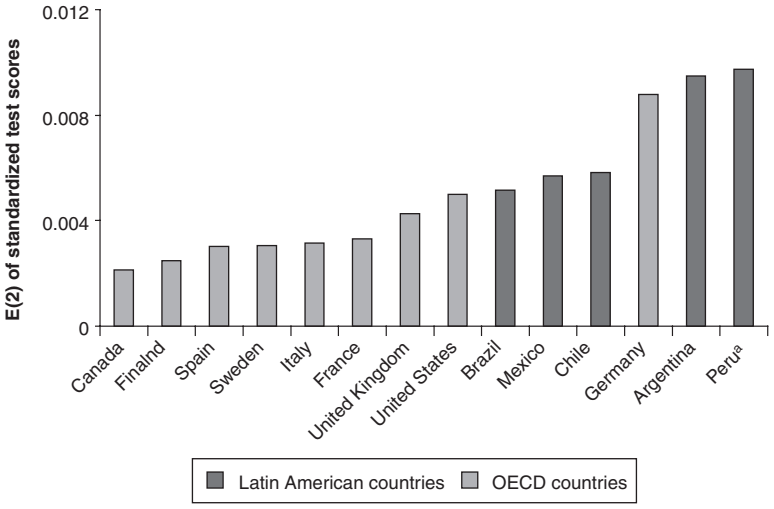


Source: PISA 2000 surveys and authors' calculations.

and in mathematics from 5 percent in Finland to 22 percent in Germany (figure 5.6). As can be seen in the figures, the estimates for Latin American countries are higher than average, but well within the OECD range. They are smaller in Canada, Scandinavian countries (Finland and Sweden), and Italy; intermediate in France, Spain, the United Kingdom, and the United States; and higher in Germany. For more complete results, see Ferreira and Gignoux (2008).

Compared with industrial countries, the median Latin American country seems to be more opportunity unequal, with about 20 percent of total inequality accounted for by circumstances. In the typical industrial country, that number is 15 percent. In Germany and the United States, relative levels of inequality of opportunity are comparable with (or above) those observed in Latin America. However, in absolute terms, Peru and Argentina have the highest estimated levels of inequality of opportunity, and the five Latin American countries have higher levels of inequality of educational opportunity than all OECD countries, with the exception of Germany (figures 5.7 and 5.8).[11] In Europe and North America, parental occupation and education account for almost all the inequality of opportunity, whereas gender and geography appear to have almost no effect; see tables in Ferreira and Gignoux (2008).

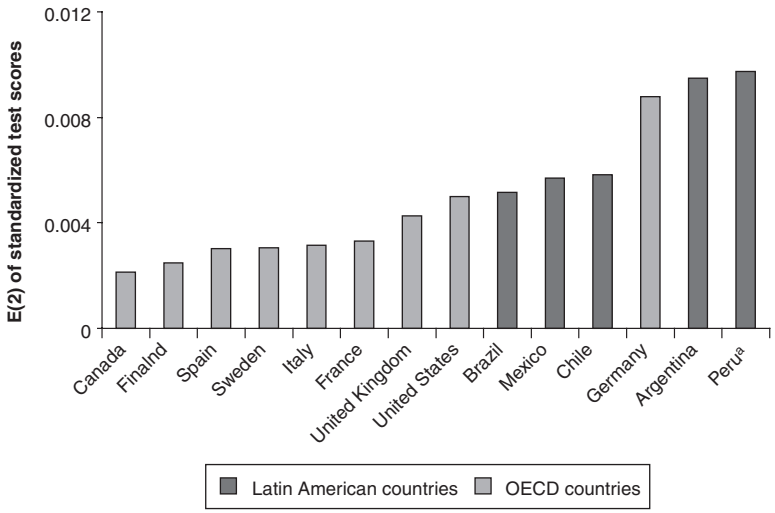
Figure 5.7 Comparison of Inequality of Opportunity in Reading Achievement in LAC and OECD Countries



Source: PISA 2000 surveys and authors' calculations.

Note: Because of normalization, the absolute values are meaningless.
a. The information on school location is not available for Peru.

Figure 5.8 Comparison of Inequality of Opportunity in Mathematics Achievement in LAC and OECD Countries



Source: PISA 2000 surveys and authors' calculations.

