Lessons for the design of fiscal transfers to improve student learning and reduce learning gaps: The case of Colombia

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1. Introduction

Among education economists, there has been a long-standing debate around *whether* and *to what extent* money matters to improve student outcomes.[1] The source of the debate comes from data showing weak correlations between per-student expenditures and learning outcomes. The data suggest that there is a wide range of student performance at almost each level of per-pupil spending (see Figure 1 related to math expenditures).

Figure 1. Relationship between education expenditures and student learning
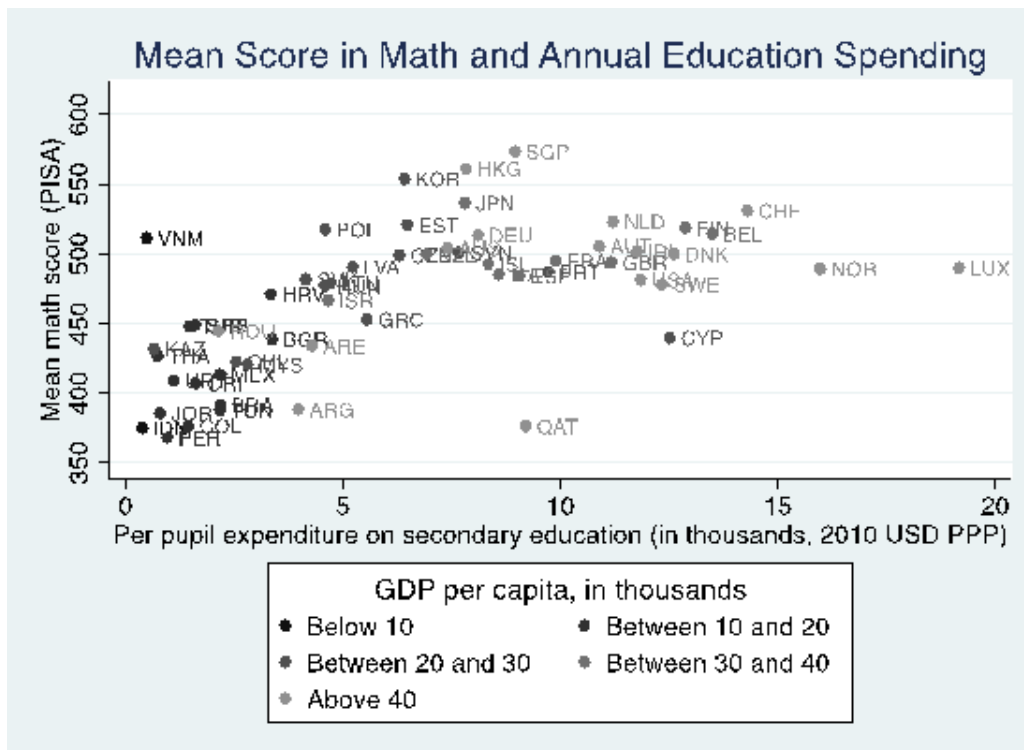
Source: Vegas and Coffin, 2015.

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[1] For an excellent summary of the evolution of this debate, see Hanushek (2019).

Yet, anyone who has visited low-resourced schools, whether in sub-Saharan Africa, South Asia, Latin America, or even in disadvantaged communities across developed countries, has to question whether money does *not* matter. And previous research has shown that when education systems are grouped into high spenders and low spenders, we can identify a cutoff point below which more education spending, indeed, is related to higher student learning. For example, Vegas and Coffin (2015) find a statistically significant correlation between per pupil expenditure and student achievement among countries that spend less than US$8,000 in purchasing parity prices (see Figure 2).

