

# Heterogeneous impact of Results-Based Education Financing

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## ABSTRACT

The Ceará was the first Brazilian state to introduce a policy of redistributing state's tax (ICMS) transfers based on the aggregate educational performance of the municipalities (*Quota-Parte* program). This paper examines whether the ICMS Law, implemented in 2009, affected the composition of municipal spending, particularly if it increases the expenditure on education. The results show that receiving more resources from the ICMS Law did not produce a higher expenditure on education; however, municipalities increase the total non-educational expenditure. Specifically, for each real received by the municipalities due to the *Quota-Parte* program, R\$ 0.45 was spent on education (R\$ 0.23 in Elementary Education) and R\$ 1.96 on total expenditure per capita. In the second part of the paper, we ask if the municipalities benefited from this policy allocate their resources to higher-performing schools, consequently increasing the inequality among schools within municipalities. We find evidence of possible targeting in public spending on education for the best-performing schools. The results suggest that policymakers need to pay close attention to adopted this incentive scheme of redistribution based on educational performance because of the risk of an increase in the inequality in the schools within the municipalities.

**Key words:** Educational financing. Intergovernmental transfers. Educational performance.

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# 1 Introduction

A fundamental factor to the provision of public education is the financing. Recent pieces of evidence indicate that the number of resources spent matters for educational outcomes (JACKSON; JOHNSON; PERSICO, 2016; JACKSON; WIGGER; XIONG, 2021; HADDAD; FREGUGLIA; GOMES, 2017). In developing countries, the relevance of educational spending may be more salient, given the restriction of fiscal space that often restricts the educational resources. Particularly in Brazil, there is substantial heterogeneity in the relationship between public spending and education, suggesting that the incentives of educational expenditure may also affect the results (BARROS et al., 2018). Thus, the presence of a diffuse incentives scheme may impact the provision of quality public education and the effectiveness of educational spending.

Recent policies attempt to consist of distributes public resources based on the performance or merit of those responsible for education (stakeholders). This kind of policy aims to solve the agency's problem by inducing the stakeholders to obtain better educational results (CARNEIRO; IRFFI, 2017). Different schemes have already been applied and tested <sup>1</sup> around the world, and their results are promising. The standard approaches redistribute resources at the school level (FIGLIO; ROUSE, 2006), the professor level (REBACK, 2008; FERNANDES; FERRAZ, 2014; MBITI et al., 2019), or the parental level (FIGLIO; LUCAS, 2004). The main advantage of adopting this type of policy is the creation of incentives aimed at improving education. On the other hand, critics argue that such incentives can replace the intrinsic motivation of education and increase inequality between entities or individuals (FIGLIO; GETZLER, 2006; CULLEN; REBACK, 2006; NEAL; SCHANZENBACH, 2010).

An innovation introduced by the state of Ceará in 2009 was the redistribution of tax transfers based on the aggregate educational performance of the municipalities. Unlike other strategies that focus on school, teacher, or student levels, the Law n<sup>o</sup> 14.023 of 2007 (henceforth *Quota-Parte* program (QPL)) defined criteria for distributing resources from the ICMS tax quota according to the educational performance of the municipalities in Elementary Education. This performance is measured considering all schools in such a municipality, implying a greater incentive to mayors to increase the local educational levels. One-quarter (25%) of resources received by the state tax with ICMS are distributed to municipalities, and 18% of these resources are distributed according to municipal educational performance. The remaining 7% are distributed according to the quality of health and the municipal environment.

Initial empirical evidence points out that such a policy increased student performance <sup>2</sup>. The Figure 5, available in Appendix, summarizes part of this evidence. The average performance of the municipalities in IDEB (Basic Education Development Index) presented a significant increase in the 5<sup>th</sup> grades of Elementary Education of Ceará's students, even though the state has the similar adverse socioeconomic situation of neighboring states.

The *Quota-Parte* program has two interesting features. First, the resources distributed are fungible; that is, the mayors who receive the resources are not obliged to spend them on education. This implies that there is no guarantee that the resources will be allocated to education. Second,

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<sup>1</sup>For a recent review of this literature, see Lee e Medina (2019).

<sup>2</sup>Examples of this literature are: Brandão (2014), Carneiro e Irffi (2017), Petterini e Irffi (2013), Shirasu, Irffi e Petterini (2013). A limitation of part of this literature stems from the absence of controls for policies that have been implemented at the same time as the *Quota-Parte* program. In the case of Ceará, an important program that can confuse the results is the Literacy Program at the Right Age (PAIC). Recent evidence (MURALIDHARAN; SINGH; GANIMIAN, 2019) shows that the combination of performance spending policies and incentives for their proper implementation can explain most of the results.

the performance of students is measured at the aggregate municipal level. This last characteristic incentive the municipal to raise the average performance of students, even if inequality among schools also increases.

This article aims to analyze these two aspects. First, we investigate whether municipalities that received more resources with the *Quota-Parte* program in 2009 increase the spending on education. Although the resources are not fungible, it is interesting to understand the composition effect of the transfers on municipal spending. Second, we examine whether previous school performance, before the *QPL* program, matters for educational school performance in municipals that benefited from the program in comparison to municipals that lost resources with the policy introduction.

We report two main findings. First, municipalities that benefited from the *Quota-Parte* program did not increase the spending on education. However, we observe an expansion in the total non-educational expenditure. Specifically, for each real received by the municipalities from the program, R\$ 0,45 was spent on education (R\$ 0,23 in Elementary Education) and R\$ 1,96 on total expenses per capita.

Second, by exploring inter-municipal heterogeneity in school performance before the *Quota-Parte* program, we find that schools with low performance in 2007 did not increase their educational results in municipalities that have been benefited from this program. The estimates suggest that the *Quota-Parte* program had a relevant impact in schools with higher performance before the introduction of the program. The direct implication is that such a policy increased educational inequality within the schools.

In addition, we extend our findings to verify whether there was evidence of different allocation of resources within the schools. We test if municipalities that received more resources from *QPL* impacted others school outcomes associated with the quality of public education provision and also with higher spending on education. The results suggest that schools with prior higher performance in municipalities benefiting from *QPL* significantly reduced the average class size. This same result was not found for schools with lower previous performances in municipalities also benefiting from *QPL*. There was no significant difference concerning the average number of hours per day, although the magnitude of the estimates supports the validity of the hypothesis of different allocations between schools.

Taking together, the intergovernmental transfers policy based on the educational performance of municipalities did not raise the expenditure on education and increased the educational inequality at the school level<sup>3</sup>. These differences within the schools may be driven by a specific allocation of resources in schools with higher previous performance. In 2011, the program was reformulated ([decree 30.796/2011](#)) to provide incentives to municipalities that improve the grades of low-achievers students ([JÚNIOR; OLIVEIRA; LOUREIRO, 2020](#)). This reformulation suggests that Ceará's government may perceived that previous rule given incentives for selective spending by the majors.

