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Do voters reward politicians for education expenditures?*

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Contents

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Abstract · **Resumo**

Since education is publicly provided in most countries, the political system typically determines the level of education expenditures. Thus, it is essential to understand politicians' incentives to allocate resources to education. This paper provides causal evidence that voters reward politicians for educational expenditures by estimating the impact of a change in public education spending on mayors' reelection chances. To do so, we use an exogenous source of variation in education expenditures brought about by a federal reform, FUNDEF, in Brazil. We show that increases in education expenditures caused by FUNDEF led to a significant increase in the mayors' reelection chances. One percent increase in per capita education expenditures due to FUNDEF led to a 1.45 percent increase in mayors' reelection chances.

1. Introduction

There is ample evidence that education is essential for a country's human capital formation and socioeconomic development. Despite that, public education expenditures and quality are extremely low in many countries, particularly in the developing

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world. As the political system typically determines public education expenditures, it is essential to understand politicians' incentives to allocate resources to education.

This paper analyzes the electoral impact of education expenditures. More specifically, it studies the variation in mayors' chances of reelection in the 2000 Brazilian local elections caused by a change in public education expenditures.

Primary education provision is an essential function of Brazilian municipalities by the significant portion of resources allocated to it and its political and popular appeal (Sakurai, 2009). Thus, one can assume that politicians choose the level of education investment to please voters, and voters reward politicians for doing so.[1] This generates a potential for reverse causality when empirically investigating the link between reelection and education expenditures.

We deal with this potential endogeneity issue by exploiting FUNDEF, a federal education funding reform implemented in Brazil in 1998.[2] Under FUNDEF, municipalities experienced exogenous variations in the educational budget of local schools. From the perspective of municipalities, these variations in spending were exogenous as the amount of funding received by a municipality depended on a rule defined by the federal government, as we will explain in section 2. Importantly, mayors had no control over the amount of FUNDEF transfers they received. In addition, the reform imposed strict rules to guarantee that schools would receive FUNDEF resources.

We expect voters to hold mayors accountable for these variations in educational spending, even if FUNDEF resources originate from constitutional transfers. While rational voting models predict that voters should not reward/penalize politicians for actions beyond their control, there is abundant evidence that, in reality, they do.[3] In particular, if voters are poorly informed, they could be unaware of the funding sources and attribute outcomes to politicians' preferences or competence levels. Using data from an Uruguayan cash transfer program, Manacorda, Miguel, and Vigorito (2011) show that voters reward politicians for this program even if these transfers are quasi-randomly assigned. In federal countries, such as Brazil, with overlapping government functions, it may be especially difficult to attribute responsibility to particular government levels (Arceneaux, 2006). Litschig and Morrison (2013) present evidence that federal transfers affected mayors' reelection chances in the Brazilian 1988 elections. In our setting, municipal governments carry out all expenditures related to municipal schools, including those made with FUNDEF resources. In fact, the majority of resources for municipal education are

[1] There is a vast literature exploring the so-called *political budget cycles* including Alesina and Paradisi (2017); Alesina and Perotti (1995); Bohn (2019); Brender and Drazen (2005); Nakaguma and Bender (2010); Rogoff (1990).

[2] More precisely, we instrument (per capita) public education expenditures by a simulated (per capita) FUNDEF's net transfers variable following Kosec (2011), as we discuss in section 2.

[3] Examples include voters punishing politicians for events, such as weather shocks (Cole, Healy, & Werker, 2012), the world economy (Leigh, 2009), and even shark attacks (Achen & Bartels, 2013).

federally funded. Moreover, since local governments have discretion on managing school investments, voters may still be extracting some signals on incumbents from policy outcomes, as in Lehmann and Matarazzo (2019).

We show that the FUNDEF reform had a significant and positive impact on educational expenditures for municipalities whose budgets were increased by the fund, leading to a substantial increase in the mayor's chances of reelection. For example, one percent increase in education expenditures due to FUNDEF led to a 1.45 percent increase in the mayor's probability of reelection. This result is consistent with the evidence in the literature that FUNDEF impacted school quality positively, a plausible explanation for the rise in mayors' chances of reelection (Estevan, 2012; Menezes-Filho & Pazello, 2007).

Our results are in line with Firpo, Pieri, and Portela Souza (2016). They find evidence that changes in a school quality composite index, IDEB, positively affect the mayor's reelection chances in Brazil. The increase of one unit in IDEB from 2005 to 2007 increased the mayor's reelection chances by 5 percentage points. The increase was most significant for the most deprived cities and the ones with more children at school age, reaching 10 percentage points.

