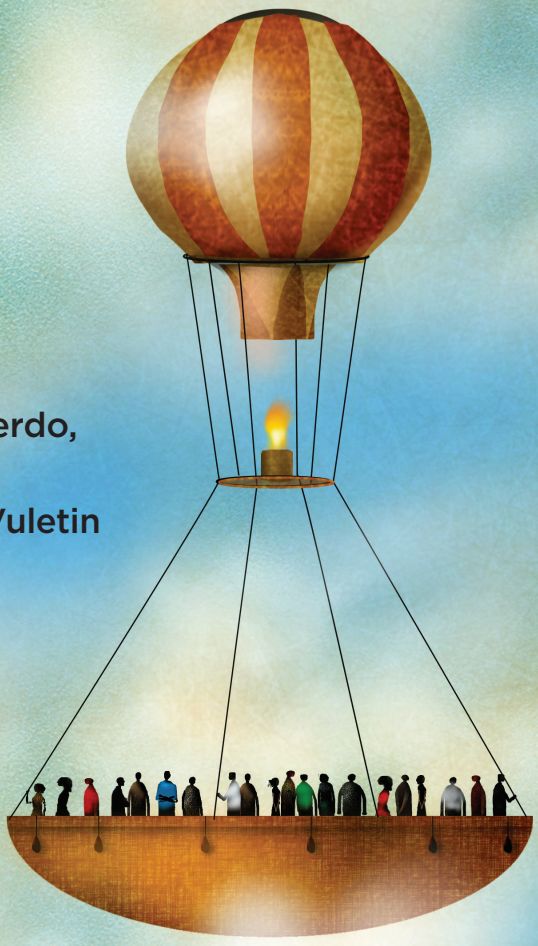
DEVELOPMENT IN THE AMERICAS

Better Spending for Better Lives

How Latin America and the Caribbean Can *Do More with Less*

Chapter 6



Edited by
Alejandro Izquierdo,
Carola Pessino,
and Guillermo Vuletin

IDB

Better Spending for Better Lives

How Latin America and the Caribbean Can *Do More with Less*

This chapter is part of an upcoming IDB flagship publication on public spending. Sign up to be among the first to receive a free copy of the book: *www.iadb.org/DIA2018spending*

6 Making Spending Count in Education

Spending on primary and secondary education has increased significantly in Latin America and the Caribbean in recent decades. Since 2000, public expenditure per student has increased in real terms by almost 80 percent at the primary level, and almost 45 percent at the secondary level, surpassing $2,000 per student at both levels.[1] These growth rates are more than double those in primary school spending and quadruple those in secondary school spending over the same period in OECD countries. This increase in spending has occurred in a favorable macroeconomic environment highlighted by higher per capita income, lower poverty rates, and declining socioeconomic inequality—all in the context of a heightened focus on education (see Table 6.1). Between 1995 and 2013, investment in education grew from 3.6 percent to 5.3 percent of GDP in Latin America and the Caribbean.

Happily, the investments have paid off in better service delivery. The student-teacher ratio decreased from 24.4 to 17.3 between 2000 and 2014, implying increasingly smaller class sizes.[2] School infrastructure is also improving. One common proxy for investment in school facilities is the availability of computers per student; according to data from the PISA study,[3] in Latin America and the Caribbean the ratio of computers to students grew 20 times between 2000 and 2015.[4] Still, according to a recent

---

1 Expenditure increase rates were computed using constant PPP dollars and data collected by UNESCO.

2 In some countries like Uruguay, El Salvador, and Jamaica, the smaller class sizes may also be due to changing demographics, since the population between 5 and 14 years old has declined since 2000. In these countries the teaching force might not be adjusting to demographic changes, which would result in smaller class sizes.

3 The Programme for International Student Assessment (PISA) is a triennial study in place since 2000, which tests 15-year-old students from different countries in science, reading, and mathematics.

4 This computation is based on the Latin American and Caribbean countries participating in both the 2000 and 2015 studies: Argentina, Brazil, Chile, Mexico, Peru.

Table 6.1 Education Indicators: Latin America and the Caribbean and OECD

	Latin America and the Caribbean			OECD		
Indicator	1999–2001	2013–2015	Var % or Var p.p.	1999–2001	2013–2015	Var % or Var p.p.
Expenditure						
Primary	$1,202	$2,191	82.2%	$5,986	$8,215	37.2%
Secondary	$1,480	$2,137	44.4%	$7,623	$8,251	8.2%
Context						
Population between 5 and 14 years old	256,000,000	281,000,000	9.8%	470,000,000	502,000,000	6.8%
GDP per capita	$11,036	$11,748	6.5%	$32,627	$39,097	19.8%
Tax revenue	18.9	17.5	–1.4	20.2	19.9	–0.3
GINI index	53.4	47.6	–5.8	32.5	31.7	–0.8
Inputs						
Student-teacher ratio	24.4	17.3	–29.2%	16.3	13.7	–16.0%
Number of computers per students in modal grade	3.0	58.0	55.0	8.6	94.2	85.6
Outputs						
Cumulative drop-out to the last year of primary education	22.0	12.3	–9.8	2.3	2.3	0.0
Adolescent out of school (% lower secondary school age)	15.2	9.6	–5.6	3.9	1.5	–2.4
Repeaters	6.6	4.4	–2.2	1.3	1.5	0.2
PISA math	356.4	391.6	9.9%	498.2	491.9	–1.3%
PISA reading	394.2	416.8	5.7%	497.8	494.0	–0.7%
PISA science	387.3	407.9	5.3%	497.1	495.1	–0.4%

Source: Authors' calculation based on the following: UNESCO Institute for Statistics: (http://data.uis.unesco.org) for expenditure indicators; World Bank for context and outputs indicators excluding PISA scores; and PISA 2000–2015 for inputs and PISA scores.
Note: Var % corresponds to percent variation (percentage variation between 1999–2001 and 2013–2015 averages) while Var p.p. stands for variation in percentage points (subtraction of the two percentages). The symbol % next to the number shows the percent variation; when this symbol is absent the variation is in percentage points.

study based on TERCE[5] data, educational infrastructure remains insufficient and unequal in spite of improvements over the last decade (Duarte, Jaureguiberry, and Racimo, 2017).

[5] The Third Regional Comparative and Explanatory Study (TERCE), is a study of math, reading, writing, and science learning in third and sixth grades of primary school. The testing was conducted in 2013 in 15 Latin American and Caribbean countries: Argentina, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay.

The performance of school systems in the region is also improving. Data from the Economic Commission for Latin America and the Caribbean (ECLAC) show that the percentage of adolescents aged 15–19 who finished primary school increased from 86.9 percent to 92.4 percent between 2000 and 2015. Additionally, the PISA study shows that student learning has improved in the region. Overall, between 2000 and 2015 math, reading, and science scores for the region increased almost 10 percent, 6 percent, and 5 percent, respectively. Specifically, the PISA study shows that learning is improving in Brazil, Chile, Colombia, Mexico, and Peru.[6]

These data suggest that the increase in expenditures may have been effective in improving school services and educational outcomes. However, while spending per student is growing at a comparatively higher rate in the region, Latin American and Caribbean governments, on average, still only allocate a quarter of the amount OECD countries spend per student and have much lower educational outcomes. More concretely, in the PISA 2015, while close to 15 percent of 15-year-old students from the OECD achieved advanced learning in science, math, or reading, less than 1.5 percent of Latin American and Caribbean students performed at this level. For Latin American and Caribbean countries to reach the performance levels of the most developed countries, investment in education needs to continue to rise. While the level of financial resources is important, and some have suggested a minimum per-pupil spending threshold for a country to be able to deliver a minimum quality of service,[7] the growing consensus among scholars is that, beyond a minimum spending threshold, how resources are spent is much more important than how much is spent. Spending more money is not necessarily important, or even feasible. Making that spending count is the key.

School Efficiency and Equity

Before increasing investment in education, it is crucial to know how efficiently resources are being used in order to justify future investments (Psacharopoulos, 1996). On the one hand, this means investing money in public education where it will benefit society the most (allocative efficiency). On the other hand, it also means ensuring that each country's

[6] Similarly, the TERCE study shows that between 2006 and 2013, most of the participating countries improved their learning outcomes. For example, math learning for 3rd grade improved in all countries but Paraguay. That is, Chile, Costa Rica, Uruguay, Mexico, Brazil, Argentina, Peru, Ecuador, Colombia, Guatemala, Panama, Nicaragua, and the Dominican Republic improved their math scores.