Figure 2. Relationship between education expenditure and student learning, for low- and high-spending countries
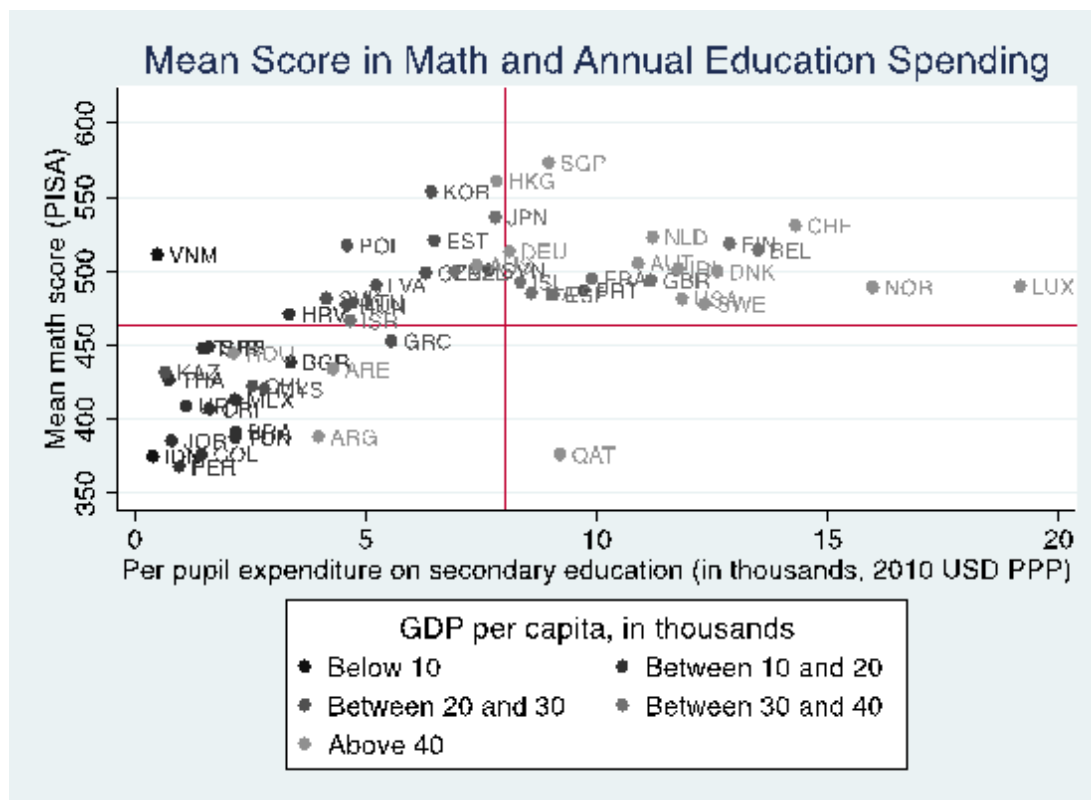
Source: Vegas and Coffin, 2015.

Using rich panel data from the U.S., researchers have documented that children living in school districts that invested more had better learning outcomes, which led to better outcomes later in life (Jackson, Johnson, and Persico, 2015).

While the question of *whether* increasing investments in education *can* improve student outcomes has largely been answered, *how* best to allocate funding to educational administrations and institutions to enhance learning and reduce learning gaps remains unclear. Yet, improving *how* financial resources are allocated throughout the education system is important to jumpstart the stagnant progress in student learning across much of the world, especially in Latin America and other developing regions. Previous research from school finance reforms in Chile found that when the per-student funding formula was modified to account for variation in student demographic characteristics (providing more resources to students from disadvantaged backgrounds) and to hold educational institutions accountable for student learning (as opposed to only enrollment and attendance), student learning improved and gaps in student learning by socioeconomic background declined (Murnane and others, 2017).

Colombia provides a useful case to analyze the impact of changes in school finance policies. During the last decade, the country introduced important in fiscal transfers from the national government to subnational entities aimed at improving access to quality education. In this policy brief, I synthesize the results of a recent analysis of these reforms and their impact on student outcomes. To do this, I first provide a brief background on the country's school finance system and how it evolved over time. Then, I analyze the relationship between levels of funding and learning outcomes during the years 2002-2021. Third, I examine changes in the funding formula granted by the national government to subnational entities to better understand the impact of these reforms on average student learning and on learning gaps. In the last section, I discuss the findings and policy implications.

During the past decades, student learning in Colombia has remained stagnant, while learning gaps have grown. I reviewed in detail the changes to the school financing formulas used to transfer resources from the national government to subnational entities and found that criteria aimed at improving the quality and equity of education have in general been absent. My findings suggest that there is a weak relationship among financial resources, fiscal management capacity, and student learning in Colombia. I find small but statistically significant effects on student learning outcomes of fiscal transfers and on improvements in the fiscal management capacity of subnational entities.

My analysis of the impact of the 2015 change in the General Participations System (GSP) formula indicates that the change led to a short-term rise in in average student learning over time, but thereafter average learning declined. Perhaps more troubling, I find that the reform led to an increase in learning inequality between high- and low-performing students. I conclude with some policy options for Colombia to revise how it allocates resources to the education system, with the goal of building on evidence to raise the impact of fiscal transfers on student learning and reduce learning inequality.

2.   Background

Colombia's 1991 constitution had established that national monetary transfers to subnational entities for education and health services were to be based on the national current income. In the next decade, national transfers to municipalities and departments were subject to great volatility due to economic fluctuations. This volatility limited subnational governments' capacity to adequately plan and allocate resources to improve health and education outcomes.