More generally, our study relates to three strands of the literature. First, it relates to studies of retrospective voting, such as described by Besley (2007), where voters reward or punish politicians according to the actions they have taken while in office. Papers such as Levitt and Snyder (1997), Ferraz and Finan (2008), Bó, Foster, and Putterman (2010), Manacorda et al. (2011), and Voigtlaender and Voth (2014) find evidence that incumbent politicians actions during office affect their subsequent political support and election outcomes. Politicians, in turn, respond accordingly, changing behavior when they are eligible to reelection (Alt, Mesquita, & Rose, 2011; Besley & Case, 1995; Curto-Grau, Solé-Ollé, & Sorribas-Navarro, 2018; Ferraz & Finan, 2011).

Second, it relates to the broader field of political accountability and taxation. It contributes to a large literature investigating the effect of fiscal policy on the electoral performance of executive chiefs at the pools. In developed countries, this literature typically shows that voters punish politicians who carry higher expenses (Brender, 2003; Brender & Drazen, 2005; Katsimi & Sarantides, 2012; Kneebone & McKenzie, 2001; Meneguin, Bugarin, & Carvalho, 2005; Peltzman, 1992; Vergne, 2009; Vermeir & Heyndels, 2006). However, there is some evidence that these results may differ in developing countries, where there seems to exist political rewards for higher spending (Alesina, Campante, & Tabellini, 2008; Brender & Drazen, 2008; Drazen & Eslava, 2010; Jones, Meloni, & Tommasi, 2012; Sakurai & Menezes-Filho, 2008; Schuknecht, 2000).

Last, it contributes to a growing literature exploring the democratic drivers for education investment. Works as Stasavage (2005), Gallego (2010), Harding and Stasavage (2013) and Acemoglu, Naidu, Restrepo, and Robinson (2015) suggest that

democracies are more likely than autocracies to invest in public education. In line with the literature mentioned above, this work indicates a channel by which this might happen.

The paper is organized as follows. Section 2 presents FUNDEF institutional framework. Section 3 describes data sources and section 4 outlines the identification strategy. The results are presented in section 5 and section 6 concludes.

2. The FUNDEF reform

According to the 1988 Brazilian Constitution, schooling is compulsory for all children between 4 and 17 years old. States and municipalities must (publicly) provide education by spending at least 25 % of their taxes and transfers revenues in the public education system. Local governments are mostly in charge of primary education.

This 25 %-rule generated considerable inequality in education expenditure across states and municipalities, as there are substantial differences in state and municipal tax and transfer revenues. In 1998, the federal government passed the FUNDEF reform to redistribute education resources within states. The FUNDEF reform directed 15 % of the states and municipalities revenues from the four main taxes and transfers (amounting to about 60 % of the original 25 %) to a fund created within each of the 26 Brazilian states.[4] The resources were then redistributed back to the state and its municipalities according to the share of students enrolled in each of their school systems. The remaining 10 % of those revenue sources (40 % of 25 %) were still to be spent directly on their respective education systems and could not be used to finance other municipal expenditures.

The redistributive role of the fund, the resource allocation rules, and supervision suggest that we should expect quality improvements as a result of FUNDEF, as found in Menezes-Filho and Pazello (2007). The reform established that municipalities should spend 60 % of FUNDEF resources on teacher wages. The remaining funds could cover various expenses related to "maintenance and development of education." Expenditures using FUNDEF were audited monthly by specific local committees formed within each municipality and by the accounting court annually, making it unlikely that municipalities could deviate FUNDEF resources to cover other expenditures. Moreover, the federal government provided additional funds to states where the amount per student did not reach a nationally set minimum.

[4]More precisely, FUNDEF is composed by ICMS (state value-added tax), FPM/FPE (transfers from the federal government), IPI (federal value-added tax), and the financial compensation for loss of income resulting from the exemption of exports, according to Supplementary Law No. 87 of September 13, 1996.

3. Data

We gather data on candidates in the 2000 local elections, their vote shares, and party affiliation and coalition from the electoral data repository of the Superior Electoral Court (TSE, 2015). As the possibility of reelection passed in 1997, all mayors elected in 1996 could run for reelection in 2000.[5]

We obtain data on constitutional transfers, taxes, and expenditures on the National Treasury website for 1997–2000 (STN, 1997, 2015), and Ipeadata (Ipea, 2018). We use demographic variables as controls from IBGE (2000).