[7] For example, Vegas and Coffin (2015) estimate that this threshold is US PPP $8,000 per student annually.

educational system makes the best possible use of available resources (technical efficiency) (Bessent and Bessent, 1980).

No less important than the efficiency of spending, however, is the equity of its distribution. Since the Universal Declaration of Human Rights in 1948, education has been recognized as a human right to be enjoyed on the basis of equality of opportunity (UNICEF/UNESCO, 2007). In line with this, the school finance literature suggests that fairness in resource allocation implies the absence of a relation between the school community's wealth and a school's funding, equitable treatment of students with similar backgrounds, compensatory programs to account for social disparities, and equality of educational opportunity (BenDavid-Hadar, 2016).

Educational Efficiency: Two Sides of the Same Coin

How does the efficiency of school systems in Latin American countries compare with countries in other regions? What are the challenges in the way educational resources are invested? These questions can be addressed in terms of the two most studied types of efficiency: allocative efficiency and technical efficiency (Haelermans and Ruggiero, 2013). While both types of efficiency will be discussed, due to data constraints[8] the focus of the analysis is on technical efficiency.

Resource Allocation: Investing Wisely

In the context of school finance, allocative efficiency is reached when educational funds are distributed in the most socially efficient way across educational levels. Although there is no research consensus on how educational resources should be ranked, prioritizing public education funding for preschool (0 to 5 years old) appears to have the highest social returns (Heckman, 2012). Early experiences often have persistent and significant effects on a wide array of important adult outcomes (Berlinski and Schady, 2015). Moreover, investments made in the early years of child development

[8] The best way of analyzing whether educational resources are allocated efficiently is estimating and comparing the *social returns* associated with investments at different educational levels. There are no comparable data between countries to perform this type of analysis including pre-primary, primary, secondary, and tertiary education. Montenegro and Patrinos (2014) estimate *private returns* to education using comparable data from 139 economies with a total of 819 harmonized household surveys. Unfortunately, this unique and intensive data work excludes the pre-primary level and does not consider social benefits.

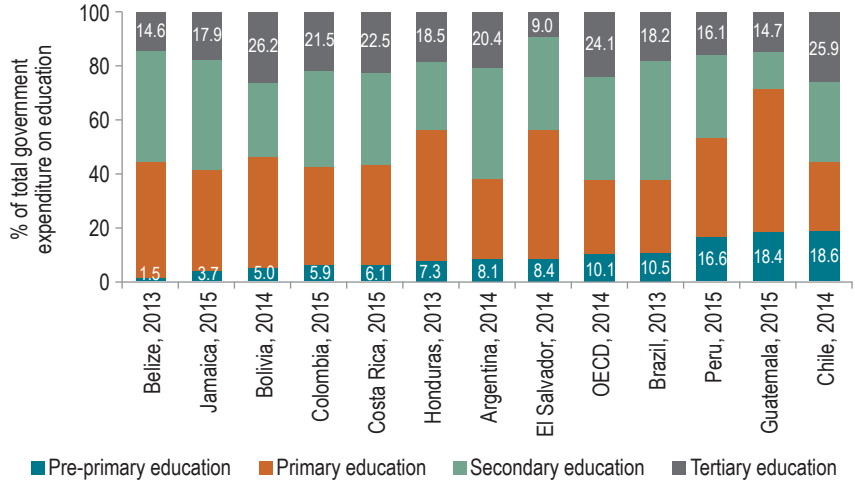
might increase the return on investments made later in life (Cunha and Heckman, 2007).

Despite this evidence, the debate persists over expenditure allocation at different educational levels. For example, a study by Mingat and Tan (1996) suggests that the focus of educational investments should depend on the country's income level. Specifically, low-income countries benefit the most from investments to expand primary education, while in middle-income countries, investments to expand secondary education show the highest social returns. In high-income countries, investing to expand higher education coverage yields the greatest returns.

The two perspectives presented above imply different policy approaches. On the one hand, focusing educational investments on the early years can be cost-effective since it can save on future investments by increasing individuals' readiness to learn new abilities as adolescents or adults, and enhancing work productivity in the economy. On the other hand, from a macro perspective, poorer countries might need to begin investing in the improvement of basic conditions in their school system before boosting investments in preschool or post-secondary education. Both perspectives complement each other and help explain the different combinations countries use to allocate their educational resources.

Figure 6.1 shows UNESCO data on the allocation of government expenditure on education by level in Latin American and Caribbean countries

Figure 6.1 Composition of Government Expenditure on Education by Education Level



Source: Authors' calculation based on the UNESCO Institute for Statistics: (http://data.uis.unesco.org).

and in OECD countries as a benchmark. The data suggest that most Latin American and Caribbean countries are not focusing their investments on preschool. Only three of the 12 countries for which data were available allocate a significantly higher share of their educational funds to pre-primary education than the OECD average (Chile, Guatemala, and Peru). Additionally, higher-income countries tend to invest more in tertiary education, with four of the five highest-income countries (Chile, Argentina, Costa Rica, Brazil, and Colombia) investing more than 20 percent of their education funds at this level. The exception is Brazil, which spends 18 percent on higher education, 6 percentage points less than the OECD average. Similarly, four of the five lowest-income countries (Honduras, Bolivia, Guatemala, Belize, and Jamaica) invest less than 20 percent of their education funds in post-secondary education. In this case, the exception is Bolivia, which spends 26 percent on tertiary education.

Technical Efficiency: Same Investment, Better Results

Technical efficiency examines the efficient use of resources once they have been allocated (De Witte and López-Torres, 2017). Given availability of data, this analysis of technical efficiency focuses on the school level using the 2015 PISA dataset. The 2015 PISA study assessed the learning of approximately 540,000 students, representing almost 29 million 15-year-olds enrolled in schools in the 72 participating countries. The focus of the PISA 2015 assessment was on science, with reading, mathematics, and collaborative problem-solving as the secondary domains. School principals also completed a questionnaire providing information on the school system, the learning environment, and the availability of resources at the school level (OECD, 2016b). The original PISA dataset is constructed at the student level, but the data were aggregated to perform the analysis at the school level using only information from schools that receive public funds.[9]

Technical efficiency can be measured by assuming that schools transform inputs into outputs through a production process (Worthington, 2001; Rice and Schwartz, 2015). Measuring the average school efficiency of each educational system that participated in PISA 2015 begins by examining the concept of productivity in education (e.g., Hanushek, 1979). In manufacturing, "average productivity" is typically defined and measured as the

[9] Schools that did not receive public funds were deleted from the database. Included are all public and private schools for which public fund contributions represent more than 0 percent of total funding, according to school principals.

amount of output produced per unit of input.[10] This seemingly straightforward concept is much more complex when applied to education (Rice and Schwartz, 2015). There is no general agreement on the fundamental goals of public education. While standardized tests that measure learning in math, language, and science are the most common metric for assessing efficiency in education, many scholars and policymakers question whether other outputs such as civic responsibility, cultural awareness, and social and economic mobility should also be considered (Brighouse et al., 2018).

A debate persists over what inputs generate the desired outputs in education. The education production function usually focuses on the inputs that produce learning. There is relative agreement that adequate infrastructure, class size, teacher salaries, and teacher qualifications are key determinants of school spending. However, less consensus exists on the optimal level of investment in each schooling input or under what circumstances a particular input is most effective in producing student learning (Rice and Schwartz, 2015). Also, learning measured by scores on standardized tests reflects not only the potential impact of schooling inputs but also the influence of students' families and communities.

Thus, the literature has divided inputs into two categories: i) discretionary and ii) non-discretionary. Discretionary inputs are factors under the control of the education system, and can be defined as physical inputs, such as teacher training, class size, infrastructure quality, and other resources in the school. They can also be expressed in terms of expenditure. However, a shortcoming of this definition is that disparities in expenditure across countries may reflect differences in the labor market that are unrelated to availability of resources, such as teacher bargaining power. Non-discretionary inputs are composed of environmental inputs that are not under the direct control of the education system. The most important environmental factors are family socioeconomic status and student innate ability (Sutherland, Price, and Gonand, 2009).

