Heterogeneous impact of Results-Based Education Financing

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Abstract

Ceará was the first state to introduce a policy of redistributing tax transfers based on the aggregate educational performance of the municipalities, achieving relevant educational results. This article examines whether the ICMS Law implemented in 2009 changes the composition of municipal spending, particularly the increase in spending on education and the impact on the educational results of municipal schools. The results show that receiving more resources from the ICMS Law does not produce a high expenditure on education but an increase in total non- educational expenditure. Specifically, for each real received by the municipalities due to the Quota Part Law, R$0.45 was spent on education (R$ 0.23 in Elementary Education) and R$ 1.96 on total expenses per capita. Estimates of the second result suggest that the allocation of resources based on municipal performance has a relevant impact only on schools with high performance before implementing the Law of the Share Quota. There was evidence of possible discrimination in public spending on education for the best performing schools before introducing the Law of Share Quota. The direct implication is that such a policy has increased educational inequality between schools.

Keywords: Educational financing. Intergovernmental transfers. Educational performance.

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1 Introduction

One of the essential factors in the provision of public education in the form of 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))). However, there is substantial heterogeneity in the relationship between public spending and education, especially in Brazil, suggesting that the way such spending is implemented is also essential for the results. In the face of diffusion incentives, the provision of quality public education may not be achieved.

A recently gained policy is distributing of public educational resources based on the performance or merit of those responsible for education. This policy consists of distributing more public resources to entities or individuals that obtain better educational results. Different models have already been applied and tested [1] around the world, and their results are promising. The traditional models 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 Cear´a 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 performance, the Law nº 14.023 of 2007 (henceforth Lei da Cota Parte or LCP) defined criteria for distributing resources from the ICMS quota the educational performance of the municipalities in Elementary School. This performance is measured in aggregate among all schools in the municipality. Of the 25% of resources owed to the municipalities derived from the state tax with ICMS, 18% are dis-

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

tributed according to these criteria. The remaining 7% is 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 4, available in Appendix, summarizes some of this evidence. Analyzing the average performance of the municipalities in IDEB (Basic Education Development Index), it can be seen that Ceará showed a significant evolution in learning in the 5th year of Elementary Education, even though it is in an adverse socioeconomic situation.

Two exciting characteristics of this model of resource redistribution are 1. The resources are fungible; that is, the mayors who receive the resources are not obliged to spend them on education, choosing to give other destinations; 2. Results are measured in aggregate at the municipality level. This last point allows municipalities to have a high average performance, even if some schools do not improve their educational results.

Despite evidence supporting the policy's effectiveness, some issues have not yet been appropriately addressed. Is there no evidence, for example, of the impact of LCP on the composition of municipal expenditures, i.e., municipalities that received more transfers, increase spending on education? This point is essential to understand if the LCP induces a search for improvements in educational quality through increased spending. In addition, there is no evidence of the impacts of this policy on inequality between schools at different levels of proficiency. Has the redistribution policy of the Quota Party Law increased or decreased school inequality according to previous performance? In addition, mayors may allocate resources in a discriminatory manner to schools that can generate better results, making it possible to maintain a stable aggregate performance level over time. Answering this last question is crucial because it helps to understand how mayors chose to allocate their resources in schools in response to the incentive generated by LCP. The ideal results of this

[2]Examples of this literature are: Brandão (2014); Carneiro & Irffi (2018); Petterini & Irffi (2013); Shirasu et al. (2013). A limitation of these works stems from the absence of controls for policies that have been implemented at the same time as the Quota Part Law. 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.

policy would be that LCP incentives would increase spending on education at the municipal level and seek to improve the performance of schools with the worst performances, reducing intra-municipal inequality.

This article aims to answer such questions. First, it is investigated whether a municipality receives more resources with the implementation of the Quota Part Law in 2009 implies higher spending on education. Through an empirical strategy of difference indifference, it appears that receiving more resources from the Quota Part Law does not produce a high expenditure on education but an increase in total non-educational expenditure. Specifically, for each real received by the municipalities due to the Quota Part Law, 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 variability before the implementation of the Quota Part Law, it appears that schools with low performance in 2007 did not increase their educational results in municipalities that benefited from LCP when compared to municipalities that lost resources with the policy. On the other hand, schools with better performance in 2007 have increased their educational results in municipalities that have benefited from the Law of Quota Part. In summary, the estimates suggest that the LCP has a relevant impact only on schools that had a high performance before implementing the Quota Part Law. The direct implication is that such a policy has increased educational inequality between schools. The results are robust to the inclusion of pre-determined characteristics of schools, partially excluding the fact that such schools have previous factors that contribute to future performance in standardized tests.

Taking the results in sets, the redistribution policy based on the educational merit of the municipalities did not lead to higher expenditure on education and increasing educational inequality at the school level. As for the first point, the Quota Part Law, by allowing spending to be separated from spending on education, maybe a desirable result for the legislators who drafted it. As for the second point, the main explanation is the presence of an intra-municipal resource allocation directed at schools that have the most significant potential to generate

good results in standardized tests.

To verify this hypothesis of different allocation of resources, a model was estimated whose result variables are: Average Class Hours per Day and Average Students per Class. These variables are associated with the quality of the offer of public education and also with higher spending on education. The results suggest that the best schools in municipalities benefiting from LCP significantly reduced the average class size. This same result was not found for schools with lower previous performances and in municipalities benefiting from LCP. 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.

