Heterogeneous impact of Results-Based Education Financing

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Abstract

The state of Ceará, Brazil, was the first 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 article examines whether the ICMS Law implemented in 2009 affected the composition of municipal spending, particularly if it increases the spending 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.

Keywords: Educational financing. Intergovernmental transfers. Educational performance.

Resumo

O Ceará foi o primeiro estado a introduzir uma política de redistribuição de transferências tributárias baseadas na performance educacional agregada dos municípios, alcançando resultados educacionais relevantes. O presente artigo analisa se a Lei da Cota Parte de ICMS implementada em 2009 muda a composição dos gastos municipais, em especial o aumento de gastos em educação, bem como o impacto dessa política sobre os resultados educacionais das escolas municipais. Os resultados mostram que receber mais recursos da Lei da Cota Parte não produz um elevado gasto em educação, mas sim um aumento no gasto total não educacional. Especificamente, para cada real recebido pelos municípios devido a Lei da Cota Parte, foram gastos R\$ 0,45 centavos em educação (R\$ 0,23 no Ensino Fundamental) e R\$ 1,96 em gastos totais per capita. As estimativas do segundo resultado, sugerem que o modelo de repartição de recursos baseados na performance municipal tem impacto relevante apenas sobre as escolas que possuíam elevada performance antes da implementação da Lei da Cota Parte. Foi evidenciado uma possível discriminação no gasto público em educação para as escolas de melhor performance antes da introdução da Lei da Cota Parte. A implicação direta é que tal política aumentou a desigualdade educacional entre as escolas.

Palavras-Chaves Financiamento da educação. Transferências intergovernamentais. Performance educacional .

JEL Codes: I22, I28, H70

Área 5 - Economia do Setor Público

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1 Introduction

A fundamental factor to the provision of public education is financing. Recent pieces of evidence indicate that the number of resources spent matters for educational outcomes (Jackson et al. (2016), Jackson et al. (2020), Haddad et al. (2017)). In developing countries, the relevance of educational spending may be more salient, given the restriction of fiscal space. In Brazil, there is substantial heterogeneity in the relationship between public spending and education, suggesting that the incentives of educational spending also affect the results (Paes de Barros et al. (2018)). Thus, the diffuse incentives may impact the provision of quality public education.

A recent educational policy consists of distributing 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 (2018)). Different models have already been applied and tested [1] 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, Muralidharan, 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 nº 14.023 of 2007 (henceforth *Quota-Parte* program (QLP)) 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 [2]. 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 5th 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, 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

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[1] For a recent review of this literature, see Lee & Medina (2019).

[2] Examples of this literature are: Brandão (2014); Carneiro & Irffi (2018); Petterini & Irffi (2013); Shirasu et al. (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 et al. (2019) shows that the combination of performance spending policies and incentives for their proper implementation can explain most of the results.

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 *QLP* 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 *QLP* 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 *QLP* significantly reduced the average class size. This same result was not found for schools with lower previous performances in municipalities also benefiting from *QLP*. 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[3]. These differences within the schools may be driven by a specific allocation of resources in schools with higher previous performance.

This paper contributes to different 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 et al. (2017), Jackson et al. (2016), Jackson et al. (2020)). 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 et al. (2017); Mbiti, Muralidharan, et al. (2019); Mbiti, Romero, & Schipper (2019); Romero et al. (2020); Kerwin & Thornton (2021). Finally, financing public education is a challenge in developing countries with few resources like Brazil. Thus, this article contributes to a wide literature that attempts to understand the impact of this specific intergovernmental transfer program (Brandão (2014); Carneiro & Irffi (2018); Petterini & Irffi (2013); Shirasu et al. (2013), Júnior et al. (2020), Silva (2021)). This last point is essential given the approval of the new FUNDEB (Basic Education Maintenance and Development Fund), which has a part inspired by the Ceará program.

In addition to this introduction, this article is subdivided into four 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 main results. Finally, section 5 comments on the general conclusions of the work.

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[3]The *Quota-Parte* program was reformulated in 2012 to adapt the incentives to reduce inequality performance among the schools.