To provide greater financial stability to subnational entities, the GSP was established by Law 715 in 2001. The law's main objectives were to create the conditions for the constitutional right to access quality basic and secondary education. Among the tools defined by the law to achieve these objectives, the following stand out: (i) a clear definition of responsibilities in the provision of the educational service by the nation, departments (similar to states in the U.S.), municipalities (similar to districts in the U.S.), and educational institutions; (ii) the definition of a mechanism to allocate resources that takes into account different variables (population served, population to be served, and poverty) and the characteristics of each educational level and region (urban and rural) to promote equity; and (iii) the establishment of a reliable information system between the national and subnational governments to help support the management of the education sector.

The reform entailed two important changes. First, different types of transfers were unified in a single fund, the GSP. Second, the annual amount in the GSP was divorced from the national current income. Instead, the law established that the

GSP would increase proportionately to inflation, plus a few additional percentage points (2 percent in the first four years and 2.5 percent in the remaining three years) during a transition period, from 2002 to 2008.

Law 715 also established that after the transition period, the GSP would be determined based on changes in the moving average of current national income during the previous four years. In 2007, Legislative Act 04 expanded the transition period and maintained the growth of the GSP divorced from current national income through 2016. As a result, GSP transfers to subnational entities grew at the rate of inflation, plus 4 percent from 2008 to 2009, 3.5 percent in 2010, and 3 percent from 2011 to 2016. In addition, the law granted an additional percentage of GSP growth to be destined exclusively to the education sector without creating a budget base. This additional percentage for education was 1.3 percent from 2008 to 2009, 1.6 percent in 2010, and 1.8 percent from 2011 to 2016.

Currently, the GSP is Colombia's main source of education finance, accounting for 85 percent of total public investment in education in 2020. The GSP funds are allocated using two main criteria:

1. *Service Provision.* Resources allocated to service provision include items such as payments for personnel, administrative expenses of schools and education secretariats, and the payment of tuition contracted with third parties. Since this category includes the payroll (including social benefits) for both teachers and administrative staff, it is the largest item of the GSP.

2. *Quality.* Resources allocated to quality are divided into: (i) Quality - Official Enrollment, which includes educational infrastructure, equipment, public services and, in general, expenses related to complementary services; and (ii) Quality - Free Education, which was designed to compensate for the elimination of tuition fees and to pay for operational expenses.

Figure 3 presents the historical evolution of the GSP transfers. On average, from 2002 to 2020, resources earmarked for service provision accounted for 94 percent of total transfers, while quality resources accounted for an average of less than 6 percent. Resources earmarked for quality had the highest share in the period 2012-2016, when they represented close to 8 percent of total transfers. In

2021, resources earmarked for quality represented the lowest share of total transfers, less than 5 percent. Because the largest share of GSP resources are earmarked to service provision, understanding the criteria for allocating resources to this category is critical to evaluate how they affect educational quality and equity.