This paper contributes to some areas of economics of education. First, for a broad literature on the importance of public spending for the quality of education ([HANUSHEK, 2005](#); [MANUELLI; SESHADRI, 2014](#); [HADDAD; FREGUGLIA; GOMES, 2017](#); [JACKSON; JOHNSON; PERSICO, 2016](#); [JACKSON; WIGGER; XIONG, 2021](#)). Second, in order to provide adequate incentives, many policies are designed to reward performance. Recent research has been carried out on this topic, and this article contributes by analyzing how incentives to specifics stakeholders potentially generate differentiated resource allocations: [Plecki et al. \(2006\)](#), [Beuermann et al. \(2018\)](#), [Haddad, Freguglia e Gomes \(2017\)](#), [Mbiti et al. \(2019\)](#), [Mbiti, Romero e Schipper \(2019\)](#), [Romero, Sandefur e Sandholtz \(2020\)](#), [Kerwin e Thornton \(2021\)](#). Finally, financing public education is a challenge in developing countries like Brazil.

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<sup>3</sup>The *Quota-Parte* program was reformulated in 2012 to adapt the incentives to reduce inequality performance among the schools.

Thus, this paper contributes to a broad literature that attempts to understand which mechanisms should be used to increase education spending. Specifically, we focus on the impact of intergovernmental transfer programs, similar to [Brandão \(2014\)](#), [Carneiro e Irffi \(2017\)](#), [Petterini e Irffi \(2013\)](#), [Shirasu, Irffi e Petterini \(2013\)](#), [Júnior, Oliveira e Loureiro \(2020\)](#), [Silva \(2021\)](#). This last point is essential given the approval of the new FUNDEB (Basic Education Maintenance and Development Fund), which was partly inspired by the Ceará program. Our paper contributes to the literature by highlight the backfires of similar results-based transfers.

In addition to this introduction, this paper is subdivided into six more sections. The following section details the *Quota-Parte* program. Section 3 discusses the database used in this work and the empirical strategies adopted. Section 4 reports and discusses the results in the impact of *QPL* on Municipal Public Spending. Section 5 reports the results in the Effect of *QPL* on Educational Outcomes. Section 6 discusses the Mechanisms of allocation resources. Finally, section 7 comments on the general conclusions of the work.

## 2 Transfer Results-Based Policy

The state of Ceará overcomes adverse socioeconomic conditions to improve education outcomes. The state promoted a relevant educational reform that increases the learning in literacy to elementary school students through Financing Results-Based (FBR) policies as part of a more broad educational reform program ([LOUREIRO et al., 2020](#)).

The Ceará's effectiveness is based on three interdependent policies, which can be mentioned as following: 1. Financial incentives for the municipalities to reach the established educational goals (*Quota-Parte* program); 2. Technical assistance to municipalities with difficulties to improve learning, emphasizing literacy at the right age for students (PAIC); 3. A reliable monitoring and evaluation system that continuously measures the main results of education, including student learning (SPAECE)<sup>4</sup>.

The ICMS (State tax of good and service circulation) is a Brazilian tax that the Constitution establishes that 1/4 of its revenues must be redistributed throughout the municipalities. This inter-governmental transfers is named as *Quota-Parte*. The decision on how to distribute such resources is defined by the states. The novelty implemented by the state of Ceará was to use such discretion to induce municipal governments to seek to improve social results, particularly in education. That was one of the first experiences in this direction carried out in Brazil. Most states allocate the ICMS's revenue based on the population criteria. Exception are the states of Ceará, Pernambuco, Amapá, Minas Gerais, Bahia and Espírito Santo, which adopt a criteria based on the quality of public service provision. However, Ceará stands out in this group of states for having the highest percentage of the share of the ICMS linked to this form of distribution.

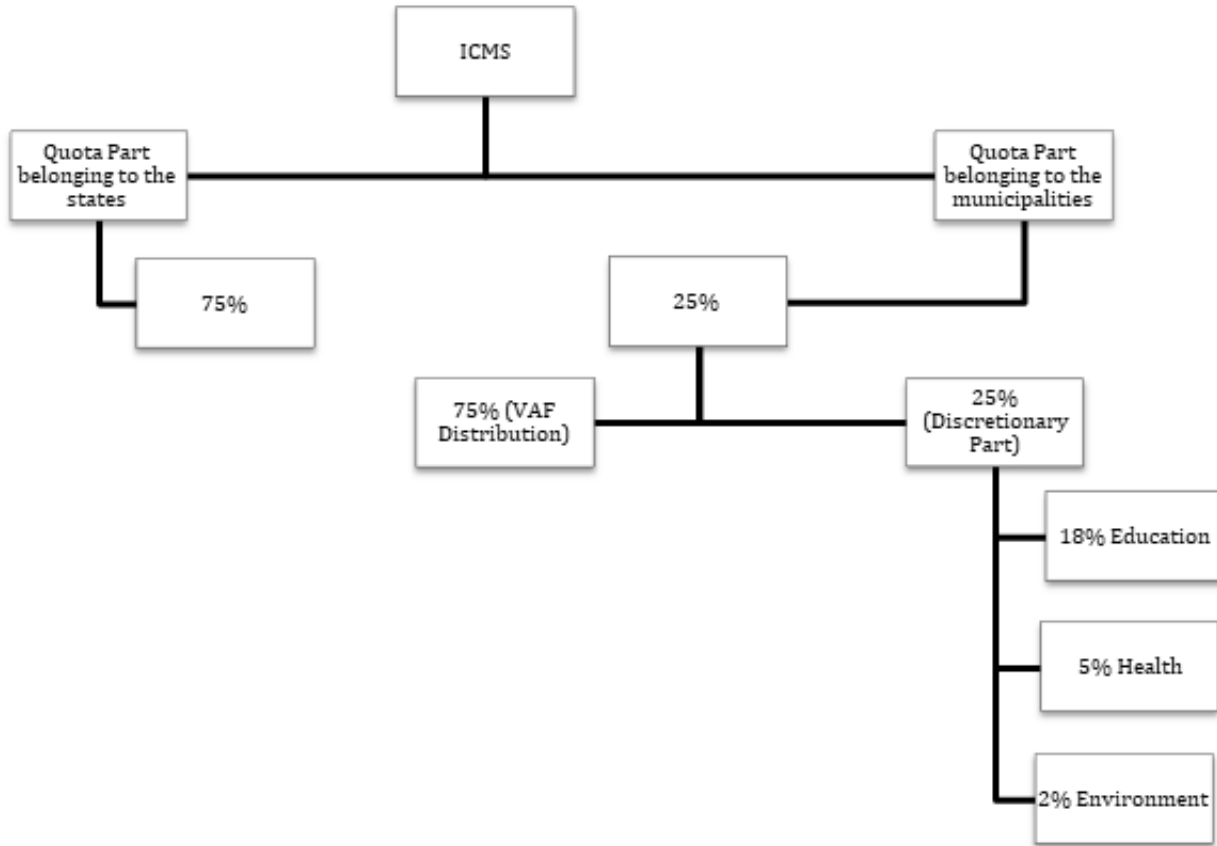
The main focus of Ceará's program is education. The program started from Law nº. 14,023 in 2007, was regulated in 2008, and became effective in 2009. From the 25% of the total state ICMS's revenue, 72% is destined based on municipal educational results, 20% for health outcomes, and 8% for environmental performance. That program of intergovernmental transfer replaced the previous criterion based on the size of the municipality, stated since 1996<sup>5</sup>. Figure 1 outlines the new distribution of ICMS for Ceará municipalities. The transfer is based on municipal performance in the educational quality

<sup>4</sup>Permanent Evaluation System for Basic Education in Ceará

<sup>5</sup>Law nº. 12,612 of 1996, established that the distribution of the ICMS share of the municipalities should comply with the following criteria: 75% in accordance with the tax added value; 12.5% relative to the proportion of spending on education over municipal revenue; 7.5% equitable to all municipalities; and 5% proportional to the population of each municipality.

indexes that consider the level and improvements in literacy of 2nd-grade students, the performance of 5th-grade students in reading and mathematics, and the average approval rates from 1<sup>st</sup> to 5<sup>th</sup> grade <sup>6</sup>.