The choice of outputs and inputs is based on the work of De Witte and López-Torres (2017). The PISA science score serves as the output since it is the focus of the 2015 assessment. In relation to inputs, physical inputs are used instead of expenditure per student. Efficiency results using expenditure per student as an input would be difficult to interpret because they would reflect both potential inefficiencies and differentials in cost provision between countries (Afonso and St. Aubyn, 2006). Six of the seven cross-country studies reviewed used the following physical inputs: teacher/student

[10] This analysis uses a non-parametric method known as order-m Data Envelope Analysis. For further details, see Cazals, Florens, and Simar (2002) and Tauchmann (2012).

ratio, computer availability, and students' socioeconomic status.[11,12,13] The teacher/student ratio can be thought of as a proxy for the quantity of human resources (teachers); the number of computers per student (in one representative class in each school) is used as an indirect measure of school facilities; and socioeconomic status is a control for student background.[14]

Outputs and inputs at the school level were used to identify inefficient schools (below the threshold), efficient schools (on the threshold), and super-efficient schools (above the threshold). The method described above assigns an efficiency score to each school. When this score is less than 1, it means that the school could organize and use its inputs in a more efficient way. If the score is equal to 1, it means that the school is on the threshold, and if the score is above 1, then the school is *super-efficient,* given its inputs.

The average efficiency score by country is reported in Figure 6.2, along with the schools located in percentiles 10 and 90 in each system. Seven of

---

11 The index was created by the PISA study based on the following variables: the International Socio-Economic Index of Occupational Status (ISEI); the highest level of education of the student's parents, converted into years of schooling; the PISA index of family wealth; the PISA index of home educational resources; and the PISA index of possessions related to "classical" culture in the family home, such as works of classical literature, poetry, and art (e.g., paintings). See https://stats.oecd.org/glossary/detail.asp?ID=5401.

12 Although this analysis followed the literature closely to select the inputs, it could have considered other inputs in the analysis. For example, teacher quality, infrastructure quality, instruction time at the school, and instruction time outside the school might be relevant inputs that are omitted from the analysis due to data constraints in several countries. Some exercises compute the efficiency levels, including the percentage of teachers holding a master's degree as a proxy for teacher quality. However, these results were not reported given the debate on whether holding a master's degree is a good proxy for teacher quality (Ladd and Sorensen, 2015). For the case of infrastructure quality, a variable reported by principals in the PISA study is physical infrastructure shortages, but answers depend on what the principal considered to be inadequate or poor-quality physical infrastructure. Thus, this variable is not included in the analysis. Regarding time in and outside the school, students report the minutes per week they study out of school and learning time in school. However, this information is not available for several countries so it was not included as an input.

13 Some 66 countries participating in PISA 2015 have information for all of these inputs. These countries are used for the analysis.

14 Student socioeconomic status can also be thought of as a proxy for teacher quality since research shows that higher-quality teachers tend to work in schools with a higher proportion of advantaged students (Lankford, Loeb, and Wyckoff, 2002; Jackson, 2009; Bonesrønning, Falch, and Strøm, 2005). However, evidence suggests that this may not be the case in every education system. For example, research on the Republic of Korea shows that the distribution of qualified teachers is skewed toward disadvantaged children (Luschei, Chudgar, and Rew, 2013). This is likely due to the mandatory teacher rotation policy in that country.

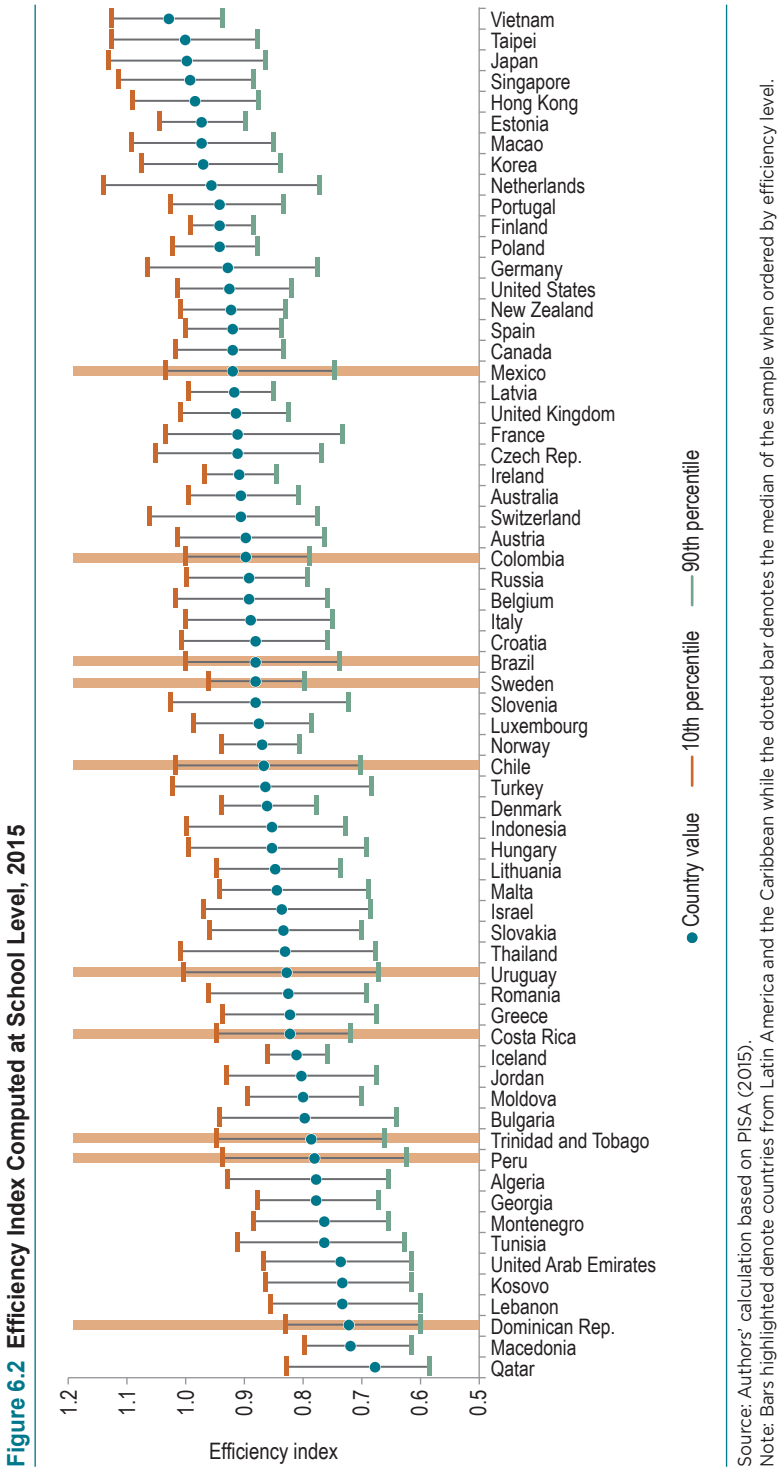


Figure 6.2 Efficiency Index Computed at School Level, 2015

Source: Authors' calculation based on PISA (2015).
Note: Bars highlighted denote countries from Latin America and the Caribbean while the dotted bar denotes the median of the sample when ordered by efficiency level.

the eight most efficient systems are from East Asia,[15] and the least efficient countries tend to be from Latin America, Western Asia, Africa, and Southeast Europe.

In Latin America and the Caribbean, the results indicate that 90.2 percent of schools are below the threshold and could improve their efficiency level by an average of 17.3 percent by reallocating education inputs. These values are 86.8 percent and 12.5 percent for OECD countries, respectively.

The results above vary significantly by country. While all schools in the Dominican Republic and 98 percent of Peruvian, Trinidadian, and Costa Rican schools are below the threshold, a significantly smaller proportion of Mexican schools are inefficient (71 percent). For other Latin American and Caribbean countries, the proportion of schools below the threshold is around 90 percent (Brazil, Chile, Colombia, and Uruguay).

The degree to which these below-the-threshold schools can improve also varies by country. In the Dominican Republic, schools using the same level of inputs could improve their output by 28 percent, in Peru and Trinidad and Tobago 22 percent, Uruguay 20 percent, Costa Rica 18 percent, Chile 16 percent, Brazil 14 percent, and Mexico and Colombia 12 percent.