Note: Because of normalization, the absolute values are meaningless.
a. The information on school location is not available for Peru.

An Opportunity Profile for Education

Much as was done for economic inequality in chapter 4, this section identifies the most-disadvantaged and most-advantaged groups for educational achievement opportunity by combinations of circumstances, and also quantifies the extent of the disadvantage faced by the most-disadvantaged groups. Again, the methodology starts by identifying the circumstance groups with the least opportunities, and continues adding groups until the most-disadvantaged 10 percent of the population is identified. The number of disadvantaged groups varies across countries, from only 4 in Peru to 26 in Brazil and Chile, with some representing thousands of individuals and others only a few hundred (table 5.2).[12] For instance, in Peru, the group of boys whose mothers and fathers are both uneducated, and whose fathers are in an agricultural or elementary occupation, is the circumstance group with the lowest mean achievement in reading, with a mean test score of 251 (to be compared with a national mean of 327), and that accounts for 6.6 percent of the population of 15-year-olds.

Males are typically large majorities in the disadvantaged groups for reading achievement. In Mexico, 96 percent of individuals in the lower-

Table 5.2 Characteristics of the Educationally Most-Disadvantaged Groups, Reading
(percentage of individuals in most-disadvantaged groups with characteristic)

Characteristic	*Argentina*	*Brazil*	*Chile*	*Mexico*	*Peru*
Female	15	10	32	4	33
Father without education	62	66	61	86	93
Father's education primary	21	24	31	6	4
Father's education secondary	17	10	7	8	3
Mother without education	75	80	76	87	96
Mother's education primary	11	14	20	9	3
Mother's education secondary	14	6	5	4	1
Father legislator, senior official, professional, technician, or service worker	7	5	4	23	1
Father worker, plant or machine operator, assembler, or with elementary occupation	16	21	35	6	4
Father skilled agricultural or fishery worker, or not reported occupation	77	74	60	71	95
School located in a village or small town (fewer than 15,000 inhabitants)	42	28	61	94	—
School located in a town (fewer than 100,000 inhabitants)	23	39	32	3	—
School located in a city (more than 100,000 inhabitants)	35	32	6	3	—
Group mean achievement	327.8	334.6	336.3	353.6	257.1
Country mean achievement	418.3	396.0	409.5	422.0	327.2
Share of group to country mean achievement (percent)	78	84	82	84	79

Source: Authors' compilation using data from the PISA 2000 and 2001 surveys.

Note: — = Not available.

The unit of measure of achievement is arbitrarily defined such that the distribution of achievement of the overall population of the OECD countries has a mean of 500 and a standard deviation of 100.

achieving groups are males, followed by 90 percent in Brazil, 85 percent in Argentina, 68 percent in Chile, and 67 percent in Peru. This result is inverted with achievement in mathematics, where females form the majority of the disadvantaged groups in all countries.

Family background is also strongly associated with membership in a disadvantaged group. In the five countries, between 61 percent and 93 percent of 15-year-olds in low-achieving groups have a father who did not go to school, and between 75 percent and 96 percent have a mother who did not go to school. These shares are highest in Mexico and Peru. In four out of five countries (Argentina being the exception), fewer than 10 percent of individuals in the most-disadvantaged groups have parents with a secondary education or higher. Parental occupation is almost as strongly associated with educational opportunity, with 95 percent of 15-year-olds in low-performing groups in Peru being the children of agricultural workers, 77 percent in Argentina, 74 percent in Brazil, 71 percent in Mexico, and 60 percent in Chile. Mexico is the only country where the children of professionals, officials, technicians, and service workers have a substantial (23 percent) risk of facing a disadvantage.

Geographic patterns of disadvantage are more heterogeneous across countries. Spatial inequalities are strong in Mexico, where 94 percent of 15-year-olds studying in villages or small towns are in the most-disadvantaged groups, and 61 percent are in such groups in Chile. In Argentina and Brazil, however, students in villages and small towns account for 42 percent and 28 percent, respectively, of the profile. The information on school location is not available for Peru.