Figure 1: ICMS transfer structure



The criteria for sharing 25% of ICMS not linked to added value were established by state law n<sup>o</sup>. 14,023 of December 17, 2007 <sup>7</sup> calculates the participation rate of ICMS 2009 collection, as follows: 18% based on the municipal rate of educational quality - IQE, based on indicators of level and progress in the quality of the initial cycle of Basic Education - 5th grade of Elementary School (ES) - and literacy indicators in the first years of formal education - 2nd grade of ES. The proportions of 1/3 for the IQF and 2/3 for the IQA were assigned, see (HOLANDA et al., 2008)

The IQF is calculated from a component that measures the flow of students, given by the pass rate, and two other components that measure the quality of education, related to the performance of students in standardized exams (Prova Brasil or SPAECE). All variables are standardized on the same scale, between 0 and 1, in relation to the results of other municipalities. The following weights are assigned: (i) 20% in relation to the pass rate in the initial grades of Elementary School and (ii) 80% in relation to the performance of students in standardized exams. The variable related to standardized

<sup>6</sup>For a review of the implementation of this policy, Simões e Araújo (2019), Brandão (2014). For a detailed description of the program rules see: Júnior, Oliveira e Loureiro (2020).

<sup>7</sup>Since 2012, when the computation of the formation of the educational index (IQE) was changed by Decree n<sup>o</sup>. 30,796 of 2011, the transfer of 18% of the ICMS share to the municipalities was linked to the weighted sum of the following components: (i) 50% of the resources are distributed according to the literacy quality index (IQA), calculated from the results in the literacy exam of students in the 2nd year of elementary school; (ii) 45% according to the elementary school quality index (IQF), measured about the performance of 5th grade students in Portuguese and mathematics tests; and (iii) 5% due to the average approval rate of students from the 1st to the 5th year.

exams, there is a level component and a variation (or advance) component, to which different weights are attributed: 40% in relation to the average grade of students in the 5<sup>th</sup> grade of elementary school; 60% in relation to the advance in the average grade of students in the 5<sup>th</sup> grade of elementary school.

The IQA is calculated based on the results of the Literacy Exam for Students in the 2<sup>nd</sup> grade of Elementary School, carried out by the Ceará State Education Secretariat – SEDUC. Starting in 2007, the exam is applied to students annually in order to monitor the literacy of children in the initial grades, assigning grades to all municipalities in Ceará. The IQA uses a methodology similar to the Elementary School Quality Index (IQF), as it relativizes and standardizes the variables and considers the level and advancement of literacy conditions for children in the municipality.

### 3 Data

The data has two parts. To assess the effect of the *Quota-Parte* program on municipal expenditure, we use the information from the Municipal Finance database - FINBRA, available in the National Treasury Secretariat - STN. We extracted the following variables at the municipal level: population size, total spending, spending on education, primary education, GDP, ICMS transfers, and federal intergovernmental transfer (FPM and FUNDEB)<sup>8</sup>. The temporal variation is from 2004 to 2017. The ICMS's share for education, health, and environment are obtained from IPECEDATA.

In turn, the educational data were obtained from administrative data from the State Department of Education of Ceará (SEDUC/CE). We consider the performance in the test scores of the 2<sup>o</sup> grade of elementary education, measured by SPAECE-Alfa. The SPAECE-Alfa uses Item Response Theory (IRT) to compare units sampled at different educational levels over time. Additionally, we use the School Census, provided by Educational Research Institute Anísio Teixeira - INEP, to access the school and teacher's variables. In the Appendix, we present the descriptive statistics of all variables (Table 6), as well the definition of all the variables (Table 7). Table 1 compares the pre-treatment variables.

Table 1: Descriptive statistics for municipals based in rank (until 2008)

Variables	Mean		SD		t test	
	Rank =1	Rank =3	Rank =1	Rank =3	t value	p value
population size	70335.891	26998.836	314092.59	39134.395	2.3	.021
total spending	52108146	19977493	248005236.58	28291861	2.2	.03
spending on education	13273205	6758540.9	48489794	8633119.7	2.25	.026
spending on primary education	11058119	5340960.7	41791771	6809668.6	2.3	.022
GDP	466997.65	136773.67	2772825.3	359656.63	2	.046
FPM	12984601	17867090	21321547	59070341	-1.3	.188
FUNDEB	7589038.2	4234720.7	22728872	4990045.5	2.45	.015
IMCS Transfers	6866874	2727865.7	38014985	7335085.6	1.8	.07
non-education spending	38834941	13218952	199666293.72	19757256	2.15	.031

**Note:** Two-sample t test with equal variances with  $H_0$ : diff = 0 and  $H_a$ : diff  $\neq$  0;  $p - value \rightarrow Pr(|T| > |t|)$ .

<sup>8</sup>We adjusted the variables to real forms using the IPCA-Fortaleza, available at the Brazilian Institute of Geography and Statistics - IBGE.



## 4 Impact of *QPL* on Municipal Public Spending

The empirical strategy is also divided into two parts. In the first part, we attempt to answer the following question: what is the impact of receiving more resources from the *Quota-Parte* program on educational and non-educational municipal expenditures? Our interest is to understand whether the *QPL* induces more spending on education, a desirable side effect. To answer this question, we use a difference-by-difference (DiD) strategy that exploit the prior educational quality of municipals, before the introduction of the *Quota-Parte* program. Our equation of interest is as follows:

$$\Delta Y_{gmt} = \sum_{t=2004}^{2007} \beta_{1t} \Delta CP_{mt} \times I(m = Q_1) + \sum_{t=2009}^{2017} \beta_{2t} \Delta CP_{mt} \times I(m = Q_1) \times I(After) + \delta' X_{gmt} + \tau_m + \tau_t + \gamma_{mt} + \varepsilon_{mt} \quad (1)$$

Where:  $\Delta Y_{gmt}$  is the per capita difference in the spending's type  $g$  in relation to 2008 value, at municipality  $m$ , and the year  $t$ . We fixed the population size in 2008 to avoid that the population changes affect the variables. This year is used as a reference just because it is one year before the *Quota-Parte* program implementation. Then, the definition of  $\Delta Y_{gmt}$  is as follows:

$$\Delta Y_{gmt} = \frac{G_{gmt} - G_{gm,2008}}{Pop_{m,2008}} \quad (2)$$

Where  $G_{gmt}$  is the specific spending's type  $g$ , at municipality  $m$ , and the year  $t$ .

The  $\Delta CP_{mt}$  refers to the difference between the revenue of the ICMS share at period  $t$ , and the municipality  $m$ . It indicates the variation in ICMS redistribution by municipals concerning the values in 2008.

$$\Delta CP_{mt} = \frac{CP_{mt} - C_{m,2008}}{Pop_{m,2008}} \quad (3)$$

Our aim is to understand whether the variation on *Quota-Parte* share affects the municipal spending composition. As before 2009, the ICMS resources was redistributed according to population criteria, such variable  $\Delta CP_{mt}$  measures how much each municipality receive more or less after the introduction of the *Quota-Parte* program. The ICMS after 2009 was redistributed based on educational performances in 2007 and 2008. We exploit this criteria modification to assess the effect of the *Quota-Parte* share gains on educational spending.