Our main FUNDEF variable is

$$\begin{aligned} \textit{Net FUNDEF p.c.}_{i,t} &= \frac{\textit{Net FUNDEF}_{i,t}}{\textit{Population}_{i,t}} \\ &= \frac{\textit{FUNDEF Revenue}_{i,t} - \textit{Contribution}_{i,t}}{\textit{Population}_{i,t}}, \end{aligned} \quad (1)$$

where $\textit{Contribution}_{i,t} = 0.15 * (\textit{FPM}_{i,t} + \textit{ICMS}_{i,t} + \textit{IPI}_{i,t} + \textit{LC87/96}_{i,t})$ is the contribution municipality i made to the fund in t, and $\textit{FUNDEF Revenue}_{i,t}$ is the amount that municipality i received from the fund in t.

Since the federal government defined the rule, the resulting variation in school expenditures caused by FUNDEF is exogenous from the municipalities' point of view. However, FUNDEF net transfers calculated using 1998–2000 data are potentially endogenous. For instance, mayors could boost the number of enrolled students and increase FUNDEF net transfers. Cruz (2018) provides evidence that this may have happened. Additionally, an unobserved macroeconomic variable could affect tax revenue (and therefore FUNDEF) and reelection chances. To deal with both concerns, we adopt the approach suggested by Kosec (2011) and calculate a simulated FUNDEF variable using enrollment and tax and transfer data from 1997, i.e., Net FUNDEF p.c. 1997. Enrollment data for 1997 is available at the 1997 Brazilian School Census (INEP, 1997). For the tax and transfer data, we use the four tax and transfer revenues (used for FUNDEF from 1998 on) from 1997 and calculate a hypothetical FUNDEF revenue and contribution, which would hold if FUNDEF was already in place in 1997. Since the financial and enrollment data collection occurred before the definition of FUNDEF rules, this variable is not affected by the mayor's possible manipulation of school enrollment or municipalities' economic activity. Moreover, before FUNDEF, mayors had no incentives to inflate enrollment, as funding was unrelated to the enrollment levels.

[5]We use electoral data from the 1996 elections to check whether incumbents were candidates and won the reelection in 2000. Note that even if reelection existed in 1996, a difference-in-difference approach would be infeasible in an electoral setting with term limits. Incumbent mayors, as well as other executive representatives, can be consecutively re-elected only once in Brazil. A higher probability of reelection in the first term would mechanically be associated with a lower chance in the second term, as a successful incumbent would not be able to run again.

Our initial sample has all 5,381 Brazilian municipalities with municipal schools. We drop 102 municipalities without electoral data (1.9%) and 58 municipalities without data on federal transfers (0.09%). For the remaining 5,221 municipalities, we can calculate the 'Net FUNDEF p.c.' and 'Federal transfers,' which we use in our reduced-form specification explained below. Thus, for 76.7% of the sample, 4,002 municipalities, we have additional tax revenue, state transfers, and expenditures data from IPEA and the FINBRA database, which allow us to perform further analysis.

Table 1 presents summary statistics of the main variables for the full sample and other samples used in the analysis. In our empirical exercises, our main outcome variable is the reelection probability of an incumbent mayor. Still, we also consider the likelihood of reelection of an incumbent party or incumbent coalition member. The incumbent mayor ran in 68% of the municipalities in 2000, and in 40% of municipalities won the reelection. The incumbent won the reelection in 59% of municipalities in which she was competing in 2000. The mayor's party coincides with the (state) governor's and president's party in approximately 22% and 15% of the municipalities, respectively. There are substantial disparities in the tax and transfers received by municipalities, consistent with significant levels of economic inequality across municipalities. Net FUNDEF and education expenditures are sizeable when compared to tax revenues and state/federal transfers.[6] The Brazilian population is young: 51% are less than 24 years old, and only about 10% are older than 60 years old. Importantly, most variables' means are remarkably similar in columns 1 and 2. As we will show in section 5, our results are very similar when we consider the full sample and the reduced sample for which tax data is available.