This work contributes to different areas of research in academic economics. 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)). 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 incentive agents use such resources and whether they potentially generate differentiated resource allocations. Finally, financing public education is a challenge in countries with few resources like Brazil. Thus, this article contributes to understanding the results of different intergovernmental tax sharing policies. 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 model of resource allocation. This article shows that the design of incentives matters to obtain specific results relevant to public policies.

In addition to this introduction, this article is subdivided into four more sections. The following section details the Quota Part Law. 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.

2 Transfer Results-Based Policy

The state of Ceará offers a relevant example of how to overcome adverse socioeconomic conditions to improve education outcomes. Through Financing Results-Based (FBR) policies as part of a more widespread educational reform program, Ceará initiated relevant educational reforms that allowed it to improve levels of learning from literacy to elementary school students Loureiro et al. (2020)

Ceará's success is based on some interdependent pillars, which can be mentioned: 1. Financial incentives for the municipalities to reach the established educational goals (Share Quota Law); 2. Technical assistance to municipalities with difficulties to improve learning, emphasizing literacy at the right age for all (PAIC); 3. Establish solid and reliable monitoring and evaluation system that continuously measures the main results of education, including student learning (SPAECE)[3].

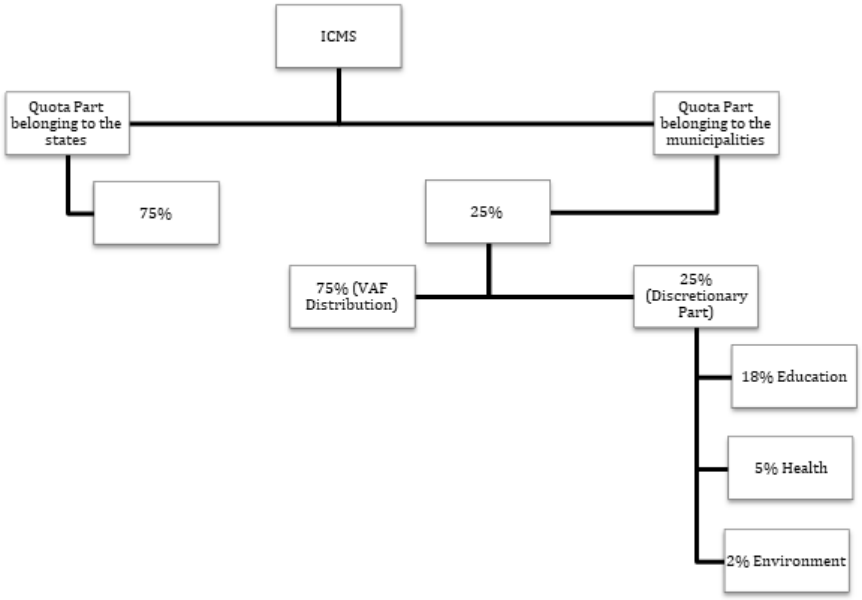
The Federal Constitution gives states the discretion to define the rules for allocating part of the ICMS quota with their municipalities. This value refers to 25% of the total collected by the state with the tax. The novelty implemented by the state of Ceará was to use such discretion to induce municipal governments to seek to improve social results, particularly in education. This possibility is still little explored in Brazil. Figure 5, in the Appendix, shows how the states have adopted different strategies to distribute ICMS resources. Most states adopt allocation criteria based on the population size of municipalities or students. Exception to the states of Ceará, Pernambuco, Amapá, Minas Gerais, Bahia and Espírito Santo, which adopt 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.

Brazil faced with a scenario of structural reforms defined by the National Government in 1996, through the Law of Directives and Bases of National Education (LDB)[4],the state of

[3]Permanent Evaluation System for Basic Education in Ceará
[4]Law nº 9,394 of 1996

Ceará innovated by placing education at the center of the share distribution, starting from Law nº. 14,023 in 2007, regulated in 2008 and effective in 2009. Thus, the discretionary portion of the quota (25% of the total collected with the ICMS) is now 72% for education, 20% for health, and 8% for the environment. This new form of distribution changes criteria in force since 1996[5]. Figure 1 outlines the new distribution of ICMS for Ceará municipalities.

Figure 1: ICMS transfer structure



When considering clear indicators, the results-based mechanism aims at transparency and generating incentives for municipalities to improve their results. To this end, the state government created education 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 pass rates from 1st to 5th grade [6].

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

[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)

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.

The IQA considers the average result of the literacy test of the municipality multiplied by the factor of universalized and the percentage of provisioning, generating a transformed average compared in level and evolution between years considered. The universalized factor considers the percentage of students provided as illiterate, incomplete literacy, and desired. The reduction of the first two groups and the third increase, the average improvement in the municipality. The percentage of students obtained is a measure of dispersion in which the objective is to prevent managers from encouraging only the best students to take the exam.

The IQF also corresponds to a transformed average compared in level and evolution between years considered and follows a calculation logic similar to the IQA. The average results obtained by students in Portuguese and mathematics assessments are considered separately multiplied by the percentage of students evaluated in the year in question and by the factor of universal learning, which classifies the results among many critics and appropriate.