Figure 3. GSP transfers: Education sector (billions of constant Colombian pesos, 2021)
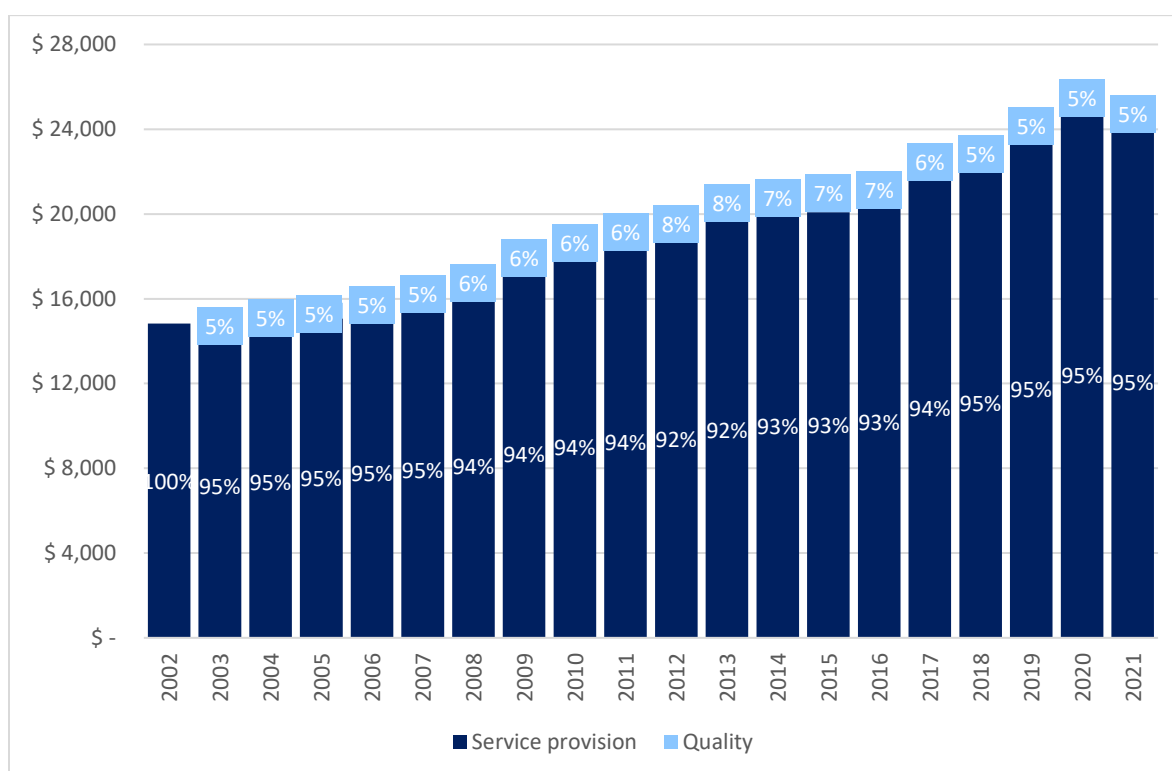
Source: Colombia's National Planning Department (DNP), accessed October 2021.

The law mandated GSP transfers to be based on the number of students and to vary by education level (preprimary, primary, and secondary) and by urban/rural areas. Importantly, the law provided the national government with the authority to define the specific variables to be considered and the weights of each of these variables, and the Ministry of Education makes annual decisions regarding the specific formula. The formula can vary by subnational entity–departments or municipalities–and by whether these subnational entities are classified as "Certified Territorial Entities" (or CTEs) by the Ministry of Education. CTEs are subnational entities with secretariats of education that the Ministry of Education

has evaluated as having adequate capacity to oversee the entity's education system. To date, there are 96 CTEs across the country.

Table 1 shows a summary of the formulas defined by the Ministry of Education between 2002 to 2021. There are three distinct periods. The first period, from 2002 to 2010, is characterized by a high volatility in the formulas implemented each year. In the second period, from 2011 to 2014, nine formulas were used that considered three variables: socioeconomic development conditions of the subnational entity, socioeconomic vulnerability of the population served, and level of development of the education system. In 2013, a new variable was incorporated that captured the geographic dispersion of educational institutions, and in 2014 an additional variable was added to recognize regional differences in the costs of providing educational services. Finally, in the third period, which began in 2015, 95 distinct formulas were introduced (one for each CTE at the time), with the goal of better capturing the specific costs of providing education services within each subnational entity. While some indicators of system performance were included (such as student performance in the national Saber assessments, as well as student dropout and repetition rates), these were later dropped. The changes in the allocation formula introduced in 2015 provide fertile ground to evaluate their impact on education quality and equity in Colombia.

Table 1. Changes in the GSP funding formula, 2002-2021

2002 - 2010	2011 - 2014	2015 - 2016	2017 - 2011
Volatility in the allocation formula, the criteria to be taken into account and number of typologies	First period of stability. Creation of 9 typologies with three assignment criteria:	One allocation typology per student for each of the FTEs that receive resources for the provision of educational services (95 typologies), with the following allocation criteria:	
1. 2002-2002: transition period (per-pupil allocation only for the 4 districts). 2. 2004: 6 groups 3. 2005-2006: 7 groups by departments and 4 by municipalities 4. 2007: two typologies for each group of 2006 5. 2008-2009: 4 typologies 6. 2010: 4 groups	1.Socioeconomic characteristics 2. Conditions of the population 3. Levels of educational development	1. Performance (payroll cost, rurality of enrollment, ethnic enrollment, IPM, % of payroll in high echelon) 2. Quality and efficiency in the use of resources (performance in SABER, dropout, repetition, survival and student-teacher gap).	1. Performance (payroll cost, rurality of enrollment, ethnic enrollment, IPM, % of payroll in high echelon)

Sources: National Council of Social Policy (CONPES) of the National Planning Department (DNP) and GSP.