The variable  $I(m = Q_1)$  designates the treated municipals. That is an indicator variable that assigns 1 to the municipalities with the best educational performance before implementing the *Quota-Parte* program in 2009. These municipalities are most likely to benefit from the redistribution of the ICMS after 2009. In addition,  $I(m = Q_1)$  assigns zero to all other municipalities. We use the quality of education index (IQE) for 2009 ( $IQE_{m2009}$ ) to define which municipals have the best educational level before the introduction of the *Quota-Parte* program. The  $IQE_{m2009}$  measures the aggregate performance of the municipals for the years 2007 and 2008. Thus, we considered as treated municipalities at the top 30<sup>th</sup> percentile (the 30% best-ranked municipalities) . The remaining 70% were considered controls.

Our parameters of interest are  $\beta_{2t}$  that measure the impact of public spending in municipalities that likely present variation in the share of *Quota-Parte* ( $\Delta CP$ ). This parameter estimate change according to a variation on  $\Delta CP$ . We expect that a large increase in the municipal share of *Quota-Parte* represents a rise in public spending.

The parameters  $\beta_{1t}$  are used as a falsification test. We expect the variation in these parameters to be insignificant, suggesting that the future changes in  $\Delta CP$  did not correlate with previous changes

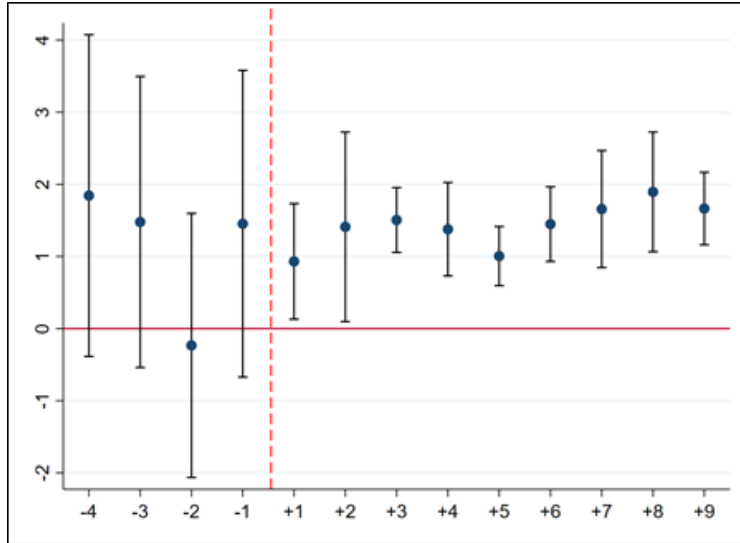
in public spending.

Additionally, the vector  $X_{gmt}$  contains municipal-level controls, as Municipal GDP, Others state and federal transfers, Ratio between the higher 10% and the 40% lower income (a measure of inequality), the proportion of the population; aged for primary education, the proportion of older people, proportion of the urban population.

Finally,  $\tau_t$  and  $\tau_m$  are year and municipal fixed effects that absorb idiosyncratic temporal (economic shocks, droughts, etc.) and local variations. The public spending, in general, is strongly associated with the economic cycle of the respective municipalities. Municipalities may vary the expenditure according to the local economic cycle (ZIDAR, 2019). Thus, to control for the cycles variation, we introduce the fixed effects of the economic cycle of each municipality varying over time,  $\gamma_{mt}$ . We follow (ZIDAR, 2019) to estimate this cycle economic fixed effect. Specifically, we estimate the variance of the annual growth rate of real GDP of each municipality between the years 1999 and 2017. Subsequently, we clustered this variance measure into four groups characterizing different economic cycles for each municipality. Thus, we interacted each of groups with year variable included in equation (1). Standard errors were estimated at the municipality level.

The Figure 2 and Figure 4 show the graphical results of the estimation of Equation 1. Specifically, Figure 2 refers to total municipal expenditure and Figure 4 refers to expenditure on education. In Figure 4, we present in Panel A, the total municipal spending in education, including all types of educational provision. In Panel B, we restricted to Elementary Education spending. It is important to note that Elementary Education is the educational stage relevant to a municipal receive more transfers from QPL.

Figure 2: Effect on Total Expenditure of the Share *Quota-Parte* program



**Note:** Figure 2 presents the estimated impact of the introduction of *Quota Parte* program, denoted in a red vertical dash line. The results after implementation indicate that total municipal spending increased significantly. Such impact is persistent over time, suggesting that QLP produced long-term changes in the number of resources spent.

Initially, the estimates before implementing the *Quota-Parte* program (denoted by the vertical red dashed line) are not significant. It is favorable evidence for the hypothesis of parallel trends required for the validity of the difference-in-difference strategy. Estimates indicate no difference between the total expenditures of municipalities with high educational performance compared to other municipals



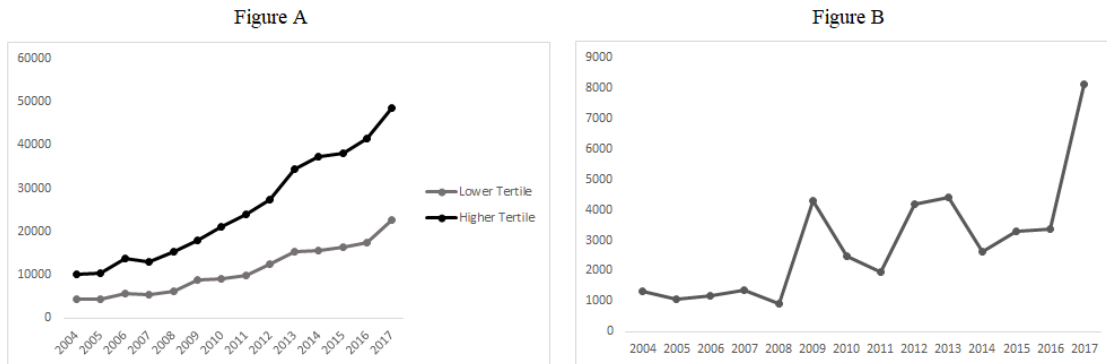
before the introduction of the *QPL*. Thus, the intergovernmental transfers before 2008 do not explain the differences between the spending patterns among the municipalities. Important to note the presence of a large variance estimate before the *QPL*, suggesting a significant heterogeneity in the association between the total municipal spending and intergovernmental transfers. After the program introduction, this relationship becomes more precise.

The estimates after the introduction of the program, we observe an increase in total municipal spending near to R\$1.62 per capita for each real received by the municipality due to the *Quota-Parte* program, in relation to the municipal expenditure in 2008. This finding suggests that municipal spending raises more than the amount received by *QPL*. We report the point estimates in the [Table 2](#).

This result is related to the Flypaper Effect according to which governments tend to spend more than the resources they receive from intergovernmental transfers<sup>9</sup>. In the case of *QPL*, the municipalities almost doubled their total spending in the face of an increase in transfers of resources.

In addition, and maybe more important, such an increase in total spending is persistent over time, suggesting that *QPL* produced a long-term impact on the total resources spent by municipalities. That is also related to the total of transfers received by the municipals after the introduction of *QPL*. We observe that municipals, benefited from *QPL* in 2009 kept receiving more resources than municipals that lost after the introduction of *Quota Parte* program. This can be observed in the [Figure 3](#).