3 Data and Empirical Strategy

3.1 Data

The database is divided into two parts. To assess the effect of the Share Quota Law, information from the Municipal Finance database - FINBRA, made available by the National Treasury Secretariat - STN, was used. The following municipal information was collected from this database: population size, total spending, spending on education, primary education, GDP, ICMS transfers, essential education maintenance and development fund - FUNDEB and municipalities participation fund - FPM. The period considered starts in 2004 and

ends in 2017. All financial information was seasonally adjusted using the IPCA-Fortaleza, available at the Brazilian Institute of Geography and Statistics - IBGE. The ICMS share apportionment coefficients, and the education, health and environment indices from 2009 to 2017 were obtained from IPECEDATA.

In order to assess the impact of changes in the ICMS distribution rule on the literacy proficiency of students in the 2nd year of Elementary School in Ceará, the SPAECE-Alfa microdata provided by SEDUC/CE during the years 2007 to 2015 were considered, in addition to the data from the School Census released by the Educational Research Institute Anísio Teixeira - INEP, on the characteristics of schools and classes. The selected variables include some characteristics of the teachers, such as age, color/race, education. School flow indicators were used in a complementary way, such as approval, failure, dropout, and age-grade distortion, provided by INEP. The description of all the variables used is available in the the table 5 in the Appendix.

The municipalities of Abaiara, Altaneira, Cariré, Groaíras, Ibaretama, Palmácia, São Benedito, São Luís do Curú, Uruburetama were excluded from the sample because they did not have enough school data for the empirical strategy to be implemented. It is worth mentioning that SPAECE-Alfa uses the Item Response Theory (IRT) to compare units sampled at different levels of education over time.

3.2 Empirical Strategy

3.2.1 Empirical Strategy for the Impact of LCP on Municipal Public Spending

The first part seeks to answer the following question: what is the impact of receiving more resources from the Quota Part Law on educational expenditures or total expenditures? To answer this question, a practical difference-by-difference strategy will be adopted.

$$\begin{aligned}\Delta Y_{gmt} &= \sum_{t=2004}^{2007} \beta_{1t} \Delta CP_{mt} \times I(m \\ &= Q_1) + \sum_{t=2009}^{2017} \beta_{2t} \Delta CP_{mt} \times I(m \\ &= Q_1) \times I(After) + \tau_m + \tau_t + \gamma_{mt} + \varepsilon_{mt}\end{aligned} \tag{1}$$

Where: ΔY_{gmt} is the difference between spending g = Total Spending, Spending on Education, Spending on Elementary Education concerning 2008 spending per capita. The year 2008 was chosen as a reference because it is the last year before implementing the Quota Part Law. Additionally, the size of the 2008 population was considered a reference to avoid population variations affect the results. The definition of ΔY_{gmt} is as follows:

$$\Delta Y_{mt} = \frac{G_{gmt} - G_{gm2008}}{Pop_m 2008} \tag{2}$$

ΔCP_{mt} Is the difference between the revenue of the ICMS Share Quota concerning how much the municipality received in 2008 in per capita terms. i.e.,

$$\Delta CP_{mt} = \frac{CP_{mt} - C_{m2008}}{Pop_m 2008} \tag{3}$$

As before 2009, the year when the Quota Part Law was implemented, the ICMS Part Quota resource was divided according to other criteria, such variable ΔCP_{mt} Measures how much each municipality started to receive more or less from 2008. LCP made it possible for municipalities with better educational performances to benefit from the approval of the Share Quota law to municipalities that did not have good educational performances.

Additionally, τ_t and τ_m are fixed annual and municipal effects whose function is to capture idiosyncratic variations in a given year (economic shocks, droughts, etc.) or municipality. Public spending, in general, is strongly associated with the economic cycle of the respective municipalities. Municipalities with more significant variability in the economic cycle may have lower expenditures than municipalities with less cyclical variation zidar2019tax. Thus, to control such effects of cycles, the fixed effects of the economic cycle of each municipality

varying over time are introduced [7], γ_{mt}. In the robustness analysis, it is verified whether the results remain the same when replacing $\gamma_m t$ by fixed municipal effects that vary over time. The analysis period considered starts in 2004 and ends in 2017.

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 Part Law in 2009. These municipalities are most likely to increase their share in the redistribution of the ICMS share. In addition, $I(m = Q_1)$ assigns zero to all other municipalities. To define which municipalities have the best educational performance before the implementation of the Quota Part Law, the quality of education index (IQE) for 2009 (IQE_{m2009}) was used. The IQE_{m2009} measures the aggregate performance of the municipalities for the years 2007 and 2008. The municipalities were ranked according to the IQE_{m2009} Moreover, the 30th percentile (the 30% best-ranked municipalities) were considered treated. The remaining 70% were considered controls. Standard errors were estimated at the municipality level.

For such a strategy to be valid, the IQE_{m2009} a pre-determined variable must satisfy two conditions. First, it should be correlated with ΔCP_{mt} from 2009 onwards. This condition is plausible, as the IQE_{m2009} measures the performance of municipal education for the years 2007 and 2008, and based on this indicator, municipalities started to receive more or fewer resources from share. Second, IQE_{m2009} should not be influenced by municipalities in order to receive more resources when the Quota Part Law is implemented. It is believed that this hypothesis is also plausible for two reasons: 1. Law 14.023, which establishes the new allocation of the share, was published at the end of 2007 (17/12/2007). Thus, spending on education in 2007 was not affected by LCP; 2. Municipalities may have increased spending in 2008 to obtain more resources from the Quota Part Law in the following year. However, it is believed that one year is not enough for substantial changes to occur in municipal educational

[7] To estimate such fixed effects of the economic cycle, the variance of the annual growth rate of real GDP of each municipality between the years 1999 and 2017 was computed. Subsequently, such variances were clustered into four groups characterizing different economic cycles for each municipality. This cycle was interacted with the year variable and added as fixed effects in equation (1).

performance. Assuming the validity of such assumptions, the IQE_{m2009} measures how much each municipality will receive from 2009 onwards and is not associated with more or less spending on education in the period before enacting the Part Quota Law.