In Figure 4, I present trends in the average public school student test scores in the Saber 11 assessment between 2004 and 2020. Students are required to take these assessments in their last year of mandatory education, or 11th grade. The vertical dotted lines indicate the years in which the three key changes to the GSP's allocation formula were introduced. Two facts stand out: (1) Average test scores among public school students have remained relatively stagnant over time; and (2) the lack of inclusion of quality criteria in the allocation formula introduced in 2016 coincides with a persistent drop in test scores.
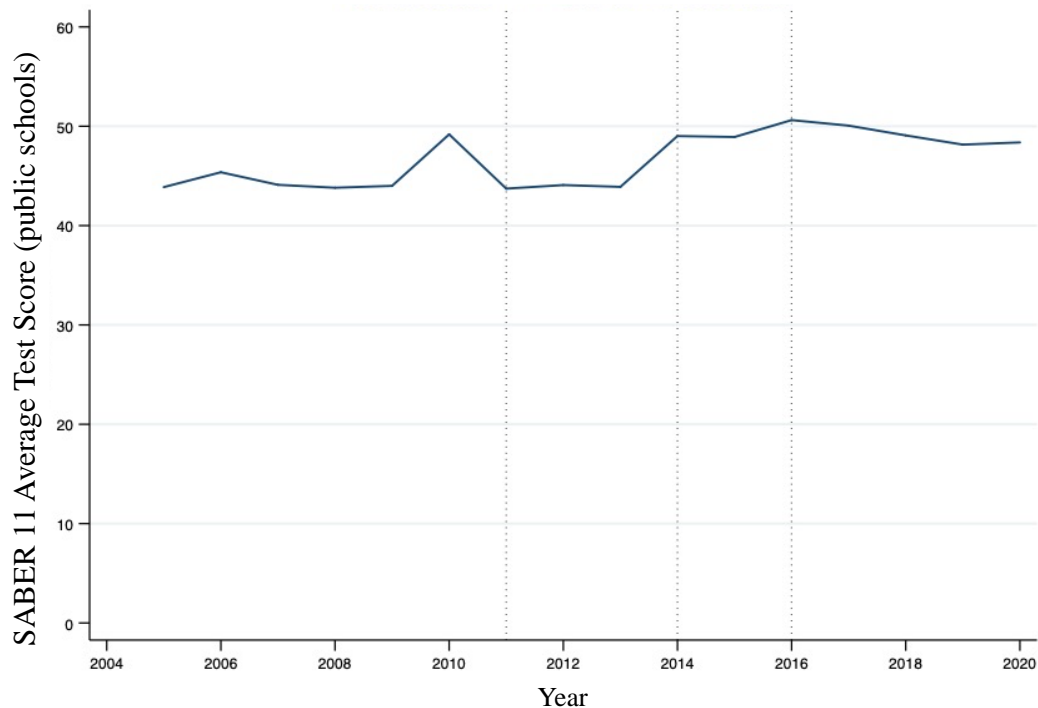
Source: Author's figure using the Colombian Institute for the Evaluation of Education data.

Note: In 2014, the SABER 11 instruments were modified to make them comparable to other national assessments, and thus the rise in scores in 2015 may be related to this change and not to actual improvements in learning (Acero and others, 2016).

3.   Methodological approach and data

Because I am interested in exploring how Colombia's GSP—both in terms of the amount of investment and its allocated to subnational entities—is affecting average student learning and gaps in student learning, I employ a two-stage approach. In the first stage, I explore the relationship between student learning outcomes and fiscal transfers to the municipal level (for which we had rich data) during 2010-2020. I also explore how the relationship between education

investment and student outcomes varies by a municipality's fiscal management capacity. Then, in the second stage, I examine the change in the GSP funding formula resulting from the 2015 reform to evaluate its impact on student learning outcomes. I employ interrupted time series analysis (ITSA), a methodology commonly used to evaluate the effectiveness of policy interventions at the population level implemented at a clearly defined time period (see Appendix 1 for details on the methodological approach).

I constructed a dataset at the subnational level with information from years 2010 through 2020 that includes data on student performance in the Saber 11 assessments obtained from the Colombian Institute for the Evaluation of Education (ICFES), the resources transferred through the GSP to each municipality, and the Fiscal Performance Index, obtained from the National Planning Department (DNP). The Fiscal Performance Index measures the financial management capacity of subnational entities by taking into consideration their capacity to generate their own resources, indebtedness, investment levels, and financial management capacity (DNP, 2020). The final sample consists of 12,203 observations from 1,114 municipalities over the 11 years studied. About 99 percent of the municipalities in the sample have records for all years.