In highly efficient systems, such as those of Vietnam, Japan, and Estonia, the percentage of schools below the threshold is much lower (32 percent, 52 percent, and 70 percent, respectively), and the degree to which they could improve keeping the same level of input is much smaller (5 percent, 9 percent, and 6 percent, respectively).

The number of Latin American countries participating in PISA tests is relatively low; only nine countries in the region had PISA scores available for this analysis. It is hard to understand how well educational systems are doing when scant information is available on student and school performance.

The results above show that efficiency levels vary among Latin American and Caribbean countries. While Mexico and Colombia seem to be doing well (conditional on the amount of resources allocated to education), with efficiency levels higher than the median, the Dominican Republic, Peru, Trinidad and Tobago, and Costa Rica are below the median. Finally, Brazil and Chile are close to the median. It must be noted that being more

[15] In East Asia, the phenomenon of "shadow education," that is, the provision of extra lessons for a fee directed to students already in the school public system is a widespread practice. For example, in South Korea over 80 percent of elementary school students received supplementary private tutoring. In Hong Kong and Japan more than 70 percent of secondary students also received private tutoring (Bray and Kwo, 2014). Because of lack of data on this practice at the school level, this issue is not addressed in our efficiency computations. Thus, the high efficiency levels of East Asia's countries might be overestimated.

efficient does not necessarily mean that results (i.e., outputs) are better, but rather that, given the amount of resources available, a particular country is closer to the efficiency threshold.

Educational Equity

While efficiency is an important issue in education policy reform discussions, most governments are also concerned with equity in their school systems. School systems that distribute country and school resources more equitably tend to perform better academically (see Chiu, 2010). Thus, in Latin America and the Caribbean, with its high levels of income inequality and poor academic performance, educational equity has become a salient policy issue.

The design of an equitable education system, in which outcomes are independent of factors that lead to educational disadvantage, would attempt to provide a fair distribution of inputs, processes, and outputs among all participants in education (Kelly, 2012). The school finance literature has identified five criteria of fairness in resource allocation: 1) neutrality, minimizing the link between school communities' wealth and schools' funding; 2) horizontal equity, meaning that students who are alike should be treated the same; 3) vertical equity, or the recognition that some groups of students need more resources than others to achieve fairness; 4) need-based, that is, fairness is achieved through differential per-student compensation for initial deficits; and 5) equality of educational opportunity, implying that there is a fair starting point, especially for students from disadvantaged and/or minority groups (BenDavid-Hadar, 2016).

The two most studied dimensions of equity are horizontal and vertical (Bandaranayake, 2013; Levačić, 2008b; Toutkoushian and Michael, 2007). Horizontal equity is based on the principle of "equal treatment of equals," which means that funds should be allocated equally among schools that share certain characteristics. Vertical equity follows the philosophy of "unequal treatment of unequals," which implies that if students have different educational needs, an equitable funding system should provide different levels of resources to meet these needs. Typically, educational needs are defined in terms of educational inputs needed to achieve a defined level of performance (Rubenstein, Doering, and Gess, 2000; Berne and Stiefel, 1999).

Various indicators have been proposed to measure horizontal and vertical equity (Nina et al., 2006; Verstegen, 2015; Kelly, 2015). For horizontal equity, the most common indicators are the McLoone and GINI indices. The former measures equity only for the lower half of the distribution of educational resources, in the range 0 to 1; higher values are associated

with greater horizontal equity. The GINI indicates how far the distribution of educational resources is from providing each proportion of schools with an equal proportion of resources. It ranges between 0 and 1, but in this case higher values are associated with lower horizontal equity.

Vertical equity is a more complex concept and difficult to operationalize since educational needs vary by student and how to identify those needing greater compensation is subject to debate (Vesely and Crampton, 2004). Different studies have attempted to identify the factors that put children at risk of academic failure to justify a greater allocation of resources to these students. These factors vary by education system and by region. For example, while in Latin American and Caribbean countries the indigenous population might be at a disadvantage, in the United States and European Union, black and immigrant children may be the most disadvantaged (McEwan and Trowbridge, 2007; Condron et al., 2013; Schnell and Azzolini, 2015). Among the most cited risk factors for students' academic failure are poverty, race, ethnicity, disability, poorly educated parents, and remoteness of school location. According to some studies, poverty is the most consistent predictor of academic failure (Bandaranayake, 2013; Land and Legters, 2002).

Given the above, the measure of vertical equity in this analysis assumes that poorer students should have more educational resources than richer students. For reasons of simplicity, other factors of disadvantage are not considered. The two indicators commonly used to measure vertical equity are: 1) the Concentration index and 2) the reformulated McLoone index. The former is frequently used to measure inequality in one variable over another variable, and it is usually employed to capture the extent to which educational resources differ across schools ranked by a socioeconomic indicator. Its range is between –1 and 1; negative values indicate that educational resources are higher for poorer schools and positive values indicate the opposite. The second index is a variation of the original McLoone index, but the ordering variable for identifying the half of schools to examine is the socioeconomic index. Its range is between 0 and infinity, and values greater than 1 represent systems that target disadvantaged students.[16]

In general, educational resources are measured by the expenditure per student in each school, but some studies use the availability of schooling inputs (e.g., Rao, 2011). Many of the educational systems that participate in PISA do not have data on expenditure per student at the school level; it is not clear whether those systems without such data available are comparable across systems. For this reason, equity indices are based on the same

[16] For more details about the indices see Kelly (2015) and Verstegen (2015).

Table 6.2 Equity Indicators Based on Availability of Inputs by Region, 2015

Equity indicator	Latin America and the Caribbean	OECD	Other regions
Horizontal equity			
GINI index ↓	0.40	0.31	0.34
McLoone index ↑	0.59	0.73	0.70
Vertical equity			
Concentration index ↓	0.02	–0.03	–0.01
McLoone reformulated index ↑	1.23	1.16	1.22
Number of countries	9	35	22

Source: Authors' calculation based on PISA (2015).
Note: The different arrows indicate whether the equity levels increase (↑) or decrease (↓) when the value of the index increases.

schooling inputs used for the efficiency analysis (i.e., teacher/student ratio and availability of computers).[17] Specifically, each equity indicator is computed separately for each input and then averaged among the two input results.

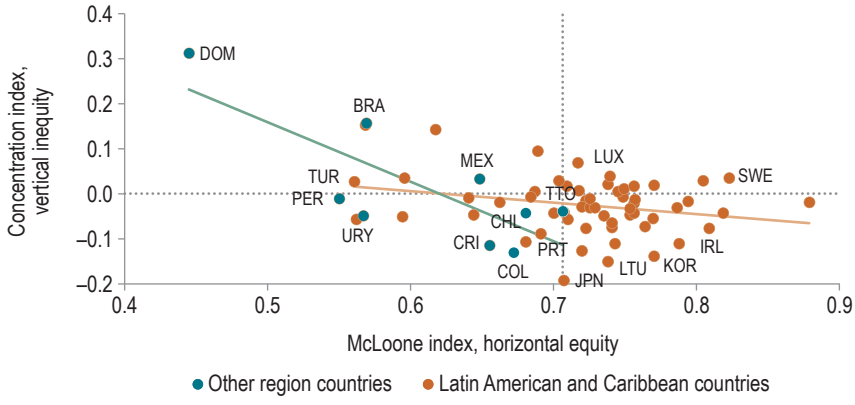
Table 6.2 shows the averaged equity indicators on educational resources at the school level for Latin America and the Caribbean, the OECD, and other regions. The results suggest that Latin American and Caribbean countries have lower levels of horizontal equity compared to the OECD and other regions, but relatively similar levels of vertical equity.

The relatively lower levels of horizontal equity with respect to vertical equity could reflect a combination of factors. On the one hand, there may be a lack of transparency related to (1) the rules regulating the distribution of inputs across schools, (2) the sources of funding of inputs, and (3) the level of government at which decisions are made on the level of inputs. Indeed, the design of specific resource allocation rules, the sources of funding, and the decision-making authority over educational inputs can impact the equitable distribution of resources within education systems. On the other hand, the relatively higher results for vertical equity could reflect the presence of compensatory mechanisms in the systems under consideration (e.g., teacher incentives to work in more disadvantaged areas in Peru, Colombia, and Chile, weighted per-pupil subsidies in Chile, and targeted programs in most systems).