4. Identification strategy

We start by estimating a reduced-form specification of the simulated FUNDEF variable on the (unconditional) probability of reelection of an incumbent mayor, her party, and her coalition:[7]

$$Reelected_i = \alpha + \beta_1 Net\ FUNDEF\ p.c._{i,97} + \beta_2 \mathbf{X}_i + u_i, \tag{2}$$

where $Net\ FUNDEF\ p.c._{i,t}$ measures per capita (simulated) FUNDEF balance in municipality i in 1997 calculated according to (1) and *Reelected* is equal to 1 if the incumbent mayor (party or party member of coalition) won the 2000 local election and 0 otherwise. $\mathbf{X}_i$ is a vector of municipal control variables that includes tax and transfer revenue data, demographic variables, and political variables. We include the

[6] The tax revenues and state/federal transfers do not include the FUNDEF funds.

[7] As discussed in Magalhães (2015), the unconditional probability is more appropriate in countries where rerunning for reelection is not so common. Indeed, in Brazil, the incumbency advantage is not so strong since not all parties rerun, and switching parties is common.

Table 1. Descriptive statistics

	Full sample (1)	Reduced sample (with tax data) (2)	Net recipients (with tax data) (3)
A. Political variables (2000)			
Incumbent reelected	0.396	0.395	0.458
Incumbent party reelected	0.473	0.472	0.521
Incumbent coalition reelected	0.545	0.548	0.579
Incumbent running	0.680	0.665	0.737
Governor party	0.217	0.200	0.226
President party	0.148	0.145	0.163
B. Tax and transfer variables (1998–2000)			
FUNDEF Net Transfers p.c. 1997	−12.96	−16.11	18.90
	(39.22)	(39.45)	(14.71)
FUNDEF Net Transfers p.c.	−9.84	−14.52	23.28
	(82.65)	(88.55)	(23.29)
Federal transfer p.c.	170.67	174.57	112.01
	(110.39)	(113.99)	(51.70)
Tax revenue p.c.		20.11	24.38
		(54.66)	(77.62)
State transfer p.c.		111.38	89.93
		(142.09)	(166.00)
C. Municipal expenditures (1998–2000)			
Education p.c.		158.54	134.44
		(236.97)	(176.79)
Housing expenditure p.c.		44.41	37.03
		(96.48)	(45.21)
Health and sanitation p.c.		79.55	68.47
		(78.49)	(74.99)
Social security p.c.		32.82	24.72
		(127.04)	(47.35)
Transportation p.c.		39.15	23.87
		(58.93)	(37.73)
Industry and Trade p.c.		3.42	2.64
		(11.41)	(6.52)
Agriculture p.c.		13.35	7.53
		(22.22)	(13.30)
Defense and security p.c.		0.98	0.89
		(4.81)	(5.55)
Energy p.c.		1.20	1.09
		(3.91)	(3.79)
Regional development p.c.		0.51	0.48
		(3.31)	(4.25)
Communications p.c.		1.02	0.54
		(3.71)	(2.49)
Other p.c.		120.05	92.80
		(288.14)	(188.13)
D. Demographic variables (2000)			
Total population	31,418	34,821	64,230
	(189,661)	(215,481)	(339,491)
Young population (%)	0.511	0.499	0.529
Elderly population (%)	0.095	0.097	0.087
Urban population (%)	0.588	0.599	0.599
Observations	5,221	4,002	1,471

Notes: Standard deviations are in parentheses. The variables in Panels B and C are means over the period 1998–2000 unless otherwise specified.

municipality's per capita total tax revenue, state and federal transfers to account for other sources of revenue that may have affected the mayor's probability of reelection.[8] We control for the proportion of young, elderly, and urban population to account for demographic features of the municipality that could affect voting behavior. For instance, a municipality's age composition could affect voters' attitudes regarding education expenditures. We also include dummy variables for mayors running for reelection in the same party as the governor or president to consider the possible effect of political favoring and political support during the elections. We cluster the error terms, ϵ_i and u_i, at the state level.

To estimate the impact of (per capita) education expenditures, instrumented by the simulated (per capita) Net FUNDEF variable, on incumbent's mayor, party, and coalition member probability of reelection, we use a two-stage least squares strategy:

$$\textbf{FS}: \textit{Education Expenditures}_{i,98-00} = \alpha + \beta_1 \textit{Net FUNDEF p.c.}_{i,97} + \beta_2 \mathbf{X}_i + \epsilon_i, \quad (3a)$$

$$\textbf{SS}: \textit{Reelected}_i = \alpha + \beta_1 \widehat{\textit{Education Expenditures}_{i,98-00}} + \beta_2 \mathbf{X}_i + u_i. \quad (3b)$$

This identification strategy is valid under the assumption that FUNDEF net transfers only affected reelection chances through education expenditures. A potential threat would arise if mayors used FUNDEF resources to increase other public expenditures or decrease taxes to improve their reelection chances.