4.   Findings

My findings suggest that there is a weak relationship between financial resources, fiscal management capacity, and student learning in Colombia. I find small but statistically significant effects on student learning outcomes of fiscal transfers or an improvement in the Fiscal Development Index (FDI). The first bar in Figure 5 shows that a 1 percent variation in the amount transferred for education is associated with an increase of 0.063 points in the average Saber 11 score. The magnitude of the impact on student learning of the FDI is marginally larger, as a 1 percent increase in the FDI is associated with an improvement of 0.072 points in the average Saber 11 score.

I also explored the relationship between transferred resources and the FDI on the gap in student learning between low-performing (25th percentile) and high-performing (75th percentile) students. Again, my findings suggest a weak relationship between resources and learning gaps, but in the opposite direction: the more resources transferred, the greater the learning gaps. In the third and fourth bars of Figure 5, I show that a 1 percent growth in the amount transferred for service delivery is associated with an increase of 0.065 points in the Saber 11 score gap, while a 1 percent increase in the FDI is associated with a widening of the gap in Saber 11 scores of 0.051 points.

Figure 5. Estimated effects of the amount of transfers and fiscal performance on student learning outcomes
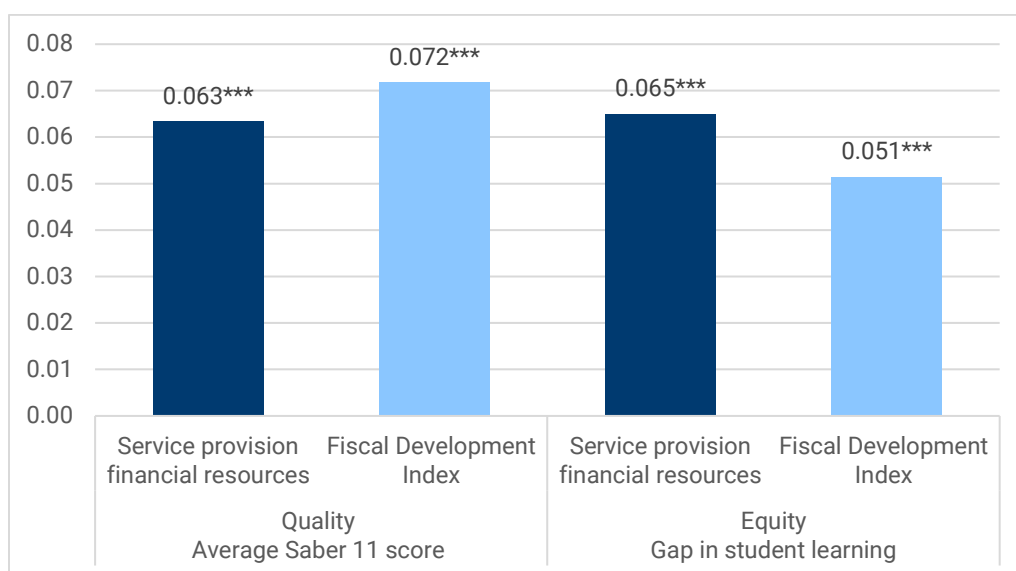
Source: Author's estimates using data from Colombia's National Institute for Education Evaluation (ICFES).

My analysis of the impact of the 2015 change in the SGP formula indicates that the change led to a short-term rise in in average student learning over time, but thereafter average learning declined. Figure 3 presents a graphical representation of the impact of the 2015 reform on average scores in the Saber 11 assessment. In the first year after the reform, average scores jumped by about 4 points, but they have been declining since. Thus, it does not appear that the reform will lead to sustained improvements in student learning over time.

Figure 3. Impact of the 2015 reform on average Saber 11 test scores

Source: Author's estimates using data from Colombia's National Institute for Education Evaluation (ICFES).