The regional averages mask the heterogeneity within the Latin American and Caribbean region. Figure 6.3 displays the position of each system regarding vertical inequity (y-axis showing the concentration index) and horizontal equity (x-axis showing the McLoone index). No Latin American or Caribbean country is above the McLoone average, indicating low levels

[17] Due to data limitations the equity analysis is based on the availability and distribution of only two inputs.

Figure 6.3 Relationship between Vertical Inequity and Horizontal Equity, 2015



Source: Authors' calculation based on PISA (2015).
Note: The horizontal line in the graph is located where the vertical axis is equal to zero. It separates countries into those that allocate more inputs to lower socieconomic status (SES) schools (concentration index less than zero) and those that allocate more inputs to higher SES schools (concentration index greater than zero). The vertical line in the graph is located where the horizontal equity axis is equal to the average of the sample, dividing systems above and below the average.

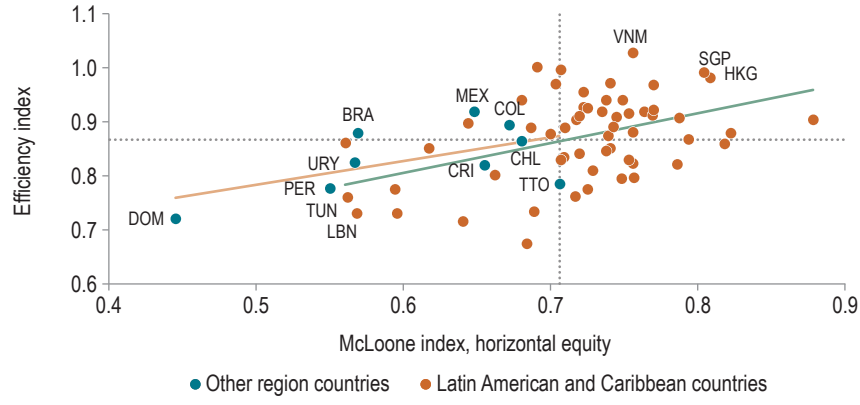
of equity in the availability of educational resources among the poorer half of schools. The Dominican Republic is the most horizontally unequal system in the study, followed by Peru. Uruguay is the fifth most horizontally unequal system and Brazil the seventh.

The concentration index shows that in six of the nine Latin American and Caribbean systems, educational resources tend to favor disadvantaged students, especially in Colombia and Costa Rica, where levels of vertical inequity are as low as in Portugal, Ireland, Korea, and in Lithuania, which has the second lowest level, after Japan, in the OECD. For the other three systems, the Dominican Republic and Brazil are the two most vertically unequal countries in the study. Mexico's level of inequity is similar to that of Turkey, Sweden, and Luxemburg, where it is positive but rather small, implying the equal availability of educational resources for poorer and richer schools. This, in effect, favors the affluent since they benefit from more resources in their home environment (as positive values indicate that educational resources are lower for poorer schools).

The Worst of Both Worlds

To deepen the analysis of efficiency and equity, the efficiency measure is correlated with the McLoone index (horizontal equity), and with the concentration index (vertical inequity). Figure 6.4 shows the first set of these

Figure 6.4 Relationship between Efficiency Index and Horizontal Equity, 2015



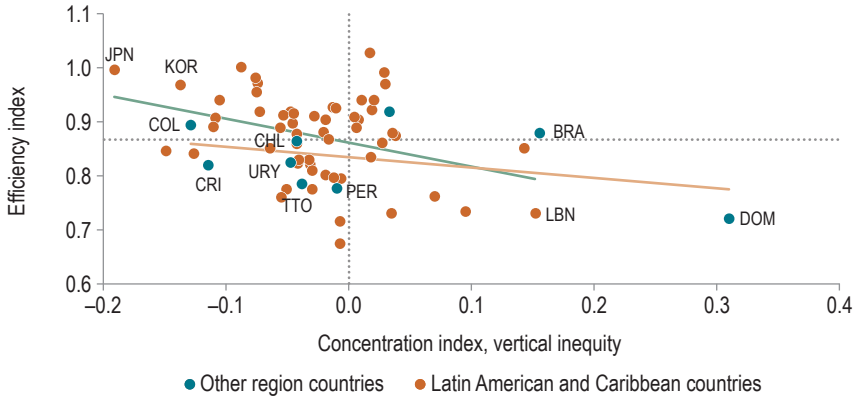
Source: Authors' calculation based on PISA (2015).
Note: The horizontal and vertical lines in the graph are located where the corresponding axis is equal to the average of the sample, dividing systems above and below the averages.

associations and divides systems according to whether they are above or below the mean on each indicator. Vietnam, Singapore, and Hong Kong are highly efficient and horizontally equitable systems. On the other hand, the Dominican Republic, Peru, Tunisia, and Lebanon are relatively inefficient and horizontally inequitable at the same time. Figure 6.4 also shows that more efficient systems tend to be more horizontally equitable.

Figure 6.5 shows the correlation between efficiency and vertical inequity and divides systems according to whether they are above or below the efficiency mean, and whether they allocate more inputs to lower socioeconomic status (SES) schools (Concentration index less than zero) or to higher SES schools (Concentration index greater than zero). Japan and Korea are highly efficient and distribute schooling inputs progressively. Conversely, the Dominican Republic and Lebanon are relatively inefficient and vertically inequitable. More efficient systems are less likely to be vertically inequitable or less regressive in the allocation of school inputs.

Despite data constraints and limitations, the results for efficiency and equity shed light on how challenges related to school finance policy vary across countries. For example, Colombia has relatively greater efficiency and equity levels than other Latin American and Caribbean countries, which might suggest that increasing the amount of resources invested in public schools may have a positive impact on achievement and narrow test score gaps. Brazil's school system appears to be relatively efficient but has high levels of both types of inequities. Thus, increasing and targeting future investments in the most disadvantaged schools might be an

Figure 6.5 Relationship between Efficiency Index and Vertical Inequity, 2015



Source: Authors' calculation based on PISA (2015).
Note: The vertical line in the graph is located where the horizontal axis is equal to zero. It separates countries into those that allocate more inputs to lower socieconomic status (SES) schools (concentration index less than zero) and those that allocate more inputs to higher SES schools (concentration index greater than zero). The horizontal line in the graph is located where the efficiency index axis is equal to the average of the sample, dividing systems above and below the average.

effective policy. In the Dominican Republic, the low levels of efficiency and equity suggest the need for a policy to boost the system's efficiency prior to increasing investment in public schools.[18] Comparing the efficiency and equity of the Latin American and Caribbean school systems with other regions of the world reveals challenges in all.

Something in the Air? Explaining Efficiency and Equity

Reviewing efficiency and equity in school education spending for 66 countries revealed that while vertical equity is close to average, horizontal equity and efficiency are relatively low in Latin America and the Caribbean. Moreover, these indicators vary considerably within the region. The next step is to ask why and identify country-level factors associated with these outcomes, following two approaches. First, reviewing available cross-country studies, each of the most widely used variables is correlated with each of three educational outcomes identified earlier in this chapter. Second, focusing on the

[18] In the Dominican Republic, spending as a percent of GDP per capita has doubled over the last 10 years. However, a large proportion of additional funding was used to hire administrative employees. In less than four years, the Dominican Republic increased the number of administrative employees by 78 percent. Currently, in the Dominican Republic there is one teacher for every administrative employee, compared to 12 in El Salvador and 16 in Guatemala EDUCA, 2016.

institutional components of school finance systems, their main dimensions are assessed in relation to either efficiency or equity outcomes.

Country Factors

While most research on school education and efficiency is based on within-country comparisons of schools, some studies measure student learning across countries to understand the factors that influence school efficiency from an international perspective (Agasisti and Zoido, 2015).