Figure 3: Total intergovernmental transfers received by municipals



**Note:** Figure 3 presents the total of intergovernmental transfers received by municipals separated in two groups: Lower and higher tertile according to our main measure of municipal educational achievement (IQE).

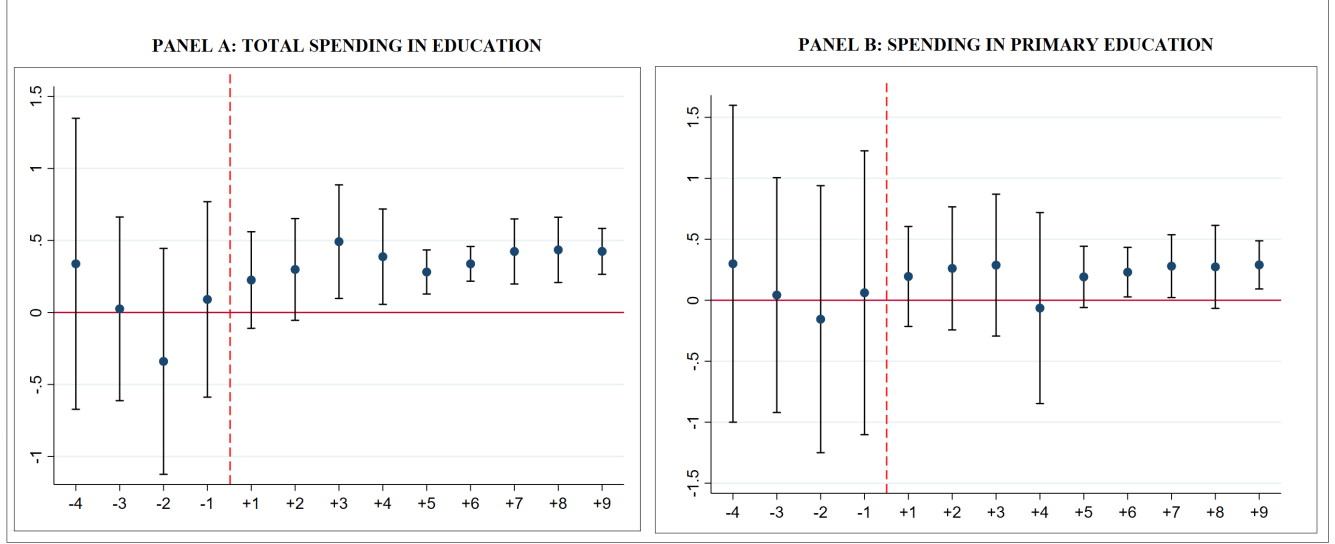
We also divided the municipals according to lower and higher tertile of our measure of municipal educational achievement (IQE) and calculated the total of intergovernmental transfers received by each group. Figure A shows that the introduction of *QPL* in 2009 represented a persistently increase in the intergovernmental transfer received by the municipals with higher educational results. In turn, figure B presents the difference between the total intergovernmental transfers received by both groups and confirms that the introduction of *Quota Parte* program represented a persistent rise of resources allocating to municipals with higher performance before the program.

The [Figure 4](#) presents the results for spending on education and spending on elementary education. The expenditure in education increased marginally as a result of the *Quota-Parte* program. The average estimate is 0.46 cents per capita for each real received by the share in 2009. However, spending

<sup>9</sup>The exact definition of the flypaper effect is that local governments increase public spending by more than do increases in private income. There is an extensive literature documenting this phenomenon, see: [Hines e Thaler \(1995\)](#), [Inman \(2008\)](#), [Helm e Stuhler \(2021\)](#). For the case of educational expenditure, see: [Gordon \(2004\)](#) and [Cascio, Gordon e Reber \(2013\)](#). For a discussion of Brazilian literature, see: [Nojosa, Linhares et al. \(2018\)](#).

on primary education did not present significant estimates after the introduction of the *Quota-Parte* program. On average, the result for elementary education was an increase of 0.23 cents per capita for each real distributed. Thus, the *QPL* did not similarly increased the spending in education. Furthermore, more intergovernmental transfers from *QPL* did not raise the spending in elementary education.

Figure 4: Effect of the Share *Quota-Parte* program on Education and Elementary Education Spending



**Note:** Panel A shows spending on education. It is noticed that expenditure increased due to LCP. Panel B showing spending on primary education has not shown significant results in almost every year (before and after LCP).

It is important to observe that the transfer from the *QPL* are not fungible. This means that municipals are not forced to spent the resources on education. However, the results presented possibly represented an unintended side effect.

In summary, the findings show that the municipalities that received more resources from *Quota-Parte* program spent less than they received on education. However, total spending increased significantly, more than the share of these municipalities initially redistributed it compared to municipalities that did not benefit from the policy. Therefore, the *QPL* incentives the non-educational spending more than education spending for the municipalities benefiting from the program<sup>10</sup>.

## 4.1 Robustness

In this subsection, we perform two robustness exercises. First, we introduce a rich set of control variables that also may determine the municipal public expenditure. Second, we estimate an alternative economic cycle fixed effects based on the  $\beta$ -differencing approach of Blanchard et al. (1992). Additionally, we also report the estimate of the main strategy presented in Equation 1.

The Table 2 shows the results. Columns (1), (4), and (7) refers to estimates of the main specification (Equation 1). Columns (2), (5), and (8) show the estimates for a specification that includes a

<sup>10</sup>The same exercise was performed considering the total expense subtracted from the educational expense, defined as non-educational spending. The estimates confirm the conclusions indicating that non-educational expenditure increased by approximately 1.45 reais per capita for each real received with the program. Such results are not reported in the article for concision but can be obtained by email to the authors.

set pre-determinant controls. These controls are Municipal GDP, Resources from the Municipality Participation Fund, Funds from FUNDEB, Ratio between the income of the wealthiest 10% and the most deficient 40% (a measure of inequality), the proportion of the population aged for primary education, the proportion of older people, proportion of the urban population. These variables may contribute to explain the spending behavior. For example, municipalities with a large share of the older population or poverty may spend less on children policies (BORSZTYN, 2016).

Finally, columns (3), (6), and (9) present the results by replacing the municipal’s cyclically-quartile-specific year fixed effect by  $\beta$ -differencing approach of (BLANCHARD et al., 1992). We do not observe any significant difference in the estimates suggesting that the findings are not driven by omitted variables. The estimates suggest that an exogenous variation in the *Quota-part* share raises the total expenditure in a high magnitude; however, presents a small size effect on educational spending.

Table 2: Spent Robustness Results

Variables	Total Spend			Education Spending			Spending on Elementary Education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share Quota Transfers	1.627 (0.318)	1.606 (0.303)	1.670 (0.325)	0.381 (0.081)	0.382 (0.082)	0.379 (0.080)	0.258 (0.116)	0.256 (0.119)	0.256 (0.120)
Obs	2,345	2,291	2,291	2,345	2,291	2,291	2,345	2,291	2,291
$R^2$	0.921	0.921	0.911	0.913	0.914	0.911	0.719	0.721	0.713
Additional Controls	N	Y	Y	N	Y	Y	N	Y	Y
Year F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Municipal F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cycle-per-year F.E.	Y	Y	N	Y	Y	N	Y	Y	N
$\beta$ -differencing F.E.	N	N	Y	N	N	Y	N	N	Y

Robust Standard Errors in parentheses ( \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 ).