While we cannot directly test these exclusion restrictions, Tables 5 and 6 investigate the correlation between FUNDEF resources and municipalities' expenditures or taxes. Table 5 shows that there is little evidence that FUNDEF correlates with municipal spending in other areas. If anything, there was a slight decrease in transport expenses. This lack of effect is consistent with FUNDEF's rules preventing mayors from reallocating funds to other expenses, as discussed in section 2. Table 6 suggests that, if anything, FUNDEF correlates with an increase in local taxes. Everything else equal, we would expect such tax increases to diminish mayors' reelection prospects.

Thus, the reduction in transport spending and the increase in taxes would go against us finding a positive impact of education expenditures on reelection chances. We can therefore consider our results to be lower-bounds of the true estimates.

5. Main Results

Table 2 presents the reduced-form estimates corresponding to equation (2). Columns 1–3 show the results for the full sample, and the remaining columns use the reduced sample allowing for tax revenue and state transfer controls. In column 1, we see that a 1 BRL increase in the (simulated) FUNDEF net transfers generates an increase

[8] State and federal transfers exclude contributions to FUNDEF.

Table 2. Reduced-form estimates of simulated FUNDEF on the incumbent's probability of reelection

	Incumbent reelected						
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Net FUNDEF p.c. 1997	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Federal transfers p.c.	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Young population (%)		0.620***	0.396*		0.861***	0.615**	0.649**
		(0.204)	(0.228)		(0.230)	(0.275)	(0.247)
Elderly population (%)		0.441	0.280		0.415	0.145	0.165
		(0.509)	(0.466)		(0.633)	(0.587)	(0.548)
Urban population (%)		−0.029	−0.084**		−0.040	−0.110**	−0.128**
		(0.044)	(0.040)		(0.055)	(0.052)	(0.052)
Governor party			0.181***			0.181***	0.180***
			(0.022)			(0.024)	(0.023)
President party			0.179***			0.191***	0.191***
			(0.040)			(0.043)	(0.043)
Tax revenue p.c.							0.001***
							(0.000)
State transfers p.c.							−0.000
							(0.000)
Constant	0.282***	−0.043	0.066	0.283***	−0.141	0.002	−0.010
	(0.018)	(0.169)	(0.168)	(0.018)	(0.198)	(0.202)	(0.185)
Observations	5,221	5,221	5,221	4,002	4,002	4,002	4,002

Notes: Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

of 0.3 percentage points in the probability of reelection for the incumbent mayor. The coefficient slightly decreases once we include population controls (column 2) and add political controls (column 3). To put these numbers into perspective, one standard deviation increase in FUNDEF net transfers leads to a 19.9% increase in the probability of reelection, considering the controls in these last specifications.[9] In columns 4–7, we estimate the same specifications as in columns 1–3 using the reduced sample, for which we have additional tax revenue and state transfer data. The coefficient estimates of our main variable of interest, "Net FUNDEF p.c. 1997," are nearly identical, which reassures us that our additional exercises in this reduced sample do not compromise the generality of our results. In column 7, we show

[9]As shown in column 1 of Table 1, the standard deviation of FUNDEF net transfers is 39.22, and the average reelection probability is 0.396.

that our estimates are robust to the inclusion of municipal tax revenues and state transfers controls.

In tables 7 and 8, we run the same reduced-form specifications (from equation (2)) by considering the likelihood that the incumbent's party or a party that is a member of the incumbent coalition wins the 2000 municipal elections. The results are remarkably similar across different specifications. Given that the incumbent party or coalition won the 2000 election in 47.3 % and 54.5 % of municipalities, one standard deviation increase in FUNDEF net transfers generates a 17.5 % and 11.0 % increase in their probability of reelection, respectively. As one could expect, these results suggest that the incumbency advantage given by FUNDEF is particularly strong for the incumbent compared to her party or coalition.