This scant but growing body of evidence examines whether different country factors are related to school efficiency. Cordero, Santin, and Simancas (2017) explore the potential influence of the public expenditure level on education, gross domestic product per capita, and cultural values of the society on technical efficiency. To measure the latter, they use data from the World Values Survey that collects information on which qualities are most valued when raising a child. Specifically, respondents are given a list of qualities (independence, hard work, responsibility, imagination, tolerance, thrift, perseverance, religious faith, unselfishness, and obedience) that children can learn at home and then asked to choose up to five traits that they think are most important. The authors assess the potential influence of three of these variables (hard work, responsibility, and perseverance), arguing that these comprise the trait known as conscientiousness, which the literature has shown to be highly correlated with educational achievement (Heckman, 2011b).

Agasisti (2014) attempts to gain insight into the relationship between efficiency and contextual country-level variables, which he divides into two categories: 1) educational system factors, including public expenditure, teacher salary, and instruction time, and 2) different socioeconomic factors such as GDP per capita.

Another dimension that may affect the efficiency of educational systems is teacher quality. The literature on this issue is scant, though, since measuring teacher quality at comparable levels across countries can be a challenge. Nonetheless, Hanushek, Piopiunik, and Wiederhold (forthcoming) recently computed measures of teachers' numeracy and literacy skills, providing an internationally comparable measure of teacher skills for 31 countries, which may be used to assess links between teacher quality and efficiency in education systems.[19]

[19] Each of the skill domains is measured on a 500-point scale, and Chile is the only participating country in Latin America and the Caribbean.

Regarding equity, apparently no cross-country statistical analyses examine potential factors related to inequity in school inputs, but recent studies do associate country-level factors with inequity in school outputs, specifically student learning. Chmielewski and Reardon (2016) conduct a multivariate analysis to associate the achievement-income gap in 19 countries with measures of poverty, income inequality, educational differentiation, and curricular standardization. A similar paper examines the influence of curricular tracking on the income-achievement gap in 15 countries (Cimentada, 2017). Both studies base their measure of curricular tracking on the work of Bol and Van de Werfhorst (2013), who compute a tracking index combining country-level information on the length of tracked curriculum, age of first tracking selection, and number of tracks at 15 years old. This measure is relevant because if students are segregated into ability tracks at early ages, the chances of incurring horizontal inequity are good. These authors also compute measures of the standardization of education in both inputs and outputs. Standardized inputs refer to the extent to which schools have limited control over the use of pedagogical decisions in education (for example, restrictions on what is taught and how, which books are used, etc.). Standardized outputs describe the extent to which educational performance is tested against external standards.

The limited results from these cross-country efficiency and equity analyses shed light on what variables might be related to efficiency or equity. Following these studies, efficiency and equity are correlated with 18 factors grouped into four categories: 1) expenditure level, 2) education system variables reflecting different policy decisions, 3) socioeconomic variables, and 4) societal values.

Table 6.3 shows the number of observations for each of the chosen factors, the average difference between Latin American and Caribbean countries and countries in other regions, and the bivariate correlations with efficiency, horizontal equity, and vertical equity. While these correlations do not imply causality, they do show interesting patterns. More efficient and equitable systems tend to have a higher level of expenditure per student, and their teachers are better trained, as shown by their higher numeracy and literary skills. In countries with more efficient and equitable education systems, citizens seem to understand the need to control corruption, and value responsibility and perseverance. For all these factors, the average value for Latin American and Caribbean countries is lower than that of countries in other regions. Thus, progress along these dimensions could help improve efficiency and equity in the school systems of the region.

Three other interesting results are pertinent to the discussion on education policy. First, systems with a higher salary at the top of the teacher pay

scale tend to have higher levels of efficiency, but not necessarily equity. Second, greater levels of curricular tracking appear to be related to lower levels of horizontal equity, but not to efficiency or vertical inequity. In other words, separating students by abilities at early ages could be associated with allocating different amounts of resources to similar students. Third, systems that standardize what schools can teach and the way they can teach seem to be less efficient. Countries in Latin America and the Caribbean have room to improve top teacher salaries (paying more to those that are better trained) and reduce their tracking levels. The first measure may be beneficial for efficiency, and the second one, for equity. In terms of standardized pedagogical decisions, the region as a whole has less standardization than other regions, which may help increase efficiency. Finally, those countries with higher GDP per capita and lower levels of income inequality measured by the GINI index tend to be more horizontally equitable. Probably, a higher national income that is distributed more equally is associated with a more homogeneous school system.

The Role of School Finance Systems

School finance can affect learning outcomes and is, therefore, another policy that can influence efficiency and equity. A school finance system can be defined as the set of formal rules and incentives that affect how resources are raised, governed, allocated, and monitored (Hansen et al., 2007). The literature on school finance system design identifies four key dimensions (OECD, 2017b; Atkinson et al., 2005): 1) sources of funding and transfers between levels of government (i.e., national, subnational, local, and school level); 2) decision-making authority at different levels of government; 3) information and accountability systems; and 4) resource allocation rules. For each dimension a debate rages on the impact of alternative policy designs on the efficiency and equity of education spending.[20]

First, the sources of school funding can be either private or public. Evidence for Argentina and Chile suggests that expanding private funding sources could trigger an increase in spending inequality (Mezzadra and Rivas, 2010; Elacqua, Montt, and Santos, 2013). While public funds may be collected at the central, subnational, local, and school levels,[21] research

[20] See Bertoni et al., 2018, for details on school finance systems in Latin America.

[21] The subnational administrative level is immediately below the national level—for example, subnational divisions are considered *provincias* in Argentina and *estados* in Brazil. Local administrative divisions are all those that fall under the subnational level. These might include, for example, municipalities, communes, counties, districts, and/or villages.

Table 6.3 Bivariate Correlation between Efficiency, Equity, and Country-Level Variables

Country	Number of observations	Latin America and the Caribbean/ other regions	Efficiency index	Horizontal equity	Vertical inequity
Educational outcomes					
Efficiency index	66	–0.04	1.00	0.48*	–0.36*
Horizontal equity	66	–0.11	0.48*	1.00	–0.43*
Vertical inequity	66	0.04	–0.36*	–0.43*	1.00
Expenditure level					
Expenditure per student	49	–$5,293	0.41*	0.39*	–0.15
Control of corruption index	63	–0.77	0.36*	0.50*	–0.22
Educational system					
Teachers numeracy skills	31	–30.80	0.39*	0.40*	–0.05
Teachers literacy skills	31	–33.40	0.57*	0.54*	–0.09
Teachers starting salary	39	–$15,491	0.26	0.38*	0.03
Teachers top salary	37	–$17,483	0.39*	0.23	0.00
Instructional time	39	–30.27	0.05	0.05	–0.11
Out of school study time	39	1.25	–0.11	–0.16	0.21
Tracking index	37	0.52	–0.06	–0.54*	0.07
Standardization of pedagogical decisions	48	–0.10	–0.60*	–0.24	0.11
Standardization of education outcomes	43	0.24	0.03	–0.07	–0.15
Private management	65	0.03	0.17	0.03	0.02
Socioeconomic variables					
GDP per capita, PPP (constant 2011 int.$)	66	–$18,031	0.16	0.36*	–0.02
GINI index	54	14.86	–0.12	–0.52*	0.16
Poverty headcount ratio at $3.10 a day (%)	31	1.50	–0.04	–0.26	0.31
Society values					
Hardwork	28	–0.24	0.08	0.14	–0.17
Responsibility	28	–0.02	0.42*	0.18	–0.52*
Perseverance	28	–0.09	0.51*	0.36	–0.35

Source: Authors' calculation based on the following: PISA 2015 student questionnaire; OECD, 2017a; Quality of Governance Basic Dataset 2016; World Bank Development Research Group and International Comparison Program Database; World Values Survey; OECD's Programme for the International Assessment of Adult Competencies (PIAAC); UNESCO Institute for Statistics: (http://data.uis.unesco.org); Eurostat database; Hanushek, Piopiunik, and Wiederhold (forthcoming); Bol and Van de Werfhorst (2013); and Acerenza and Gandelman (2017).
Note: * indicates statistical significance of 5%.

shows that where subnational/local governments are the main source of funding, there may be a risk of generating spending inequality across jurisdictions (Farvacque-Vitkovic and Kopanyi, 2014). While wealthier regions are more likely to raise sufficient funds from local tax revenues to provide an adequate level of funding, more disadvantaged jurisdictions may be unable to raise enough money.