Such hypotheses can be verified in the estimation of the parameters β_{1t} that represents the difference in expenditure between treaties and control before the Law of the Share Quota. If the hypothesis of parallel trends is valid, these parameters will not be significant. The set of parameters of interest are β_{2t} which indicates the differences in spending between the treated and control municipalities after implementing the Law of the Share Quota. The period after implementing the Quota Part Law is designated by the indicator variable $I(After)$.

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

We also seek to understand whether the impact of the enactment of the Cota Parte Law differently affected the performance of schools in the 2nd year of elementary school. To this end, the variability in the quality of schools will be explored before the introduction of the Law of the Quota Part, an approach similar to that used by Cilliers et al. (2020), which uses a difference-in-difference model. In summary, such an approach explores the variability in the quality of schools inter-municipally, measured before the introduction of the Law of the Share Quota.

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: low performance and high performance. To facilitate exposure, these categories will be indexed at $k = 1$ and 2, respectively.

The goal is to verify if there were significant differences between the schools of each category in municipalities that in 2009 will benefit or not with the introduction of the Law of the Quota Part. Again, the benefited municipalities were obtained by ranking the IQE_{m2009}. The municipalities this time are divided into three groups: Municipalities that

have benefited from the Share Quota Law (after this Beneficiaries), neutral municipalities that have either had a slight benefit or minor loss (after this Neutral) and municipalities that have presented losses in terms of quota resources part with the new distribution method (after this impaired). This separation took into account the median in which the municipalities are located according to the IQE_{m2009} [8]. Set the indicator variable $I(CP_m) = 1$ if municipality m is in the group of Beneficiaries and $I(CP_m) = 0$ if municipality m belongs to the group of Beneficiaries

Consider y_{qmt} the average performance of schools in SPAECE-Alfa of municipality m, at period t and in categories $Q = 1, 2$. The empirical equation to be estimated for the second exercise is:

$$y_{qmt} = \beta_0 + \beta_k I(CP_m) + \tau_t + \theta_{mt} + u_{kmt} \tag{4}$$

β_k is the parameter of interest, measuring the effect of a given municipality being in the group of Beneficiaries in comparison to the group of Impaired ($I(CP_m)$) for each category k of schools. Thus, it will be compared if there is an effect (positive or negative) in having high or low performance before the Law of the Share Quota and being in a municipality that has been harmed or benefited by the Law in terms of gains intra-government resources. τ_t represents fixed temporal effects andθ_{mt} It fixed municipal effects that vary over time. Standard errors were estimated at the school level.

β_k can be considered causal for two reasons: First, the introduction of the Share Quota Law at the end of 2007 potentially did not affect the performance of schools in that same year, as the SPAECE-Alfa exam was carried out before the promulgation of the Quota Part Law. Second, the introduction of the Quota Part Law can be considered exogenous in time to the educational performance of schools in each municipality. Before introducing of the Quota Part Law, schools had differences in intra-municipal educational performances that were not correlated with future inter-municipal resources.

[8]Note that the municipalities considered to be Beneficiaries are in the 33rd largest centile, the Neutral municipalities are between the 34th and 65th centile. Finally, the impaired municipalities are in the 66th to the 100th centile

A limitation of this approach represented by equation 3.2.2 stems from the possibility that schools between categories are not comparable before introducing the LCP. To overcome this problem, two strategies are adopted. First, a large set of pre-determined control variables for the year 2007 is added. This allows control for observable characteristics between the schools measured before the introduction of the LCP. Second, an Entropy pairing is carried out (Hainmueller (2012)) using pre-determined variables for 2007 at the school level. 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.