Strikingly, the reform led to increased learning inequality between students from the top and bottom of the learning distribution. Figure 4 presents a graphical representation of the impact of the 2015 reform on student learning inequality, or the learning gap between students in the 75th percentile and those in the 25th percentile of the test score distribution. The results suggest that the reform led to an increase in learning inequality, as the gap in student learning increased right after the 2015 reform and has continued growing since then.
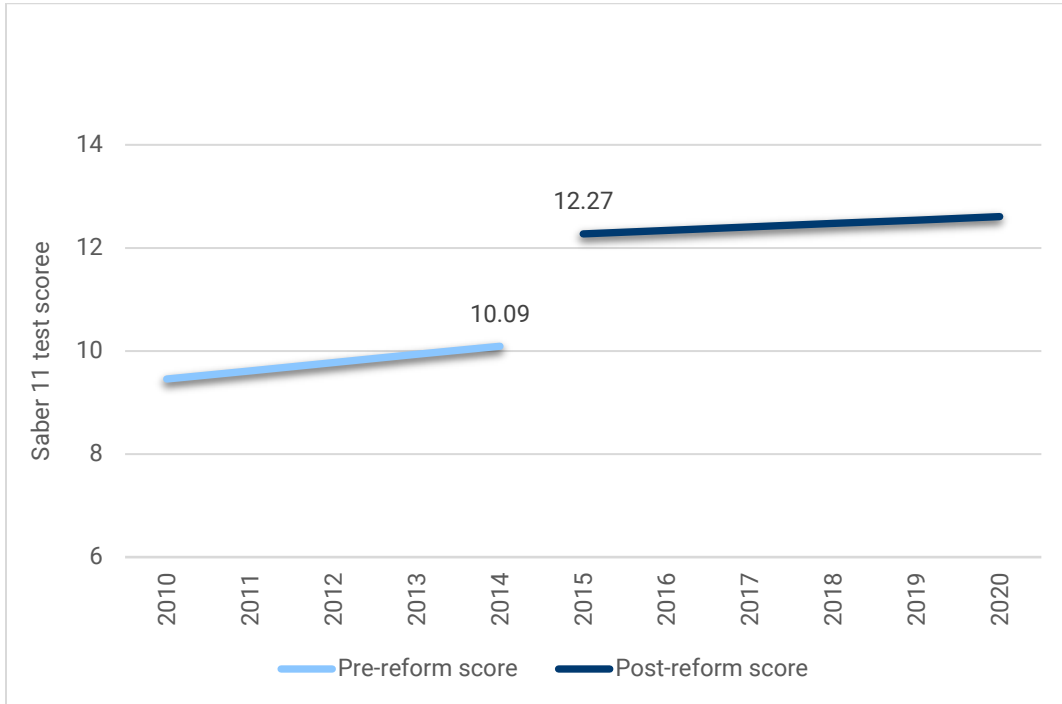
Figure 4. Impact of the 2015 reform on student learning gaps

Source: Author's estimates using data from Colombia's National Institute for Education Evaluation (ICFES).

5.   Discussion

Consistent with previous research on the impact of financing on education outcomes, my research indicates that in Colombia larger fiscal transfers from the national government to subnational entities are associated with improved learning outcomes. However, the magnitude of this relationship is small, suggesting that *how* these resources are distributed may matter more to improve education quality and reduce learning inequality.

During the past decade, criteria aimed at improving the quality and equity of education have not been consistently included in the formulas used to transfer resources from the national government to subnational entities through the GSP. While the formulas applied between 2011 and 2014 included some equity considerations, such as the Multidimensional Poverty Index and share of disadvantaged populations in student enrollment, these variables were not

maintained in the formulas applied after the 2015 reform. And while the funding formulas used in 2015-2016 included variables related to student learning or progression in the education system, these were excluded in later years.[2]

Given this scenario, it is perhaps not surprising that student learning in Colombia has remained stagnant, while learning gaps are growing. And, while leading to short-term increase in student learning, the 2015 changes in the GSP allocation formula are associated with a decline in average student test scores and an increase in learning gaps between high- and low-performing students in later years.

If Colombia is to reach its goal of ensuring that all children and youth have access to quality education, it needs to rethink the design of its main source of education finance, the GSP. Based on international evidence, Colombia should consider increasing the share of fiscal transfers to subnational governments that are linked to indicators of quality and equity in the provision of education services.

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[2] The quality dimension included CTE-level variables of performance on the Saber 3, 5, 9, and 11 tests and dropout, repetition, and survival rates.

6.   References

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Appendix 1. Methodological approach and detailed estimates

Stage 1: Panel model with fixed effects by municipality

In the first estimation stage, a panel model with fixed effects per municipality is used to identify the causal effect of the resources transferred for the provision of educational services on educational quality and equity results. This model considers the existence of fixed effects over time for each of the municipalities that are related to the explanatory variables included in the model. The fixed effects include unobservable characteristics of the municipalities that remain constant over time, such as the institutional capacity of each municipal entity. Additionally, all models are estimated using robust errors seeking to correct for possible individual heteroscedasticity mentioned by the presence of clusters at the level of certified territorial entity or department. The panel type estimation is done with municipality fixed effects as follows in equation (1):

$$Y_{it} = \beta_0 + \beta_1 X_{it-1} + \gamma_i + \varepsilon_{it} \qquad (1)$$

In equation (1):

- X_{t-1} is the independent variable of interest lagged by one period. Estimates are made for two variables: the amount transferred for the provision of educational services and the Municipal Fiscal Performance Index.