**Note:** Columns (1), (4), and (7) refers to estimates of the main specification. Columns (2), (5), and (8) show the estimates for a specification that includes aset pre-determinant controls. columns (3), (6), and (9) present the results by replacing the municipal’s cyclically-quartile-specific year fixed effect by  $\beta$ -differencing approach of Blanchard et al. (1992).

## 5 Effect of *QPL* on Educational Outcomes

We also attempt to understand whether the impact of the *Quota-Parte* share differently affected the performance of schools in the 2nd year of elementary school. Evidence in favor of this hypothesis may imply that *QPL* increases the inequality among the schools. To this end, we exploit the variability in the quality of schools within the municipals before the introduction of the program, an approach similar to that used by Cilliers, Mbiti e Zeitlin (2021). In summary, we compare schools with similar performance before the *Quota-Parte* program in municipals that earn more transfers from the *QPL* in relation to the schools in municipals that lost resources.

In 2007, the SPAECE-Alfa test was applied to all students in the 2nd year of elementary school. Based on this test, schools in each municipality of Ceará’s state (184 municipals), were divided into two categories according to their average performance: lower and higher achievers school. Lower achievers schools had an average performance in test scores below the median of schools in their municipal. On the other hand, higher achievers schools had an average performance above the median of all schools in

their municipal. To facilitate exposure, these categories will be indexed at  $k = 1$  and  $2$ , respectively.

The goal is to verify if there are significant differences in performance test scores among the schools of each category in municipalities that in 2009 earns more or less with the introduction of the *Quota-Parte* program. The benefited municipalities from *QPL* were obtained by ranking the  $IQE_{m2009}$  similarly to the empirical exercise in Section 4. The municipalities that earned with the program are in the 33<sup>rd</sup> largest percentile (treated group), the Neutral municipalities are between the 34<sup>th</sup> and 65<sup>th</sup> percentile. Finally, the municipalities that likely lost with the *Quota-Parte* are in the 66<sup>th</sup> to the 100<sup>th</sup> percentile (control group). Let  $I(CP_m) = 1$  if municipality  $m$  are in the treated group and  $I(CP_m) = 0$  if municipality  $m$  belongs to the control group. The neutral group is excluded to avoid collinearity.

Consider  $y_{imt}$  the average performance of schools  $i$  in SPAECE-Alfa of municipality  $m$ , at period  $t$ . Additionally, consider the categories  $k = 1, 2$  above defined. The empirical equation to be estimated for the second exercise is:

$$y_{imt} = \beta_0 + \sum_{k=1}^2 \beta_k \times I(CP_m) + \delta' X_{imt} + \tau_t + \theta_m + u_{imt} \quad (4)$$

The  $\beta_k$  is the parameter of interest and measured the effect of a given municipality in the treated group compared to the control group for each category  $k = 1, 2$  of schools. The parameters  $\tau_t$  and  $\theta_m$  are the year and municipal fixed effects, respectively. Standard errors were estimated at the school level.

The empirical strategy identifies the causal effects for two reasons. First, the introduction of the *Quota-Parte* program at the end of 2007 likely did not affect the performance of schools in that same year, as the SPAECE-Alfa exam was applied before the promulgation of the *Quota-Parte* program. Second, the introduction of the *QPL* can be considered exogenous in relation to the educational performance of schools in each municipality. That is, before introducing the *Quota-Parte* program, schools had differences in educational performance that are not correlated with future inter-municipal state transfers program. Important to note that we are not comparing lower and higher achievers schools in different municipalities. However, lower and higher schools are differentiated within the same municipals. This guarantees the validity of the second assumption.

A threat of the identification stems from the possibility that schools between categories  $k = 1, 2$  are not comparable before the *QPL*. To overcome this problem, two strategies are adopted. First, we consider a large set of pre-determined school-level controls, represented by the vector  $X_{imt}$ . This allows absorbing for observable differences among the schools measured before the introduction of the *QPL*. Second, we use the balanced entropy method, developed by [Hainmueller \(2012\)](#), to pairing the schools through the pre-determined variables. The pairing method allows comparing homogeneous schools.

We analyze if the effect of the *Quota Parte* program is homogeneous among the schools within the municipals on the school average performance at 2nd grade. We compare schools from municipals that have been benefited from the introduction of the *QPL* relative to similar schools in municipals that received less after the *QPL*. We consider the median of the average performance at 2nd grade, in 2007, to differentiate the schools between the higher and lower-performing schools. The results are presented in terms of standard deviations, and we also control for time and municipal fixed effects.

The [Table 3](#) presents the results of the estimation of equation (4). The result in column (1) compares the lower-performing schools in municipals with different transfer gains. In this turn, Column (2) compares higher-performing schools in municipals in the gradient of gains with *QPL*. Indeed, we are analyzing how these *QPL* gains have heterogeneous effects on schools above and below the median performance within the municipals.

The results suggest that higher-performing schools increase the performance at the average test score with the introduction of *QPL* (category  $k = 2$ ). However, lower-performing schools do not present

significant differences according to *QPL* gains. This result indicates that the inequality among the schools within the municipals increased after the *QPL* introduction.

An potential explanation to these estimates it is that the mayor decided to allocate the resources to the schools within the municipal differently. That is, they prefer to spend in schools with a larger potential to performs well. We verify this possibility in the next Section.

Table 3: Educational Results

	k=1	k=2
Treatment	0.537 (0.340)	1.112*** (0.376)
Obs	10,120	10,200
$R^2$	0.689	0.551
Municipal F.E.	Y	Y
Year F.E.	Y	Y

Robust Standard Errors in parentheses ( \*\*\*  
p<0.01, \*\* p<0.05, \* p<0.1 )

**Note:** k=1 ->Lower school median + 3rd tertile cp  
in relation to 1st tertile cp  
k=2 ->Upper median school + 3rd tertile cp in re-  
lation to 1st tertile cp

## 5.1 Robustness

An important issue associated with the estimates in the [Table 3](#) is the possibility that schools in different municipalities are not comparable in each of the median. That is, schools with low (or high) performance in 2007 in municipalities that will benefit from the *Quota-Part* program may not be directly comparable to schools with low (or high) performance in municipals that will lose resources with the *QPL*. To overcome this limitation, two robustness exercises are performed.

The first exercise uses a rich set of control at school-level. Such measures are related to the quality of the educational offer (such as teacher quality indicators, number of students) and the characteristics of students, average literacy rate, a measure of a school delay, among others. Importantly, all these covariates are predetermined and were measured in 2007, before the introduction of the *QPL*.

The second exercise applies entropy matching ([HAINMUELLER, 2012](#)) considering the same pre-determined variables used in the previous exercise. The pairing increases the similarity between schools through the assigned weights, enabling an adequate comparison between treaties and control groups. Both procedures are intended to allow such schools to be comparable in each category, k.