2 Transfer Results-Based Policy

The state of Ceará is an example of how to overcome adverse socioeconomic conditions to improve education outcomes. Ceará initiated a relevant educational reform that allowed to increase 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 are based on some 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)[4].

A crucial characteristic of the ICMS structure is that the Brazilian constitution establishes that 1/4 of ICMS revenues must be redistributed to municipalities, referred to here as *Quota-Parte* program. 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. This 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 state of Ceará innovated by placing education at the center of the intergovernmental transfer distribution, starting from Law nº. 14,023 in 2007, regulated in 2008, and became effective in 2009. Thus, from the 25% of the total state ICMS's revenue, 72% is destined to education, 20% for health, and 8% for the environment. This new form of intergovernmental transfer replaced the previous criterion based on the size of the municipality, stated since 1996[5]. Figure 1 outlines the new distribution of ICMS for Ceará municipalities. The transfer is based on municipal performance in the educational quality 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 1st to 5th grade [6].

The criteria for sharing 25% of ICMS not linked to added value were established by state law 14,023 of December 17, 2007 [7] 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

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[4]Permanent Evaluation System for Basic Education in Ceará

[5]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.

[6]For a review of the implementation of this policy, Simões & Araújo (2019), Brandão (2014)

[7]Since 2012, when the computation of the formation of the educational index (IQE) was changed by Decree nº. 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.

Figure 1: ICMS transfer structure
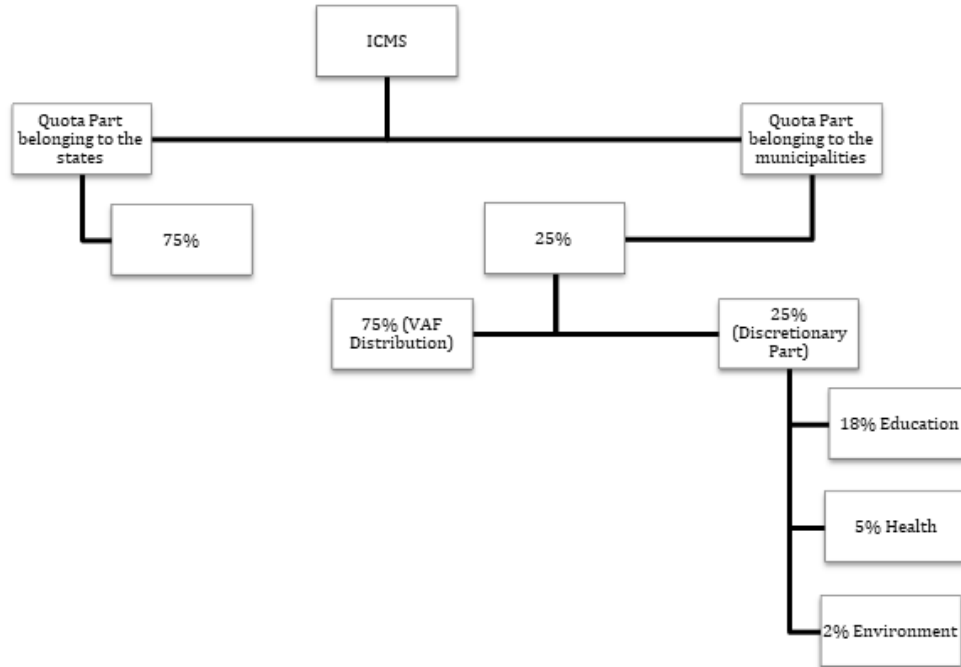
to the pass rate in the initial grades of Elementary School and (ii) 80% in relation to the performance of students in standardized exams. The variable related to standardized exams, there is a level component and a variation (or advance) component, to which different weights are attributed: 40% in relation to the average grade of students in the 5th grade of elementary school; 60% in relation to the advance in the average grade of students in the 5th grade of elementary school.