In systems where a sizable proportion of funds is generated at the subnational/local level, intergovernmental transfers may be an important instrument for equalizing the spending capacity of different territorial units. School finance reforms have often incorporated equalization grants to address inequality. In Brazil, the Fund for the Maintenance and Development of Basic Education and Teacher Appreciation (FUNDEB), is a federally mandated redistributive program intended to reduce regional inequities in per-pupil spending. FUNDEB is a state fund that receives revenues from specific state and municipal taxes. This fund is then redistributed to state and municipal governments based on student enrollments. If per-pupil funds in a state do not meet the national minimum, the federal government provides additional resources to the state's FUNDEB account. Evidence on the effects of FUNDEB indicates that the program decreased interstate inequalities in educational spending (Cruz, 2017).

Second, an ongoing discussion focuses on whether decentralization improves equity and efficiency in the provision of public services. Arguments in favor of decentralized decision-making posit that local leaders may have a better sense of local preferences, and will allocate resources more efficiently (Oates, 2006; Barankay and Lockwood, 2007; Tiebout, 1956). In this scenario, the needs of individual schools can be better addressed because of the closer proximity to decision-making (European Commission, 2000).[22] Additionally, by bringing decisions closer to the interested local community, decentralization may improve the monitoring of teachers and schools by parents and local communities (Galiani, Gertler, and Schargrodsky, 2008).

On the other hand, critics contend that strong reliance on subnational decision-making may raise equity concerns (OECD, 2017b). Arguments for a strong centralized role emphasize the lack of capacity at subnational levels of government to exercise responsibility for public services (Treisman, 2007; Gordon, 2015). Moreover, to the extent that some education-related activities have large fixed costs, such as research and development,

[22] In fact, economic models of school governance often suggest that greater autonomy at the school level could lead to increased efficiency of public schools (Hoxby, 1999; Nechyba, 2003) because autonomy offers the possibility of using superior local knowledge, with positive consequences for outcomes.

centralized provision allows efficient pooling of resources to operate at scale (Gordon, 2015).

Evidence in Latin America shows that a 2001 reform that decentralized the provision of public education in Colombia improved enrollment rates (Faguet and Sánchez, 2014) but reinforced performance gaps between more and less developed municipalities (Brutti, 2016). In Bolivia, the decentralization of education financing made government more responsive to re-directing public investment to the areas of greatest need (Faguet and Sánchez, 2008).

Third, authorities who make funding decisions are usually held accountable for complying with budgetary laws and regulations and for distributing resources in an efficient and equitable way. In decentralized school systems, controlling the finances of lower level authorities is assumed to be a necessary strategy to ensure adequate allocation of resources (Hanushek , Link, and Woessmann, 2013; Burns and Köster, 2016; OECD, 2017b).

Multi-level governance systems may deal with different types of accountability: governments can be made accountable to citizens (bottom-up accountability), to public agencies (horizontal accountability), and to higher-level authorities (vertical accountability) (Schaeffer and Yilmaz, 2008). Bottom-up accountability includes citizens who hold governments accountable through elections, civil society organizations, and the media. Parental choice of schools also represents a form of bottom-up accountability because it gives parents more power to pressure schools to deliver better education. In Latin America, Chile's school voucher system is the best-known example of school choice.[23]

Peru, Chile, and Colombia have implemented high-stakes vertical accountability in which the central government determines financial incentives for schools, local governments, or teachers based on student achievement and other outcomes. The Chilean system imposes the most severe consequences for low-performing schools: if they do not improve their performance in three years, the Ministry of Education will encourage families to consider another schooling option, as well as facilitate transportation. Moreover, if the low-performing school does not improve for two additional years, the ministry will revoke its license to operate and receive public funding. Low-performing schools in Chile respond to these

[23] Despite the theoretical argument, the empirical evidence is not conclusive on the effects of school choice on student learning. Moreover, critics question whether all parents have the capacity to make informed decisions and pressure schools to improve (Schneider, Teske, and Marschall, 2002). Also see Schneider, Elacqua, and Buckley (2006) for evidence from Chile.

accountability pressures by adopting time-efficient measures to improve test scores in the short term, such as relocating effective teachers to grade levels that are evaluated by Chile's high-stakes testing systems (Elacqua et al., 2016). Similarly, Murnane et al. (2017) argues that the combination of more resources and accountability introduced in Chile by the Preferential School Subsidy Law (SEP) in 2008 were the critical mechanisms to increase student learning.

Another example of vertical accountability is when schools condition financial transfers on performance. For example, in Colombia the funding formula that determines how many resources are transferred from the central government to local authorities includes a performance component that allocates more funds to higher-performing regions. No robust empirical evidence evaluates the impact of performance-based funding formulas on school effectiveness.

Additionally, in 2015 Peru implemented a nationwide teacher bonus program that ranked schools according to their performance on the national standardized test. Schools were ranked within groups of similar school districts, instruction time, and location (urban and rural). Every teacher and principal in the top 20 percent of the ranking within each group received a fixed payment of more than a month's salary. Despite these efforts, Bellés Obrero and Lombardi (2017) find no effect of the program on students' performance. They hypothesize that teachers in Peru had no guidance on how to improve their instruction to raise their students' scores on the standardized test. Thus, incentives may need to be properly studied and coupled with additional tools for them to be effective in raising student performance.

Fourth, there is a discussion about the advantages and disadvantages of the mechanisms to define the amount and transfer of funds to different administrative levels (subnational and local governments) and to schools. In many systems, a funding formula (a formal procedure based on predetermined criteria) is defined to avoid discretionary decisions.

Funding formulas can promote equity because they require equal treatment of administrative units (local governments and schools), while administrative discretion and historical criteria could lead to idiosyncrasies due to incremental adjustments and political games (Levačić, 2008a). Funding formulas may also increase efficiency, since they eliminate the accumulated inefficiencies of historical criteria. Lastly, formulas can increase transparency, because administrative units and stakeholders can anticipate the amount of resources schools will receive (Levačić and Downes, 2004).

At the same time, formulas can cause problems too. They might not be the optimal option to allocate resources for all types of expenditures. For instance, they may be less effective for less permanent spending categories,

like infrastructure, where project-based funding is more common (Levačić and Ross, 1999; OECD, 2017b). Additionally, the implementation of funding formulas requires reliable information on student enrollment and teacher allocation, not always available in less developed countries.

In some Latin American and Caribbean countries, most transfers are based on funding formulas. For instance, Colombia uses well-defined formulas to transfer resources from the national government to Territorial Entities (mainly for the Sistema General de Participaciones—SGP—that represents 65 percent of total spending), and national rules that define salary spending allocation among schools, because pay scale and teacher needs by school are defined at the central level. For the rest of the spending categories, certified entities (ETCs) have more discretion to allocate the resources among different spending categories and among schools.

Chile also has a formula for most spending categories, because central government transfers via per-student vouchers account for approximately 80 percent of total revenue.[24] The voucher subsidies are transferred directly to school owners that can be public (municipalities) or private, and they are allocated based on student attendance rates. Although over the last decade a series of mechanisms have been incorporated to address some of these differences (e.g., base funding for small rural schools and an additional subsidy for full-day schools and for disadvantaged students), many small and medium-sized urban schools are unable to pay minimum payroll and operational costs with the subsidy (Bertoni et al., 2018).

Given the relevance of teachers and the fact that teacher salaries are the main source of expenditure in education, the way teachers are allocated is a key policy topic (Bertoni et al., 2018). In some systems, such as Brazil and Colombia, a fraction of the money transferred from the central government is earmarked and can only be spent on teacher salaries, imposing constraints on local governments' budgets and managerial decisions.

Teacher allocation involves several processes, the most important ones being the hiring process and the allocation of new and experienced teachers. Improving the hiring process has the potential to be a cost-effective policy since it can help avoid the costs of remedial programs by preventing students from being exposed to ineffective teachers (Staiger and Rockoff, 2010). It can also reduce the probability of costly dismissals of ineffective teachers (Rothstein, 2015).

[24] The subsidy system in Chile has 24 different transfers with different assignment criteria. Among the 24 transfers two central subsidies are important to analyze separately: the per-pupil subsidy (Subvención de Escolaridad) and the preferential student subsidy (Subvención Escolar Preferencial). These two transfers account for almost 70 percent of overall governmental K-12 funding.