4 Results

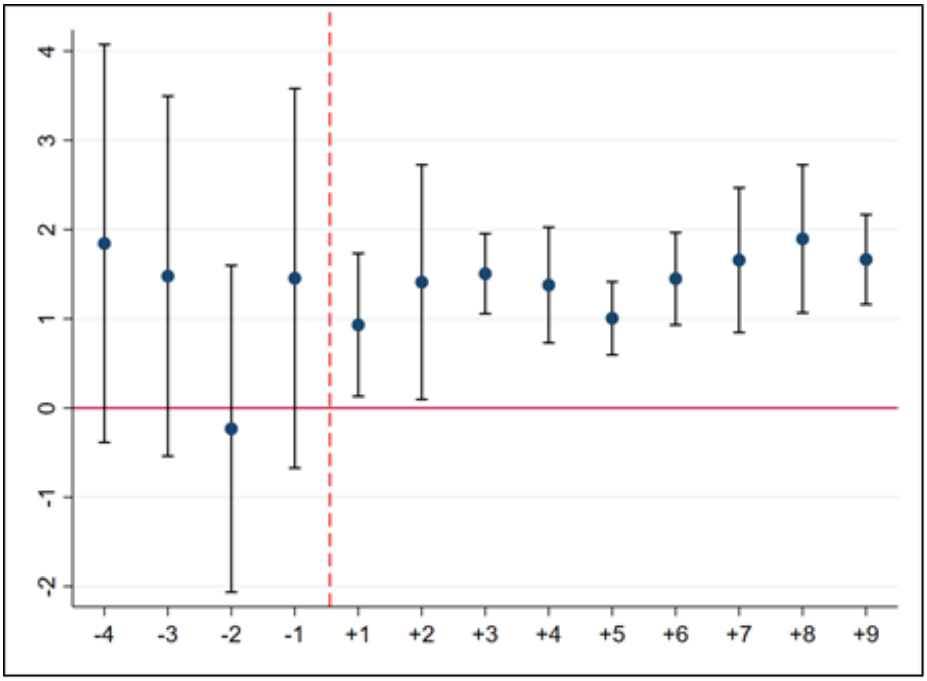
4.1 Results for Spending

figure 2 and figure 3 show the graphical results of the estimation of equation (1). Specifically, figure 2 refers to total expenditure. figure 3 refers to expenditure on education (Panel A), including all types of educational provision that the municipality carries out[9], and expenditure specifically on Elementary Education (Panel B). It is important to note that Elementary Education is the stage in which the aggregate municipal performance is measured to compute how much the municipalities will receive concerning to the share.

Initially, the estimates before implementing the Share Quota Law (marked by the red dotted 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 municipalities before the introduction of the LCP. I.e., the quota share resources before 2008 do not explain the differences between the spending patterns of the

[9]This category includes spending on Youth and Adult Education (EJA) and other expenses associated with programs carried out by the municipality

Figure 2: Effect on Total Expenditure of the Share Quota Law



Note: Prior estimates to the implementation of the LCP (marked by the red dotted line) inform that there was no difference between the total expenditures of the municipalities with high educational performance compared to the other municipalities. The results after implementation indicate that total municipal expenditure was more significant than the amount initially received by LCP. Such an increase is persistent over time, suggesting that LCP produced long-term changes in the number of resources spent.

municipalities.

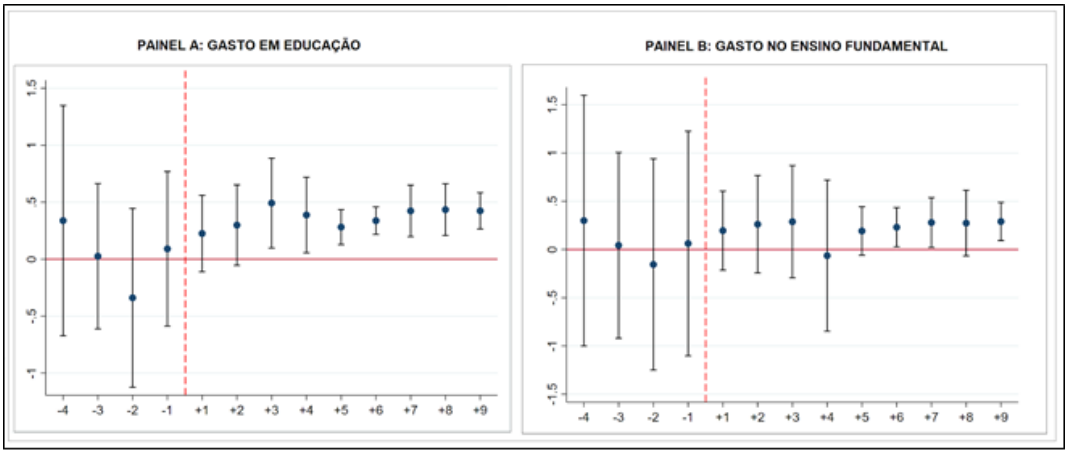
Analyzing the estimates after the implementation of the program, it can be seen that the total municipal expenditure increased by approximately R$1.96 for each real received by the municipality due to the distribution of the portion of the ICMS. This evidence suggests that the Quota Part Law significantly increased total expenditures, more significant than the monetary amount initially received.

This phenomenon is known in the literature as the Flypaper Effect, according to which public entities tend to spend more than the resources they receive from intergovernmental transfers[10]. In the case of Ceará, it can be seen that the municipalities almost doubled their

[10]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

total expenses in the face of an increase in LCP resources. In addition, and perhaps more importantly, such an increase in total spending is persistent over time, suggesting that LCP has produced long-term changes in the number of total resources spent by municipalities.

Figure 3: Effect of the Share Quota Law 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).

figure 3 presents the results for spending on education and spending on primary education. Education spending increased marginally as a result of the Quota Part Law. The average estimate is an increase of of 0.46 cents for each real received by the share in 2009. However, spending on primary education did not present significant estimates almost all years after introducing the Share Quota Law. On average, the result for elementary education was an increase of 0.23 cents for each real distribution. Thus, the LCP did not similarly stimulate spending in education and did not cause changes in spending specifically for elementary education.

In short, the results show that the municipalities that received more resources under the Share Quota Law spent less than they received on education, whether in elementary school education or not. However, total spending increased significantly, more than the share of these municipalities initially redistributed it compared to municipalities that did not benefit

al. (2013). For a discussion of Brazilian literature see: Nojosa et al. (2018).

from the policy. Therefore, the Quota Part Act encouraged non-educational spending more than education spending for the municipalities benefiting from the program[11].