The IQA is calculated based on the results of the Literacy Exam for Students in the 2nd 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 and Empirical Strategy

3.1 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 municipal level: population size, total spending, spending on education, primary education, GDP, ICMS transfers, and federal intergovernmental transfer (FPM and FUNDEB)[8]. 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 was obtained from administrative data from State Department of Educa-

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[8]We adjusted the variables to real forms using the IPCA-Fortaleza, available at the Brazilian Institute of Geography and Statistics - IBGE.

tion of Ceará (SEDUC/CE). We consider the perfomance in the test scores 2º grade of elementary education, measured by SPAECE-Alfa. The SPAECE-Alfa uses the Item Response Theory (IRT) to compare units sampled at different levels of education over time. Additionally, we use the School Census, provided by Educational Research Institute Anísio Teixeira - INEP, to access the school and teacher's variables. The summarize statistics of all variables used is available in Table 6, as well the description of all the variables used is available in the the Table 7 in the Appendix. Table 1, bellow describes the descriptive statistics for municipals based in rank (until 2008).

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_o: diff = 0 and H_a: diff != 0, i.e, p value $! \ Pr(|T| > |t|)$.

3.2 Empirical Strategy

3.2.1 Empirical Strategy for the Impact of LCP 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 *QLP* 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:

$$\mathrm{D}Y_{gmt} = \sum_{t=2004}^{2007} b_{1t} \mathrm{D}CP_{mt} \quad I(m = Q_1) + \sum_{t=2009}^{2017} b_{2t} \mathrm{D}CP_{mt} \quad I(m = Q_1) \quad I(After) + d^{\theta}X_{gmt} + t_m + t_t + g_{mt} + e_{mt} \quad (1)$$

Where: $\mathrm{D}Y_{gmt}$ 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 the population changes affect the variables. This year is used as reference because is one year before the *Quota-Parte* program implementation. Then, the definition of $\mathrm{D}Y_{gmt}$ is as follows:

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

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

$$\mathrm{D}CP_{mt} = \frac{CP_{mt} \quad C_{m,2008}}{Pop_{m,2008}} \tag{3}$$

As before 2009, the ICMS resources was redistributed according to population criteria, such variable $\mathrm{D}CP_{mt}$ measures how much each municipality receive more or less after the *Quota-Parte* program. The ICMS after 2009 was redistributed based on educational performances in 2007 and 2008. Then, we exploit this exogenous variation in the ICMS share to understand how it affect the educational spending. Finally, 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.

Additionally, t_t and t_m are year and municipal fixed effects that absorb idiosyncratic temporal (economic shocks, droughts, etc.) and local variations. However, 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, g_{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).

The variable $I(m = Q_1)$ designates the municipalities that will be considered treated. This 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 benefited 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 municipalities have the best educational performance before the implementation of the *Quota-Parte* program and was considered treated. The IQE_{m2009} measures the aggregate performance of the municipalities for the years 2007 and 2008. Thus, we considered as treated municipalities the top 30th percentile (the 30% best-ranked municipalities) . The remaining 70% were considered controls. Standard errors were estimated at the municipality level.

Our parameters of interest are b_{2t} that measure the impact of public spending in municipalities that likely increase the share of ICMS. This parameter estimate change according to a variation on $\mathrm{D}CP$. We expect that a large increase in the municipal share of *Quota-Parte* ($\mathrm{D}CP$) represents a rise in public spending. The parameters b_{1t} are expected to be insignificant, suggesting that variation on future $\mathrm{D}CP$ are not correlated with previous changes in public spending.

3.2.2 Empirical Strategy to Measure the Effect of LCP on Educational Inequality

We also attempt to understand whether the impact of the *Quota-Parte* differently affected the performance of schools in the 2nd year of elementary school. Evidence in favor of this hypothesis may imply that QLP increases the inequality among the schools. To this end, we exploit the variability in the quality of schools within the municipals by the introduction of the program, an approach similar to that used by Cilliers et al. (2020). In summary, we compare schools with similar performance before the *Quota-Parte* in municipals that earn more transfers from the QLP 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 $m = 1, ..., 184$, 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 QLP were obtained by ranking the $IQE_{m_{2009}}$ similarly to the prior empirical exercise. The municipalities that earned with the program are in the 33rd largest percentile (treated group), the Neutral municipalities are between the 34th and 65th percentile. Finally, the municipalities that likely lost with the *Quota-Parte* are in the 66th to the 100th 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. Consider the categories $k = 1; 2$ above defined. The empirical equation to be estimated for the second exercise is:

$$y_{imt} = b_0 + \sum_{k=1}^{2} b_k \quad I(CP_m) + d^{\prime}X_{imt} + t_t + q_{mt} + u_{imt} \tag{4}$$