- Y_{it} is the dependent variable of interest. Estimates are made using two variables: the municipality's average overall score on the Saber 11 tests and the gap between low- and high-percentile performance on the Saber 11 tests.

- γ_i are fixed effects at the municipality level, which represent the component of unobservable and constant characteristics of the municipality.

- ε_{it} is the model error.

Table 2: Estimated effects of the amount of transfers and fiscal performance on student learning outcomes

	Resources for service provision		Municipal Fiscal Performance Index	
	Linear shape	Logarithmic transformation	Linear shape	Logarithmic transformation
Panel A. Quality				
Average overall score	3,52e-11***	6,333***	0,111***	7,172***
	(1,80e-11)	(0,149)	(0,00792)	(0,511)
Panel B. Equity				
Difference p25 to p75	3,78e-11***	6,490***	0,0912***	5,143***
	(1,98e-11)	(0,0974)	(0,00646)	(0,432)
Remarks	11.031	11.031	10.904	10.904
Number of municipalities	1.108	1.108	1.095	1.095
R-squared	0,019	0,216	0,030	0,025
Fixed effects municipality	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Stage 2. Interrupted time series analysis (ITSA)

The second stage of the methodology is based on an ITSA to evaluate the effectiveness of policy interventions—in this case the change in the 2015 funding formula on the quality of education measured as the performance of students in public schools in the Saber 11 tests. This methodology is ideal for these types of research questions because it allows constructing the counterfactual with the

trend that the outcome variable of interest had been presenting. The counterfactual is a hypothetical scenario, in which the intervention would not have taken place and the trend of the outcome variable remains unchanged. This hypothetical scenario provides a comparison for the evaluation of the impact of the intervention, as it examines any changes that occur in the post-intervention period either in levels or in variations (Bernal, Cummins, & Gasparrini, 2017). To implement this type of analysis, two conditions must be met: i) a clear differentiation between the pre-intervention period and the post-intervention period and ii) one or more outcome variable(s) that can take various forms, such as counts, continuous data, or binary variables. Both conditions are met in this case.

As explained above, the SGE allocation formula experienced several changes during the 2002-2020 period. But the most substantial changes were introduced in the 2015 reform, which introduced a per-student allocation formula for each CTE.

A standard ITSA analysis uses a segmented regression model in which three main variables are defined: i) the time elapsed (in years) since the policy intervention; ii) a dummy variable indicating the pre-intervention period (takes the value of 0) and the post-intervention period (takes the value of 1); and iii) an outcome variable (overall Saber 11 score). This specification allows for different trends in municipalities' performance over time in the pre- and post-intervention periods. Following the methodology of Murnane et al. (2017) that evaluates the impact of increasing the value of vouchers for students with lower incomes, we propose to estimate for the case of Colombia the following model for the municipality i in the year t:

$$Y_{it} = \beta_0 + \beta_1 T + \beta_2 X_t + \beta_3 T X_t + \gamma_i + \varepsilon_{it}$$

Where:

- T: time elapsed (in years) since the policy intervention $[-4, 6]$.

- X_t: a dummy variable indicating the period before the intervention (takes the value of 0 until 2014) and the period after the intervention (takes the value of 1 from 2015 onwards).

- Y_{it}: outcome variable (for the quality outcome it is the average overall score of the municipality in the Saber 11 tests, and for the equity outcome it is the gap between the performance of a low and a high percentile).

- γ_m: are fixed effects at the municipality level.

- ε_{it}: the model error.

According to Linden (2015), the interpretation of the coefficients for the quality scores is as follows:

- β_0 is the initial level of the Saber 11 tests (before the intervention).

- β_1 is the slope (growth rate over time) of the Saber 11 tests before the intervention.

- β_2 represents the change in the level of the Saber 11 tests in the period immediately after the intervention (year 2015) compared to the counterfactual.

- β_3 represents the change in slope after the intervention.

Table 3. Estimated impacts of the 2016 SGP reforms on average learning and learning inequality

	(1) Overall score	(2) Difference p25 to p75
T	-0.0549**	0.159***
	(0.0222)	(0.0151)
X_t	4.255***	2.180***
	(0.0849)	(0.0576)
TX_t	-0.304***	0.0671***
	(0.0278)	(0.0189)
Constant	47.62***	9.456***
	(0.704)	(0.478)
Observations	12,149	12,149
Number of municipalities	1,109	1,109
R-squared	0,699	0,647
Fixed effects by municipality	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1