It is important to note that this may be an expected result by the formulators of the Law of the Share Quota, since the resources distributed by such a program are not linked to any specific type of expenditure, and mayors give the destination they deem most appropriate. However, the estimates confirm that this type of design does not increase the municipalities' educational expenditure.

4.1.1 Robustness Exercise

In this subsection, two robustness exercises are presented for the results for public expenditures. First, a rich set of control variables is added that may be associated with municipal public expenditure. Second, the fixed effects associated with the municipal economic cycle are replaced by the fixed municipal effects that vary over time. Additionally, the result associated with the main specification used to estimate figure 2 and figure 3 will also be reported.

table 1 shows the results for the strength exercises. Columns (1), (4) and (7) are the estimates considering the main specification. Columns (2), (5) and (8) show the results considering the addition of a set of 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. The literature indicates these variables as responsible for affecting public spending in general and educational spending in particular. Finally, columns (3), (6), and (9) present the results by replacing the fixed effects associated with the economic cycle with fixed municipal effects that vary over time.

[11] The same exercise was performed considering the total expense subtracted from the educational expense, defined as non-educational expense. The estimates confirm the conclusions indicating that non-educational expenditure increased by approximately 1.45 reais for each real received with the share. Such results are not reported in the article for brevity, but can be obtained by email to the authors.

There is no significant difference in the estimates of the magnitude of the impact on different types of expenditure. The results suggest that the main estimates are not driven by unobserved factors that may skew the results. In addition, there were no differences in inferential terms, indicating that different specifications do not affect the estimates of standard errors.

Table 1: 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
-2*Share Quota Transfers	(0.318)	(0.303)	(0.325)	(0.081)	(0.082)	(0.080)	(0.116)	(0.119)	(0.120)
R^2	0.921	0.921	0.911	0.913	0.914	0.911	0.719	0.721	0.713
Observations	2,345	2,291	2,291	2,345	2,291	2,291	2,345	2,291	2,291
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
Municipal F. E. by Cohort	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[12] 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_{m2009} ranking) and 2. re-estimation of standard errors considering the bootstrap procedure. There were no relevant differences in the main conclusions.

[12]Such exercises can be requested by e-mail to the authors.

4.2 Results for Education

As described in the empirical strategy, the interaction between the schools' previous proficiency and the share transfer will be analyzed. However, the focus will be on the municipalities that have benefited from the municipalities that the introduction of the LCP has harmed. This difference will be compared in groups of schools with similar levels of prior proficiency in the 2nd year of elementary school. The previous performance is divided into the median. It will be observed how schools in each of this median differ in 2009 if the municipality is among those benefited or harmed by the LCP. The results are presented in terms of standard deviations and are controlled using a fixed municipal effect that varies in time and a fixed temporal effect.

table 2 presents the results of the estimation of equation (4). Each column compares the schools in each of the performance categories incorporated into their ranking in the quota share about those most benefited. The result of column (1) compares the most inferior performing schools and the most benefited municipalities concerning the most affected regarding the share distribution. The result is not significant. Column (2) compares high-performance schools in benefited municipalities to the disadvantaged. Again, the estimate is positive, significant, and high magnitude 1.112 s.d. (p-value 0.000). Thus, it can be concluded that being benefited by LCP is relevant for schools with more extraordinary previous educational performance.

Table 2: Educational Results

	k=1	k=2
Treatment	0.537	1.112***
	(0.340)	(0.376)
Observations	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

In summary, the results suggest that schools with low performance in 2007 did not increase their educational results about the municipalities that benefited from the Share Quota Law. However, being in a municipality that benefits from LCP significantly affects the performance of the best schools. It is essential to point out that although the Quota Part Law contains mechanisms of control and penalties for municipalities that increase inequality between schools or try to reduce the rate of adherence to the exam, these mechanisms are not related to differences in performance between comparable groups of schools.

4.2.1 Robustness Exercise

In this subsection, two robustness exercises are presented for the results of educational performance. An important issue associated with the estimates in the table 2 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 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 predetermined 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 3: 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)
Observations	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 3, available above, are divided into two panels. Panel A presents the specification with the addition of control variables.[13]The result for this first

[13]Control variables:% of students with incomplete literacy,% of students with intermediate literacy,% of students with sufficient literacy,% of students with desirable literacy, 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 4 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.

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 digested by experimental factors that can skew the results. As a way to explore and give more evidence to the results already found, another exercise is done, this time, changing the result variable to variables related to higher spending on education

4.2.2 Mechanisms

A possible explanation for the previous results is that the mayors allocate their resources differently in schools with different categories. Managers over schools with lower productivity may prefer those schools that have better productivity with public resources. As a way of verifying this hypothesis of different allocation of resources, a model was estimated, such as the equation (4), having as result variables (1) Teaching Regularity; (2) Adequacy of teacher training$_1$; (3) Adequacy of teacher training$_3$; (4) Adequacy of teacher training$_5$; (5) Management Complexity; (6) Teaching effort$_{(e.y.)_3}$; (7) Students Per Class; (8) Class Duration; (9) Teachers with a college degree and (10) Using Principal Component Analysis of those variables. The variables are associated with the supply and quality of public education and higher spending on education.