The b_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 t_t and q_{mt} are the year and municipal fixed effects, respectively. Standard errors were estimated at the school level.

The empirical strategy identifies the causal parameter for two reasons. First, the introduction of the *Quota-Parte* program at the end of 2007 potentially 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 QLP can be considered exogenous in time about the educational performance of schools in each municipality. Before introducing the *Quota-Parte* program, schools had differences in educational performance that are not correlated with future inter-municipal state transfers. 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 municipality. 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 QLP. 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 QLP. Second, we use the balanced entropy method, developed Hainmueller (2012), to pairing the schools through the pre-determined variables. The pairing method allows comparing homogeneous schools in different municipalities in the same category $k = 1; 2$.

4   Results

4.1   Results for Spending

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 QLP.

Figure 2: Effect on Total Expenditure of the Share *Quota-Parte* program
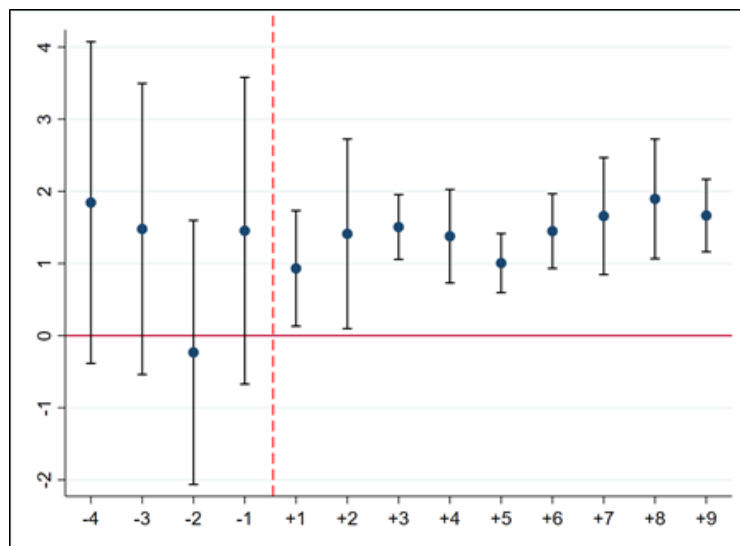
Note: Figure 2 presents the estimated impact of the introduction of *Quota Parte* program, denoted in a red vertical dash line. The results after implementation indicate that total municipal spending increased significantly. Such impact is persistent over time, suggesting that QLP produced long-term 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 QLP. 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 QLP, suggesting a significant heterogeneity in the association between the total municipal spending and intergovernmental transfers. After the program introduction, this relationship becomes more precise.

Analyzing the estimates after the implementation of the program, we observe an increase in total municipal spending near to R$1.96 per capita for each real received by the municipality due to the *Quota-Parte* program about the total municipal expenditure in 2008, one year before the program introduction. This finding suggests that municipal spending raises more than the amount received by QLP.

In the literature, this result is related to the Flypaper Effect, according to which governments tend to spend more than the resources they receive from intergovernmental transfers[9]. In the case of QLP, 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 QLP 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 QLP. We observe that municipals that benefited from QLP in 2009 kept receiving more resources than municipals that lost with QLP after the introduction of *Quota Parte* program. In the Figure 3, we divided the municipals according to lower and higher tercile of our measure of municipal educational achievement (IQE) and calculated the total

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[9]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 & Thaler (1995), Inman (2008), Helm & Stuhler (2020). For the case of educational expenditure, see: Gordon (2004) and Cascio et al. (2013). For a discussion of Brazilian literature, see: Nojosa et al. (2018).

of intergovernmental transfers received by each group. Figure A shows that the introduction of QLP 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.