For the most-advantaged groups, females are the majority of 15-year-olds in high-achieving circumstance groups for reading, particularly in Argentina and Chile (table 5.3). In these two countries, females are also the majority of the high-achieving groups in mathematics, although to a lesser extent. There is, therefore, an asymmetry in the gender composition between the top and bottom types: while boys do worse in reading but better in mathematics among the disadvantaged types, girls dominate the advantaged types in both reading and mathematics.

Looking at family background, few people with uneducated fathers—only 11 percent in Brazil, 8 percent in Argentina, 2 percent in Chile, 1 percent in Mexico, and none in Peru—belong to the most-advantaged types. Similarly, there are few children of agricultural workers in the high-opportunity groups: 16 percent in Argentina, 4 percent in Brazil and Mexico, 2 percent in Chile, and none in Peru.

In Mexico and Chile, the most advantaged are as geographically concentrated as the most disadvantaged, with 84 percent and 80 percent of them, respectively, going to school in a metropolis. They are less concen-

Table 5.3 Characteristics of the Educationally Most-Advantaged Groups, Reading
(percentage of individuals in most-advantaged groups with characteristic)

Characteristic	*Argentina*	*Brazil*	*Chile*	*Mexico*	*Peru*
Female	95	51	84	53	61
Father without education	8	11	2	1	0
Father's education primary	22	21	28	14	7
Father's education secondary	70	69	70	86	92
Mother without education	11	4	1	1	0
Mother's education primary	42	35	38	43	17
Mother's education secondary	47	61	61	56	83
Father legislator, senior official, professional, technician, or service worker	77	86	85	94	99
Father worker, plant or machine operator, assembler, or with elementary occupation	7	9	12	2	0
Father skilled agricultural or fishery worker, or not reported occupation	16	4	2	4	0
School located in a village or small town (fewer than 15,000 inhabitants)	21	4	16	1	—
School located in a town (fewer than 100,000 inhabitants)	40	28	4	16	—
School located in a city (more than 100,000 inhabitants)	40	69	80	84	—
Group mean achievement	514.3	470.7	489.0	501.5	411.5
Group share of country mean achievement (percent)	123	119	119	119	126

Source: Authors' compilation using data from the PISA 2000 and 2001 surveys.

Note: — = Not available.

The unit of measure of achievement is arbitrarily defined such that the distribution of achievement of the overall population of the OECD countries has a mean of 500 and a standard deviation of 100.

trated in Brazil, where this share is 69 percent, and in Argentina where it is 40 percent. Argentina and Chile are the only two countries where significant shares (21 percent and 16 percent, respectively) of educationally advantaged 15-year-olds go to school in a village or small town.

The mean achievement in reading and math of the most-disadvantaged and most-advantaged group, compared with the country's overall mean achievement, gives an idea of how far ahead and behind these groups are from society as a whole. The mean achievement in reading of the 10 percent of individuals in the most-disadvantaged groups compared with the overall mean is 78 percent in Argentina, 79 percent in Peru, 82 percent in Chile, and 84 percent in Brazil and Mexico.[13] However, the mean achievement in reading of the 10 percent of individuals in the most-advantaged groups is 126 percent of the overall mean achievement in Peru, 123 percent in Argentina, and 119 percent in Chile, Mexico, and Brazil. As noted previously, however, the standardization of scores underlying these proportions means that they allow for rank comparisons across countries, but have no relevant absolute interpretation.

Summary

This chapter presented the results of a comparative assessment of inequality of opportunity in educational achievement in five Latin American countries, as well as in nine countries of North America and Europe. The analysis followed the same approach that chapter 4 applied to economic inequality: total inequality in educational achievement was decomposed into a component resulting from a set of predetermined circumstances and a second component encompassing individual effort and luck. The predetermined circumstances were almost exactly the same across countries: gender, mother's and father's education, father's occupation, and school location. Information on race or ethnicity was not available for any country.

Inequality of opportunity was estimated to account for between 14 percent and 28 percent of overall inequality in reading achievement in Latin America, and for between 15 percent and 29 percent in mathematics achievement, as a lower-bound estimate. The estimates varied somewhat across countries, but were not precise enough to provide a statistically significant ranking of countries by inequality of educational opportunity. The estimates also varied according to the method of decomposition used: parametric methods yielded lower estimates than did the nonparametric approach.