In 2002, the hiring process of Colombian public school teachers was reformed with a selective recruitment process and performance incentives. Brutti and Sánchez Torres (2016) estimate how new quality-screened teachers impact students' high school performance. The authors exploit the fact that the new regulation applied only to newly hired teachers, whereas those already employed in 2002 remained exempt, creating a mix of new-regulation and old-regulation teachers in Colombian schools. Using data at the school-year-subject level, and controlling for school-level confounders, they report a positive and significant effect of new-regulation teachers on student performance.

Once teachers are hired, the way they are placed in schools varies by education system, but a common pattern in Latin America and the Caribbean is that applicants are matched based on entry exam scores in the screening process and applicants' preferences. Applicants with a higher score can usually choose the school of their preference (Bertoni et al., 2018). This may foster inequities since teachers generally prefer to work in schools with fewer disadvantaged students (e.g., Loeb and Wyckoff, 2002). The sorting of effective teachers may be exacerbated in Latin American and Caribbean systems, most of which have few incentives to attract teachers to hard-to-staff schools (Bertoni et al., 2018).

Keeping these debates in mind, comparable data between countries that proxied the main school finance dimensions were correlated with the efficiency and equity measures. Table 6.4 reports the bivariate correlations for nine variables grouped in the four main types of school finance. The reported results show interesting patterns but cannot be interpreted as causal.

Regarding the sources of funding, the data suggest that a higher share of funds that originate from private sources is related to both lower efficiency and lower equity. This association could be relevant for Latin America and Caribbean countries since the private share of their schools' funds are 12 percentage points higher than countries in other regions.

In relation to autonomy, results show that more decentralized systems tend to be more horizontally equal in the decision-making process of teacher hiring and firing, which is consistent with the argument that the needs of individual schools can be better addressed by local authorities because of their closer proximity to conditions on the ground (European Commission, 2000). Additionally, by bringing decisions closer to the interested local community, decentralization may improve the monitoring of teachers and schools by parents and local communities (Galiani, Gertler, and Schargrodsky, 2008).

Table 6.4 Bivariate Correlation between Efficiency, Equity, and School Finance Variables

Country	Number of observations	Latin America and the Caribbean/ other regions	Efficiency index	Horizontal equity	Vertical inequity
Educational outcomes					
Efficiency index	66	–0.04	1.00	0.48*	–0.36*
Horizontal equity	66	–0.11	0.48*	1.00	–0.43*
Vertical inequity	66	0.04	–0.36*	–0.43*	1.00
Funding sources					
Private funds	51	11.87	–0.39*	–0.60*	0.23
Public sources					
Central	44	20.23	–0.23	–0.12	–0.16
Subnational	44	–3.26	0.28	0.04	–0.04
Local	44	–16.97	0.02	0.13	0.26
Transfers from central government to other levels	44	–0.63	0.02	0.19	–0.23
Decision-making authority					
Personnel autonomy	66	–12.94	0.07	0.30*	0.03
Budget autonomy	66	1.73	0.05	0.06	0.01
Accountability					
School externally evaluated (%)	66	–6.32	0.01	0.19	–0.02
School choice	57	–0.03	0.29*	0.23	–0.03
Resource allocation rules					
Staff compensation (%)	50	0.36	–0.29*	–0.25	–0.14

Source: Authors' calculation based on OECD's Education at a Glance 2017; PISA 2015 principals' questionnaire; and UNESCO Institute for Statistics: (http://data.uis.unesco.org).
Note: * indicates statistical significance of 5%.

The more efficient countries tend to have a higher degree of school choice. In the Latin American and Caribbean region, parent involvement in school management varies considerably. The extent of school choice in Chile is high, but parents in most other systems have fewer choices (Elacqua, Ibarren, and Santos 2016) and may not have sufficient information about school performance to make informed decisions.

Finally, the measure for resource allocation indicates that a higher percentage of funds allocated for staff compensation is related to lower efficiency. This result is interesting for Latin American and Caribbean countries since they, on average, rely relatively more on human resource inputs than other countries. The percentage spent on staff compensation is 36 percentage points higher than the other regions considered, perhaps

because of the relevance of teachers' unions in the region and their power in setting wages that may not be necessarily aligned with performance.

Improving Efficiency and Equity: Lessons Learned

Efficiency estimates in education are limited by a lack of internationally comparable data on schooling inputs and on the design of school finance systems. Despite these shortcomings, available research consistently shows that East Asian countries have the most efficient school systems in the world (Agasisti and Zoido, 2015; Sutherland, Price, and Gonand, 2009). This analysis is consistent with this finding and contributes to the literature by estimating the efficiency level for 66 countries including several in the Latin American and Caribbean region, using data at the school level, something that has been rarely done when analyzing efficiency using DEA models in cross-country studies. Results show that efficiency levels in the region are low: no Latin American and Caribbean countries are in the top 15 systems, and three appear among the 15 least efficient. Only Mexico, Brazil, and Chile are above the average efficiency level of the 66 systems analyzed.

This analysis also examined the equity levels of input distribution between schools across school systems. Vertical equity in Latin America and the Caribbean is, on average, similar to that of more developed countries. This suggests that the increased number of compensatory programs and weighted subsidies (e.g., in Chile and Colombia) introduced in the region in recent decades might have reduced funding disparities. While encouraging, this result should not breed complacency, as countries such as Brazil and the Dominican Republic are among the most unequal in terms of vertical equity in the sample. Regarding horizontal equity, results indicate that schools with similar student demographics receive unequal resources. This type of inequity could improve in the region if the level of transparency in the transfer of resources improved.

In order to improve efficiency and equity in school systems in Latin America and the Caribbean, measures that increase expenditure per student are promising, but not in isolation. Higher spending per student must be accompanied by better accountability measures that reduce corruption, better trained teachers, and better pay for top performers.

Policies related to school finance can also affect efficiency or equity. Latin American countries vary widely in the school finance dimensions of their systems, but it is encouraging that some systems in the region are implementing reforms to increase the efficiency and the equity of public spending in education.

A wide array of school finance policies can be implemented to increase educational outputs by more efficiently allocating inputs. For example,

Colombia's 2001 reform, which changed the spending allocation rule from an input-based to a per-student formula, successfully incentivized territorial entities to increase enrollment rates while preventing overspending on school personnel (Faguet and Sánchez, 2014). The timeliness of a discussion on allocation rules is exemplified in the heated debate in Brazil that occurred in the wake of the recent economic recession; the discussion centered on whether federal contributions to FUNDEB funds should be tied to the performance of school systems, in order to incentivize governments to make better use of resources. Of course, allocation rules must be accompanied by accountability. Studies show that strengthening accountability measures improves education results by reducing corruption (Olken, 2007; Ferraz, Finan, and Moreira, 2012), and by changing in-school behavior in educationally meaningful ways (Elacqua et al., 2016).

With respect to policies that aim to improve equity in the distribution of resources, most evidence shows that when school funding strongly relies on local sources, spending inequalities may arise across jurisdictions (e.g., regions or municipalities). To address these inequities, school finance reforms have incorporated equalization funds as a compensatory tool to overcome these imbalances worldwide. For example, the redistributive role of FUNDEB in Brazil led to a 12.2 percent reduction in the inequality index of municipal resources between 2006 and 2011 (Araújo, 2013). Targeted voucher programs have also been perceived as an effective instrument to tackle learning inequities within school finance systems, particularly when they are weighted, meaning that vouchers for disadvantaged students are more valuable. Evidence from Chile shows that the achievement gap between high and low-income students has narrowed by one third since the government implemented the school subsidy law in 2008 (Murnane et al., 2017). Thus, equalization funds from the central government and weighted vouchers can be effective tools to improve learning overall and to narrow the socioeconomic learning gap.

Regarding decentralization, more autonomy for schools and local governments could allow them to use their knowledge of the local context to make more equitable decisions. However, for this to be an effective policy, the central government will need to support schools and subnational governments that lack the capacity to manage and allocate resources efficiently.

Latin America and the Caribbean shows a much higher share spent on teachers and other human resources than other regions—perhaps hinting at the effect of stronger unions—implying that there may be fewer resources for ancillary services and pedagogical inputs. Providing all the services and materials for students with diverse needs is key to improving efficiency and equity.