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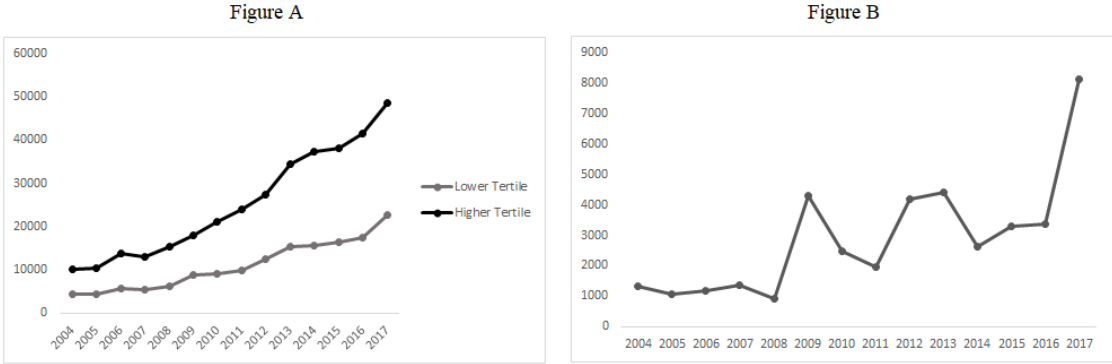
Note: Figure 3 presents the total of intergovernmental transfers received by municipals separated in two groups: Lower and higher tercile according to our main measure of municipal educational achievement (IQE).

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 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 QLP did not similarly increased the spending in education. Furthermore, more intergovernmental transfers from QLP did not raise the spending in elementary education.

It is important to observe that the transfer from the QLP 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 QLP incentives the non-educational spending more than education spending for the municipalities benefiting from the program[10].

4.1.1 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 approach follows the b-differencing approach of Blanchard et al. (1992). Additionally, we also report the estimate of the main strategy presented in Equation 1.

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[10]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.

Figure 4: Effect of the Share *Quota-Parte* program on Education and Elementary Education Spending
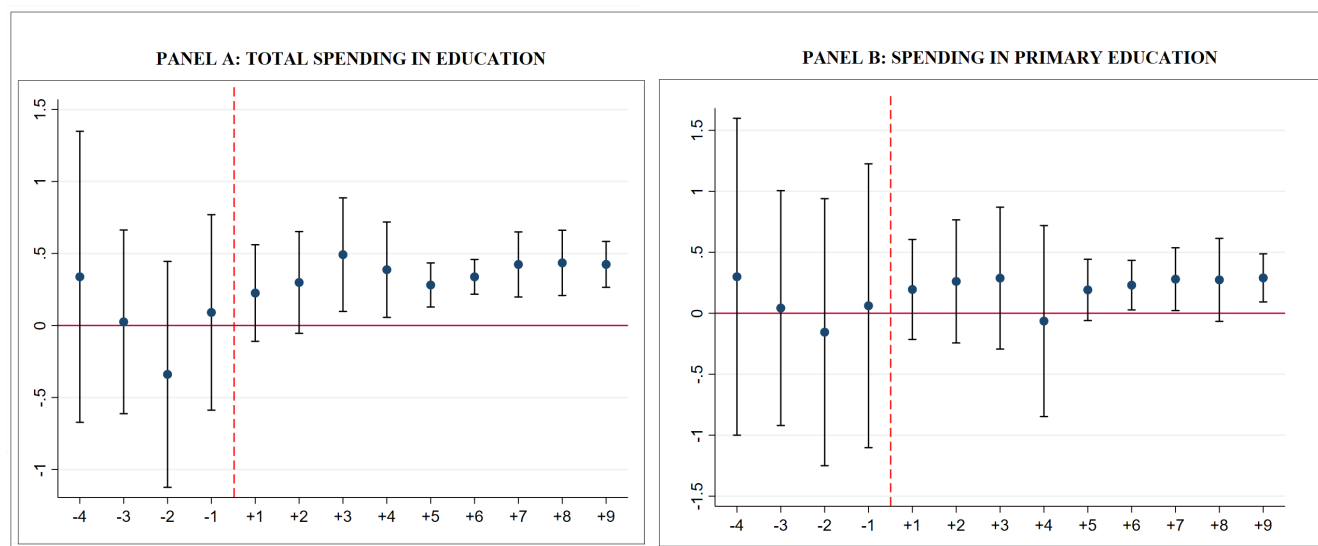
Note: Panel A shows spending on education. It is noticed that expenditure increased due to LCP. Panel B showing spending on primary education has not shown significant results in almost every year (before and after LCP).