Table 4: Educational robustness results

Panel A: Adding Controls	k=1	k=2
Treatment	0.498 (0.440)	1.631*** (0.518)
Obs	8,389	8,648
$R^2$	0.702	0.575
Panel B: Matching by Entropy	k=1	k=2
Treatment	0.327 (0.354)	1.116*** (0.393)
Obs	8,389	8,648
$R^2$	0.718	0.604
Municipal F.E. by Cohort	Y	Y
Year F.E.	Y	Y

Robust Standard Errors in parentheses ( \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 )

**Note:** The treatment parameter analyzes the impact of the interaction between schools' proficiency and the transfer of the quota, previously part of the change in legislation. Each column represents a median of proficiency (lowest performance (1) to upper performance (2), respectively). The median is associated with the transfer of LCP (municipalities most benefited with the affected ones) in order to be able to define the treatment variable.

The results present similar estimations concerning the [Table 4](#). Lower-performing schools are not affected by the introduction of *Quota-Part* program. However, the higher-performing schools increase the average educational performance after the implementation of the *QPL*.

## 6 Mechanisms

A potential explanation for the previous results is the municipal's resources allocation is differently according to the school's productivity. We refer to school productivity as the capacity of the school to use the available resources to increase the average performance of its students. Schools with lower productivity may not be preferred by the mayor over those schools that use the public expenditure with higher productivity. Under the differences in the school's capacity to raise the student performance, the mayor may have incentives to increase the resources in schools that allowed a superior gain from the *QPL* program.

To verify this hypothesis, we estimate a model similar to equation (4), but replacing the dependent variable for indicators of school supply that may suggest greater spending in a specific school. We consider ten school-level variables as follows: Management Complexity; Teacher's Adequacy; Teacher's Effort I, II, III; Teacher's Regularity, Students per Class, and Teacher's with College Degree. To avoid multiple testing issues, we aggregate the outcomes using the principal component analysis (PCA) of

those variables<sup>11</sup>.

The variables are standardized to have mean zero and variance one, except for student per class and class duration. The results are available in the [Table 5](#). Important to note that those variables are related to the supply and quality of public education. Then, a heterogeneous variation of *QLP* program on those variables may indicate that mayors selected schools with different performances to spent the municipal resources.

The indicators of management complexity, teacher's adequacy, teacher's effort I and II, students per class<sup>12</sup> and class duration, were not significant. However, the signal of the estimates and the difference in magnitudes supporting our hypothesis that schools within municipals are selected to receive more grants.

Teacher's effort III, teacher's regularity, and teachers with a college degree are significant. Teacher's efforts show that schools in the upper median have more teachers for better schools, reducing the number of students, classes per teacher, and teachers' turnover. The teacher's regularity is similar for both groups. These results maybe consequence of the selection process for teachers in the public service.

Teacher's with a college degree is significant for both groups, however only positive for the lower median, indicating that schools in this position invest in teachers with a university degree, regardless of training. Potentially, higher-performing schools already had a large share of teachers with tertiary education, suggesting that the new teachers are hired to lower-performing schools.

The variable that uses principal component analysis (PCA) is negative, however significant for the higher-performing schools. These results complement the previous estimates, suggesting that the available resources are allocated differently in schools with better prior performance. The negative sign of the PCA estimate indicates a rise in the spending on higher-performing schools in relation to lower-performing ones when the introduction of *Quota-Part* program.

Table 5: Mechanisms Results

	Management Complexity		Teacher's Adequacy		Teacher's Effort I		Teacher's Effort II		Teacher's Effort III	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
treatment	0.500 (0.435)	0.160 (0.298)	1.062 (0.683)	-0.274 (0.384)	0.203 (0.418)	0.284 (0.238)	0.203 (0.418)	0.284 (0.238)	-0.770*** (0.247)	-0.802* (0.464)
Obs	2,404	2,513	2,179	2,373	2,179	2,373	2,179	2,373	2,179	2,373
R <sup>2</sup>	0.339	0.306	0.442	0.406	0.312	0.271	0.312	0.271	0.382	0.382
	Teacher's Regularity		Students per Class		Class Duration		Teacher's with College Degree		(PCA)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
treatment	0.895** (0.401)	0.825*** (0.292)	-0.014 (0.109)	-.0007 (0.875)	2.540 (0.672)	-3.037 (0.255)	0.421** (0.202)	-1.099*** (0.005)	-0.012 (0.098)	-1.488*** (0.005)
Obs	2,395	2,513	1,571	1,848	1,703	2,029	1,631	1,692	1,188	1,274
R <sup>2</sup>	0.370	0.382	0.414	0.318	0.699	0.638	0.444	0.424	0.003	0.547
Municipal and Year F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Matching by Entropy	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Robust Standard Errors in parentheses ( \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 )

**Note:** The variables are standardized to have mean zero and variance one, except for student per class and class duration, those variables are correlated to the supply and quality of public education. A heterogeneous variation of *QPL* program on those variables may indicate that mayors selected schools with different performances to spent the municipal resources.

<sup>11</sup>The detailed description of these variables are found in [Table 8](#), available in Appendix

<sup>12</sup>For the measurement of students per class, we use 1 divide by the average of students per class. This strategy allows us to interpret the results more clearly and with an increasing scale.



## 7 Conclusion

This article analyzed the impact of introducing the *Quota-Parte* program (*QPL*) that allocates intergovernmental transfer according to educational performance. We focus on two aspects not yet analyzed in the literature about the *QPL*: The allocation of municipal public expenditure and the educational performance inequality at the 2nd year of elementary school. The results show that municipalities that gain with *Quota-Parte* program allocated a larger part of resources on non-educational spending. Spending on education also increased after the introduction of the program, but modestly. The spending in primary education was not affected by *QPL*. This result suggests that the *Quota-Parte* program did not induce the municipalities to increase their spending on education. Important to note that this is not an objective of the program. The intergovernmental transfer from the *QPL* is non-earmarked money for the mayors. However, we expected that a side effect of the program was the incentive to spend more on education.

Subsequently, we verified whether the educational impact of the *QPL* was different among schools within the municipalities. The results showed that only schools with better previous performances improved their outcomes test scores when they were located in municipalities that gained with *QPL*. Thus, the *Quota-Parte* program increased the inequality among the schools within the municipalities.

These findings indicate the existence of a different allocation of resources within schools in benefited municipalities. We confirm this hypothesis by analyzing the impact of the *QPL* on a higher set of school-level variables. Estimates suggest that schools with greater productivity in the use of public resources potentially received more expenses from mayors.

Taken together, the results showed that the *QPL* effect did not induce municipalities to spend more on education and contributed to increasing educational inequality at the school level. Our findings suggest as policy recommendations that incentives based on performance, similar to *QPL*, should consider aspects related to the allocation of resources vising to avoid the increase of inequality of schools within municipalities.