The indicators of school management complexity, level 3 training adequacy, the average number of students per class and duration per class were not significant. However, it is worth noting that schools in the lower median have a higher number of students than the higher median; however, the class duration is longer.

The adequacy training$_1$ is significant and negative only for k = 2. In contrast, for training$_5$. It shows that teachers who do not have higher education are significant for the entire sample, however negative for the lower median and the upper median.

The regularity of teaching and the teaching effort is significant and positive for the entire sample. It is being optimistic for teaching regulation and harmful for teaching effort. The variable that measures the percentage of professors with a higher education level is positive and significant only for the lower median.

The variable that uses Principal Component Analysis which is a synthetic indicator from (1), (2), (3), (4), (5), (6), and standardized duration class, 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.

The results are available in the table 4, divided by the median, i.e., k=1 is the lower median and k=2 is the upper median. All the results are standardized (i.e., mean = 0, s.d. = 1), except for Students Per Class and Class Duration, which are not standardized to understand the results better.

Table 4: Results Mechanisms

Variable	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2	k=1	k=2
Treatment	0.895**	0.825***	-0.285	-1.049***	1.062	-0.274	-0.494***	1.018***	-0.500	-0.160	-0.770***	-0.802*	6.894	-0.445	2.540	-3.037	0.421**	-1.099	-0.199	-1.407***
	(0.403)	(0.293)	(0.571)	(0.323)	(0.688)	(0.387)	(0.176)	(0.194)	(0.438)	(0.300)	(0.249)	(0.467)	-4.579	-1.704	-6.082	-2.695	(0.206)	(0.000)	(0.291)	(0.230)
Observations	2,425	2,546	2,214	2,412	2,214	2,412	2,214	2,412	2,434	2,546	2,214	2,412	1,625	1,902	1,754	2,074	1,689	1,753	1,752	2,074
R^2	0.381	0.388	0.425	0.466	0.452	0.415	0.434	0.398	0.35	0.314	0.389	0.39	0.405	0.322	0.703	0.64	0.461	0.444	0.595	0.561
Municipal F.E. by Cohort	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Matching by Entropy	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	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: Variables number are represented by (1) Teaching Regularity; (2) Adequacy of teacher training$_1$; (3) Adequacy of teacher training$_3$; (4) Adequacy of teacher training$_5$; (5) Management Complexity; (6) Teaching effort$_{(e.y.)_3}$; (7) Students Per Class; (8) Class Duration; (9) Teachers with a college degree$_{e.y.}$; (10) Principal Component Analysis (PCA). The description of these variables is in the table 6, available in Appendix.

5 conclusion

This article analyzed the impact of introducing the Share Quota Law (LCP) in 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 LCP have allocated more significant resources for non-educational spending. Total educational expenditures increased more petite than the amount received with the share, and, specifically, spending on primary education was not affected. This result suggests that the LCP did not induce municipalities to increase their spending on education.

Subsequently, it was verified whether the educational impact of the LCP was different between schools with different performances before the introduction of the program. The results show that only schools with better previous performances improved their results when they were in municipalities benefited by LCP. The results suggest the existence of a different allocation of resources in the benefited municipalities. In the analysis of mechanisms, the possibility of this differentiated allocation of resources was verified.

Conjointly, the results show that the effect of the LCP did not induce municipalities to spend more on education and increased educational inequality at the school level. As for the first point, it can be seen that the municipalities almost doubled their total spending in the face of an increase in LCP resources, an effect known as the Flypaper. In addition, such an increase in total spending is persistent over time, suggesting that the LCP has produced long-term changes in the number of total resources spent by the municipality. As for the second point, the results show that schools with low performance in 2007 did not increase their educational results concerning the municipalities that benefited from the LCP. The main explanation is the presence of an intra-municipal resource allocation directed at schools that have the most significant potential to generate good results in standardized tests.

Some exercises were carried out to provide further robustness to the results, one for the expenditure and two for education. For the results of Flypaper, a set of control variables that

may be associated with municipal public expenditure is added. The fixed effects associated with the municipal economic cycle are replaced by the fixed municipal effects that vary over time. There was no significant difference in the magnitude of the impact on the different types of expenditure.

For educational results, a series of control variables are used that may be associated with the future performance of schools. applies entropy matching (hainmueller2012entropy) considering the same predetermined variables used for the previous control. The results suggest that the estimates are not potentially digested by experimental factors that can skew the results. The last activity, changing the result variable to variables related to higher spending on education, suggests no difference between low-performing schools before LCP.

The results found are intriguing and lead us to investigate which other channels were crucial for improving educational performance in Ceará and the significance of LCP in the set of educational mechanisms in Ceará. Such questions are not the target of this research, being left for future research.