The Table 2 shows the results. 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 a set of additional 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. Finally, columns (3), (6), and (9) present the results by replacing the municipal's cyclicality-quartile-specific year fixed effect by b-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.

Table 2: Spent Robustness Results

Variables	Total Spend			Education Spending			Spending on Elementary Education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	1.627	1.606	1.670	0.381	0.382	0.379	0.258	0.256	0.256
Share Quota Transfers	(0.318)	(0.303)	(0.325)	(0.081)	(0.082)	(0.080)	(0.116)	(0.119)	(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
b-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)

Other robustness exercises were performed but not reported for brevity[11]. The other robustness exercises were: 1. re-estimation considering different cutoff points between the treated and control groups (30%, 15%, and 10% for the group treated according to the $IQE_{m_{2009}}$ ranking) and 2. re-estimation of standard errors considering the bootstrap procedure. There were no relevant differences in the main conclusions.

4.2 Results for Educational Outcomes

In this section, 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 QLP relative to similar schools in municipals that received less after the QLP. 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 QLP. Indeed, we are analyzing how these QLP 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 QLP. Lower-performing schools do not present significant differences according to QLP gains. This result suggest that the inequality among the schools within the municipals increased after the QLP introduction. A potential explanation to these estimates are the different allocation of resources within municipals.

Table 3: Educational Results

	k=1	k=2
Treatment	0.537	1.112***
	(0.340)	(0.376)
Obs	10,120	10,200
R^2	0.689	0.551
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: k=1 ->Lower school median + 3rd tertile cp in relation to 1st tertile cp
k=2 ->Upper median school + 3rd tertile cp in relation to 1st tertile cp

Two robustness exercises are presented for the results of educational performance. 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 may not be directly comparable to schools with low (or high) performance in municipalities

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[11]Such exercises can be requested by email to the authors.

that will suffer from LCP. To this end, two robustness exercises are carried out to reduce the possibility of incomparability between schools.

The first exercise uses a series of control variables associated with the future performance of schools. Such measures are related to the quality of the educational offer (such as teacher quality indicators, number of students, among others) and the characteristics of students, average literacy rate, a measure of a school delay, among others. Importantly, all these covariates are measured in 2007, before the introduction of the LCP.

The second exercise applies entropy matching (Hainmueller (2012)) considering the same pre-determined variables used in the previous exercise. The pairing allows the similarity between schools to assign weights, enabling an adequate comparison between treaties and control. 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	1.631***
	(0.440)	(0.518)
Observation	8,389	8,648
R^2	0.702	0.575
Panel B: Matching by Entropy	k=1	k=2
Treatment	0.327	1.116***
	(0.354)	(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 presented in the Table 4, available above, are divided into two panels. Panel A presents the specification with the addition of control variables.[12] The result for this first robustness test is not significant, unlike the result k = 2, in which the best schools in terms of performance and most benefited municipalities have a positive result of magnitude 1.631 standard deviations (p-value 0.000), similar to that found in the first estimate, but with greater magnitude.