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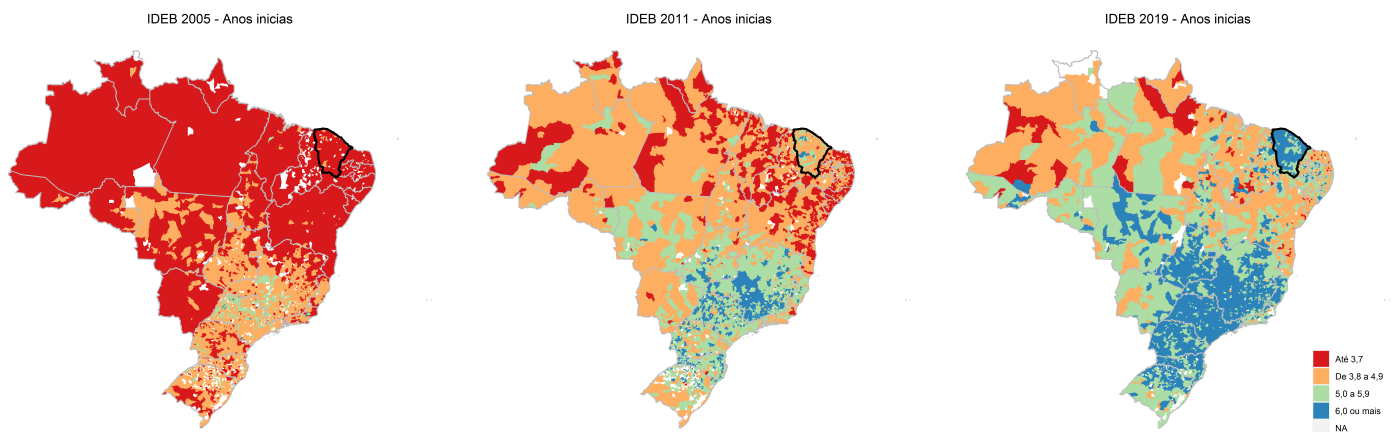
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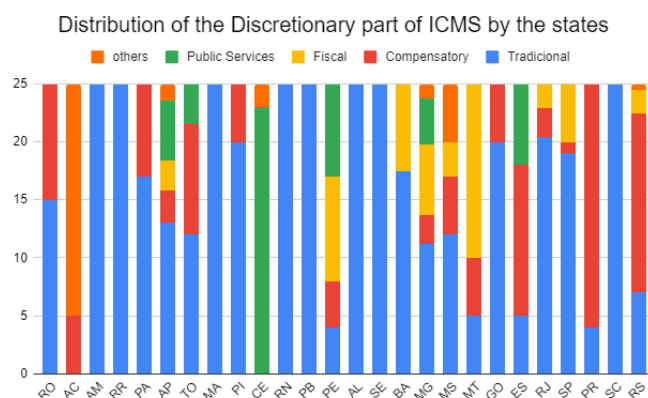
## Appendix

Figure 5: Average evolution of municipalities to IDEB in the early years



**Note:** The set of maps shows the evolution of IDEB for the early years over the years 2005, 2011, 2019. Ceará recorded the most significant historical evolution, going from 2.8 in 2005 to 6.3 in 2019. In addition, 131 municipalities in Ceará reached an average of 6 for this stage of education in 2019. Still, according to the indicator, in 2019, 21 municipalities and 79 schools are among the 100 best rated in the initial grades.

Figure 6: Distribution of the Discretionary part of ICMS by the states



**Note:** Figure 1 shows the forms adopted by the states to distribute resources from the ICMS quota. Traditional referring to the VAF, egalitarian part, population, and geographic area; Compensatory payments aimed at reimbursing certain municipalities for situations or activities that are not part of the ICMS tax base; Taxes that take into account the municipal own tax revenue and some measure of lack of resources intending to equalize the municipal budgetary capacity; Public services include education, health and sanitation policies; Others include among the state programs of a very particular character such as the preservation of cultural heritage, activities related to sport and tourism, as well as the number of voters.

**Source:** (SIMÕES; ARAÚJO, 2019)

Table 6: Summary Statistics

Variable	Obs	Mean	SD	Min	Max
population size	2453	46851.107	189344.035	3632	2609716
total spending	2453	60985328	280108465.381	2904592.11424	5960404444.8
spending on education	2453	19343711	55273691.7878	48996.5514253	1147099622.24
spending on primary education	2453	14035782	39623631.6099	0	813009044.14
GDP	2453	447544.35	3021839.52039	9508.53343864	60212580.3096
FPM	2525	14600306	38540951.6963	1575605.25	768149696
FUNDEB	2517	13490497	31010444.0692	4062.03515625	607000576
ICMS transfers	2524	7591082.9	43770242.0899	451462.15625	915825344
Non-literate	38261	9.753	14.274	0	100
Intermediary	38261	12.667	15.025	0	100
Sufficient	38261	14.884	15.747	0	100
Desirable	38261	50.487	34.294	0	100
Specialization studies	35264	.201	.247	0	1
postgraduate studies	35264	.0028	.0360	0	1
Age <sub>1</sub>	38227	.089	.155	0	1
Age <sub>2</sub>	38227	.1537	.190	0	1
Age <sub>3</sub>	38227	.383	.250	0	1
Age <sub>4</sub>	38227	.298	.2455	0	1
Gender	38227	.808	.2055	0	1
White	38227	.169	.2090	0	1
Approval rate <sub>1</sub>	36516	94.870	11.838	0	100
Approval rate <sub>2</sub>	38128	91.760	14.314	0	100
Abandonment Rate <sub>1</sub>	36516	1.468	5.071	0	100
Abandonment Rate <sub>2</sub>	38128	1.121	4.246	0	100
Proficiency SPAECE-Alfa	38261	152.072	49.308	29.654	294.545

**Note:** The results on municipal expenditure are from 2004 until 2017. Otherwise educational data are from 2007 to 2015

Table 7: Description of the Variables Used for Educational Results

Variable	Description
Approval rate	The proportion of students from first and 2nd year of elementary school approved
Abandonment Rate	The proportion of 1st and 2nd Year Elementary School students who dropped out of school
Proficiency SPAECE-Alfa	Average proficiency of students in the 2nd year of elementary school at SPAECE-Alfa
Non-literate	Percentage of illiterate students (SPAECE -Alfa)
Incomplete Literacy	Percentage of students with incomplete literacy (SPAECE-Alfa)
Intermediary	Percentage of students with Intermediate literacy (SPAECE-Alfa)
Sufficient	Percentage of students with sufficient literacy (SPAECE-Alfa)
Desirable	Percentage of students with Desirable literacy (SPAECE-Alfa)
White	Average of professors declared with color/race White
Gender	Average of female teachers
Age <sub>1</sub>	Average age of teachers up to 24 years
Age <sub>2</sub>	Average age of teachers from 24 to 29 years old
Age <sub>3</sub>	Average age of teachers from 30 to 39 years old
Age <sub>4</sub>	Average age of teachers from 40 to 49 years
Specialization studies	Average of teachers with specialization
postgraduate studies	Average of professors with master's and/or doctorate degrees

Table 8: Description of the Variables Used for the Mechanism

Variable	Description
Teacher's Regularity	Indicator to evaluate the regularity of the teaching staff in the schools of basic education from the observation of the permanence of the teachers in the schools in the last five years
Teacher's Adequacy	Teachers with a higher education degree (or bachelor's degree with pedagogical complementation) in an area different combination that you teach.
Management Complexity	The school management complexity indicator summarizes the size, operating shifts, level of complexity of the steps, and the number of steps offered in a single measure.
Teaching effort I	A teacher who, in general, has up to 25 students and works in a single shift, school and stage.
Teaching effort II	A teacher who, in general, has between 25 and 150 students and works in a single shift, school and stage
Teaching effort III	A teacher who has between 25 and 300 students and works in one or two shifts in a single school and stage.
Students Per Class	1/Average Students per Class
Class Duration	Duration of school hours in minutes
Teachers with a college degree	Percentage of teachers with higher education at school in the early years
Principal Component Analysis (PCA)	Combination of indicators Teacher's Regularity ; Teacher's Adequacy; Management Complexity Teaching effort I; Teaching effort II; Teaching effort III, standardized duration class and students per class using the Principal Component Analysis methodology