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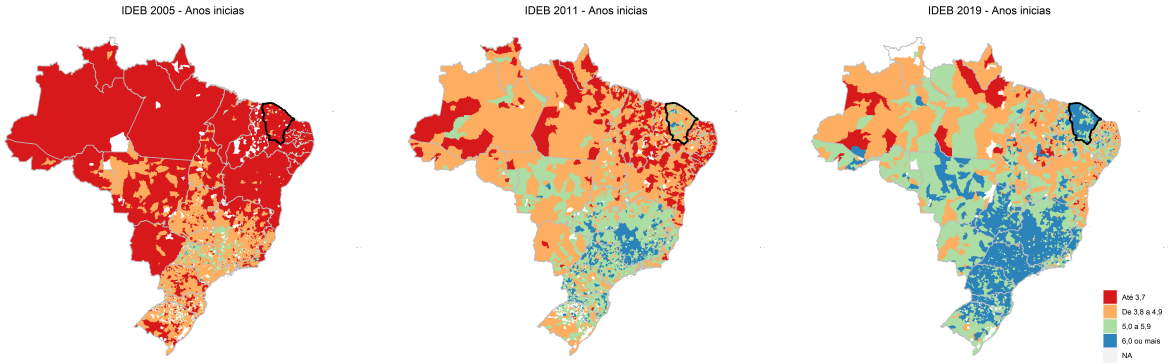
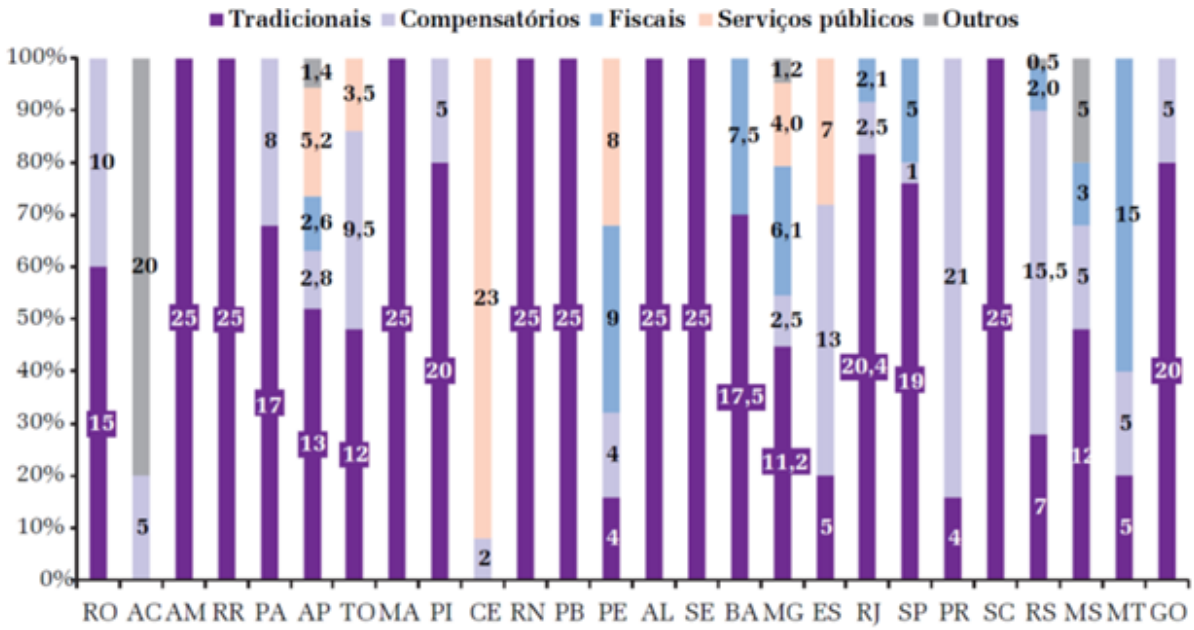
Appendix

Figure 4: 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 5: 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 5: 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.
Failure rate	The proportion of students in the 1st and 2nd year of an elementary school failing.
Abandonment Rate	The proportion of first and 2nd Year Elementary School students who dropped out of school.
Age-Series Distortion	The proportion of students in the 1st and 2nd year of elementary school-aged above the appropriate grade in which they attend.
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)
Teachers with Higher Education	Average of teachers with higher education
White	Average of professors declared with color/race White
Gender	Average of female teachers
Age_1	The average age of teachers up to 24 years
Age_2	The average age of teachers from 24 to 29 years old
Age_3	Average age of teachers from 30 to 39 years old
Age_4	The average age of teachers from 40 to 49 years
Age_5	The average age of teachers over 50 years
class duration	Average class hours of school in the 2nd year
Specialization studies	Average of teachers with specialization
postgraduate studies	Average of professors with master's and/or doctorate degrees
no postgraduate studies	Average of professors without master's and/or doctorate degrees

Table 6: Description of the Variables Used for the Mechanism

Variable	Description
(1) - Teaching Regularity	indicator to evaluate the regularity of the teaching staff in the schools of primary education from the observation of the permanence of the teachers in the schools in the last five years
(2) - Adequacy of teacher training_1	Teachers with higher education (or degree with pedagogical complementation) in their area of the discipline he teaches.
(3) - Adequacy of teacher training_3	Teachers with a higher education degree (or bachelor's degree with pedagogical complementation) in different combinations that you teach.
(4) - Adequacy of teacher training_5	Teachers without higher education
(5) - 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.
(6) - Teaching $\text{effort}_{(initialyears)_3}$	A teacher who has between 25 and 300 students and works in one or two shifts in a single school and stage
(7) - Students Per Class	Average Students per Class
(8) - Class Duration	Duration of school hours in minutes
(9) - Teachers with a college $\text{degree}_{inthecarlyyears}$;	Percentage of teachers with higher education at school
(10) - Principal Component Analysis (PCA)	Combination of indicators (1), (2), (3), (4), (5), (6) and standardized duration class using the Principal Component Analysis methodology