The result of panel B refers to the application of entropy matching. As with the main results, these estimates are positive and significant only for schools with better performances, similar to the main conclusions. The magnitude similar to that found in the first estimation

The results suggest that the estimates are not potentially driven by omitted factors that can bias the results. As a way to explore and give more evidence to the results already found, another exercise is done, this

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[12] Control variables:% of students with incomplete literacy,% of students with intermediate literacy,% of students with sufficient literacy,% of students with desirable literacy, an average of teachers in a specific school with specialization, Average of teachers in a specific school with postgraduate (master's and/or doctorate), Average of teachers in a specific school divided into four categories (up to 24 years, 24 to 29 years, 30 to 39 years, 40 to 49 years), sex, white color/race, approval and abandonment in the 1st and 2nd year, total spending per capita, GDP per capita and municipal participation fund per capita. All variables for 2008.

time, changing the result variable to variables related to higher spending on education.

The findings indicate that schools with lower performance in 2007 did not increase their educational results according to *Quota-Parte* program. Two main hypotheses rationalize these results. First, the mayors may prefer to focus their resources on schools with higher productivity. These schools could increase the performance in test scores of the municipal, allowed it to receive more transfers from the *Quota-Parte* program. Second, the lower-performing schools are not sensible to more transfers.

In the next section, we test the first hypothesis by verifying whether the higher-performing schools present evidence of more educational expenditure than schools below the median performance within the municipals.

5   Mechanisms

A potential explanation for the previous results is the municipal' resources allocation be different 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 have higher productivity on the usage of the public resources. That is, the mayor may incentives to increase the resources in schools that allowed a large gain in the QLP 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 additional 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[13].

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 and may suggest the presence of larger spending on education. Then, a heterogeneous effect of *QLP* 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[14] and class duration, were not significant. However, the signal of the estimates and the difference in magnitudes between the lower median and the upper median, 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 sides of the median. These results are may be consequence of the selection process for teachers in the public service. Teacher's with a college degree is significant for both sides of the median, however only positive for the lower median, indicating that schools in this position invest in teachers with a university degree, regardless of training.

The variable that uses Principal Component Analysis is negative, however significant for the upper median. These results complementary to the previous ones suggest that there was a different allocation of the available resources in the municipalities in schools with better previous performance.

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[13]The detailed description of these variables are found in Table 8, available in Appendix

[14]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.

Table 5: Mechanisms Results

PAINEL A

	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	0.160	1.062	-0.274	0.203	0.284	0.203	0.284	-0.770***	-0.802*
	(0.435)	(0.298)	(0.683)	(0.384)	(0.418)	(0.238)	(0.418)	(0.238)	(0.247)	(0.464)
Obs	2,404	2,513	2,179	2,373	2,179	2,373	2,179	2,373	2,179	2,373
R^2	0.339	0.306	0.442	0.406	0.312	0.271	0.312	0.271	0.382	0.382

PAINEL B

	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**	0.825***	-0.014	-.0007	2.540	-3.037	0.421**	-1.099***	-0.012	-1.488***
	(0.401)	(0.292)	(0.109)	(0.875)	(0.672)	(0.255)	(0.202)	(0.005)	(0.098)	(0.005)
Obs	2,395	2,513	1,571	1,848	1,703	2,029	1,631	1,692	1,188	1,274
R^2	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

Note: The description of each variable is in Table 8, available in Appendix.
Robust Standard Errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

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

Subsequently, it was verified whether the educational impact of the QLP was different among schools within the municipalities. The results showed that only schools with better previous performances improved their outcomes in test scores when they were located in municipalities benefited by QLP. Thus, the *Quota-Parte* did not increase the inequality among the schools within the municipals.

These findings suggest the existence of a different allocation of resources within schools in benefited municipalities. We confirm this hypothesis by analyzing the similar model specification on school characteristics related to larger public spending. The result for the aggregate variable suggests that schools with higher productivity in the use of public resources may have received more spending from the mayors.

Taken together, the results showed that the QLP 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 QLP, should consider aspects related to the allocation of resources vising to avoid the increase of inequality of schools within municipals.