As in the case of economic outcomes, the circumstances that had the largest impact on opportunity shares were family background variables, notably mother's education and father's occupation. Nevertheless, school

location was particularly important in Mexico, revealing large geographic inequalities in educational achievement in that country. The impact of gender on opportunity shares was found to be limited, but when looking at the composition of types at the extremes of the distribution (those with the lowest and highest mean scores), the gender profile was quite important. Girls dominate among the most advantaged in both subjects, as well as among the most-disadvantaged for mathematics. Boys are a majority of those in the most-disadvantaged groups for reading.

When compared with OECD countries, the median Latin American country seems to be more opportunity unequal with regard to educational achievement, with about 20 percent of total inequality accounted for by circumstances, while in the typical industrial country, 15 percent of inequality is associated with the same circumstances. Because total outcome inequality was also higher in Latin America, this pattern is even more pronounced in levels, with Argentina and Peru recording the highest gross amounts of inequality of educational opportunity.

Educational opportunity profiles of the circumstance types with the least and most advantage in educational opportunity reveal that for all countries, the most-disadvantaged groups tended to include a disproportionate share of children of agricultural workers and parents with little or no schooling. In Chile and Mexico, most disadvantaged individuals are studying in rural areas, whereas in Argentina and Brazil, a significant proportion are found in urban areas.

Notes

1. This chapter is based on Ferreira and Gignoux (2008). The reader is referred to that work for technical details.

2. See the *World Development Report 2006* (World Bank 2006) for a synthesis of the arguments.

3. This impossibility result was formally established by Zheng (1994).

4. E(0) and E(2) are two members of the generalized entropy class of inequality indexes. This class encompasses all inequality indexes satisfying a set of five properties. Among these properties are the Pigou-Dalton transfer principle, which requires that a transfer from a "poorer" to a "richer" person should not imply a decrease in inequality, while a transfer from a "richer" to a "poorer" person should not imply an increase in inequality. This class is preferred to other indexes, such as the Gini, because it also satisfies a decomposability property that requires that the measure should be additionally decomposable into between-group and within-group inequality. The different members of the class are obtained for different values of a parameter of sensitivity to income changes in different parts of the distribution. E(2) is sensitive to changes in the upper tail, while E(0) does not put more weight on changes in the upper or lower tails.

5. "Elementary occupations" is an ISCO88 category that encompasses occupations such as street vendors, domestic helpers, building caretakers, porters, garbage collectors, agricultural and fishery laborers, mining and construction laborers, manufacturing laborers, and transport laborers.

6. PISA also collected information on the mother's occupation. This variable was used in preliminary calculations, and results were unchanged, so they were omitted from this analysis.

7. See, for example, De Ferranti et al. (2004) and the references therein.

8. Exceptions include Mizala and Romaguera (2000) and Chay, McEwan, and Urquiola (2005) on Chile, and Albernaz, Ferreira, and Franco (2002) on Brazil.

9. Possible exceptions are comparative studies of intergenerational mobility in education; see, for example, Gaviria (2007).

10. Although Mexico is an OECD member, it is grouped here with the other Latin American countries, and the nine industrial countries are listed as "the OECD." There is some heterogeneity in sample sizes across the OECD: whereas the Canadian sample, with 29,687 participating children, is much larger than that in the other countries, the American one, with 3,846 participating children, is comparable to the Latin American ones, with about 4,000 participating children, but small in proportion to the population of the country. Results for the United States should thus be treated with caution. Rates of coverage by the surveys of the population of 15-year-olds attending school are higher than 80 percent in all OECD countries.

11. Because the scores are standardized with respect to a single mean and variance across all countries, these levels can be compared in relative terms. Nevertheless, the standardization does imply a simultaneous scale transformation and translation of the distribution, thereby making absolute values difficult to interpret.

12. The educational opportunity–deprivation profile is presented in full in Ferreira and Gignoux (Forthcoming). Peru is not fully comparable, because the definition of circumstance groups is more parsimonious in this country.

13. The overall mean for the country populations vary considerably—327 in Peru, 396 in Brazil, 409 in Chile, 418 in Argentina, and 422 in Mexico—in the PISA scale where achievement measured in all OECD countries has a mean of 500 and a standard deviation of 100.

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