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Appendix

Figure 5: Average evolution of municipalities to IDEB in the early years
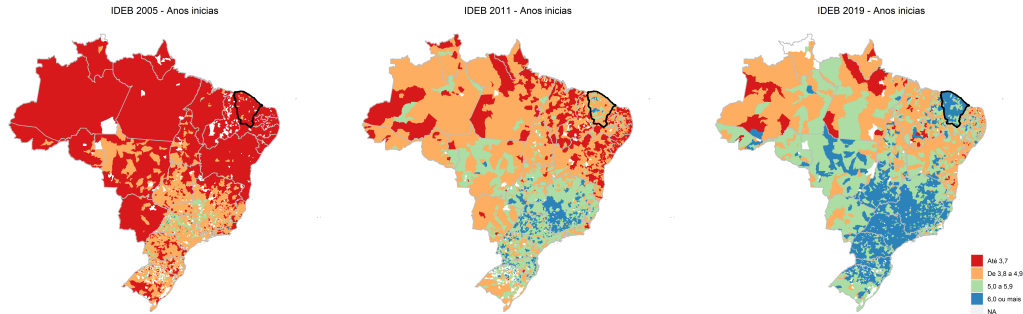
Note: The set of maps shows the evolution of IDEB for the early years over the years 2005, 2011, 2019. Ceará recorded the most significant historical evolution, going from 2.8 in 2005 to 6.3 in 2019. In addition, 131 municipalities in Ceará reached an average of 6 for this stage of education in 2019. 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
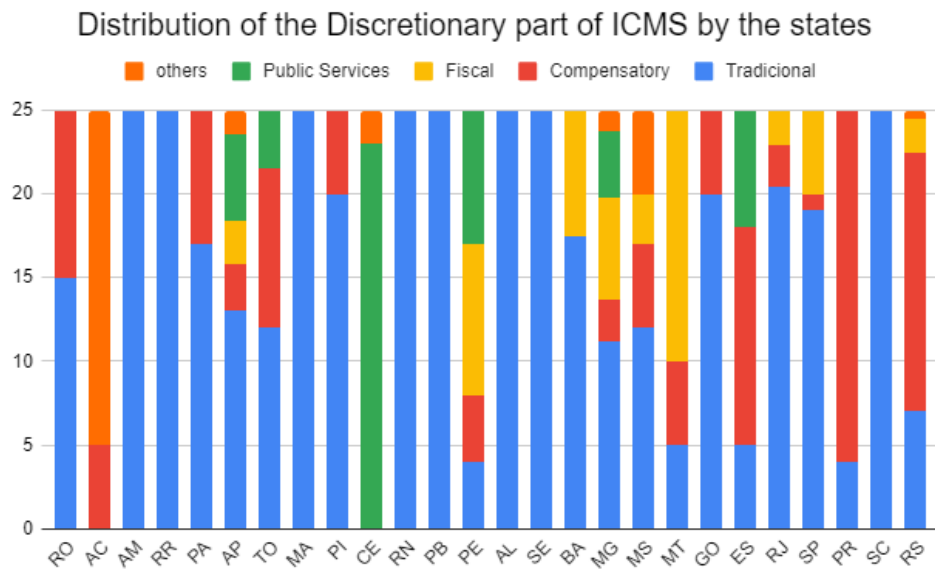
Note: Figure 1 shows the forms adopted by the states to distribute resources from the ICMS quota. Traditional referring to the VAF, egalitarian part, population, and geographic area; Compensatory payments aimed at reimbursing certain municipalities for situations or activities that are not part of the 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_1	38227	.089	.155	0	1
Age_2	38227	.1537	.190	0	1
Age_3	38227	.383	.250	0	1
Age_4	38227	.298	.2455	0	1
Gender	38227	.808	.2055	0	1
White	38227	.169	.2090	0	1
Approval rate$_1$	36516	94.870	11.838	0	100
Approval rate$_2$	38128	91.760	14.314	0	100
Abandonment Rate$_1$	36516	1.468	5.071	0	100
Abandonment Rate$_2$	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_1	Average age of teachers up to 24 years
Age_2	Average age of teachers from 24 to 29 years old
Age_3	Average age of teachers from 30 to 39 years old
Age_4	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 and standardized duration class and students per class using the Principal Component Analysis methodology