As we discussed in the previous section, we should expect that the main channel of influence in FUNDEF is education expenditures. We start by investigating the impact of (per capita) net FUNDEF p.c. on (per capita) education expenditures to exploit this mechanism. We allow for a differential impact on municipalities that received and lost resources with FUNDEF. Indeed, Estevan (2015) shows that FUNDEF had a significant effect on education expenditures only for municipalities receiving positive net FUNDEF transfers ("net recipients"). Municipalities that were net contributors seem to have somehow neutralized the impact of (negative) FUNDEF net transfers by using other sources of revenue. This explanation is consistent with the idea that it may be nearly impossible to reduce education expenditures, especially in the short term, as teachers have tenure in Brazil and substantial fixed costs characterize the educational sector.[10]

Table 3 presents the results of the first-stage in equation (3). As expected, we can use net FUNDEF transfers as an instrument for education expenditures only for the municipalities that received positive net transfers, i.e., columns 4–6. Therefore, we focus the remaining of our analysis on municipalities that were net recipients from FUNDEF. Accordingly, Table 1 (column 3) presents descriptive statistics for municipalities that were net recipients from FUNDEF.

We now investigate whether education expenditures affected reelection chances in the 2000 Brazilian local election. First, we present the results of the first- and second-stage regressions in Table 4 for municipalities that were net recipients from FUNDEF. The first lines of the table confirm that the instrument is relatively strong for this group of municipalities, especially once we include all control variables. Then, as before, we present the results for incumbent, party, and coalition reelection.

The results of the second-stage regression show that an increase in education expenditures causes an increase in the mayor's probability of reelection. In columns 1–3, we restrict our attention to the likelihood that the incumbent will win reelection. One percent increase in per capita education expenditures (roughly 1.3 BRL) leads

[10] In the longer run, mayors can decrease education spending in real terms by not indexing it to inflation.

Table 3. First-stage estimates of simulated FUNDEF net transfers on education expenditures

	Education expenditures p.c. 1998–2000								
	Full Sample			Net recipients			Net contributors		
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Net FUNDEF p.c. 1997	0.390**	0.609**	−0.098	1.194**	1.643***	0.568***	0.120	0.292	−0.287
	(0.176)	(0.251)	(0.425)	(0.436)	(0.416)	(0.153)	(0.204)	(0.360)	(0.714)
Federal transfers p.c.	0.639***	0.755***	0.312**	0.464***	0.564***	0.179	0.598***	0.708***	0.253
	(0.069)	(0.070)	(0.127)	(0.071)	(0.134)	(0.247)	(0.081)	(0.073)	(0.202)
Tax revenue p.c.			0.518			0.220			2.031
			(0.319)			(0.364)			(1.482)
State transfers p.c.			0.956**			0.715**			1.184**
			(0.392)			(0.299)			(0.556)
Demographic controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Political controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
F-statistic	4.93	5.89	0.05	7.50	15.62	13.84	0.34	0.66	0.16
p-value	0.036	0.023	0.819	0.012	0.000	0.001	0.563	0.424	0.691
Observations	4,002	4,002	4,002	1,471	1,471	1,471	2,531	2,531	2,531

Notes: Net recipients and net contributors are defined by "FUNDEF net transfers p.c. 1997" greater or smaller than zero. Sample includes only municipalities with data on tax and transfer revenues and expenditures. Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

Table 4. 2SLS estimates of education expenditures on reelection in 2000

	Incumbent reelected			Incumbent party reelected			Incumbent coalition reelected		
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I. First-stage									
Net FUNDEF p.c. 1997	1.194**	1.643***	0.568***	1.194**	1.643***	0.568***	1.194**	1.643***	0.568***
	(0.436)	(0.416)	(0.153)	(0.436)	(0.416)	(0.153)	(0.436)	(0.416)	(0.153)
F-statistic	7.50	15.62	13.84	7.50	15.62	13.84	7.50	15.62	13.84
p-value	0.012	0.000	0.001	0.012	0.000	0.001	0.012	0.000	0.001
II. Second-stage									
Education expenditure p.c.	0.004**	0.002**	0.005**	0.004**	0.002**	0.006***	0.004**	0.002**	0.005***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Federal transfers p.c.	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tax revenue p.c.			−0.001			−0.001			−0.001
			(0.002)			(0.002)			(0.002)
State transfers p.c.			−0.004			−0.004			−0.004
			(0.003)			(0.003)			(0.002)
Demographic controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Political controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471

Notes: Sample includes municipalities that were net recipients from FUNDEF, defined by "FUNDEF net transfers p.c. 1997" greater than zero, with data on tax and transfer revenues and expenditures. Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

to a 0.66 percentage point increase in the probability of reelection once we add all tax, demographic, and political control variables. This is a sizeable effect, corresponding to a 1.45 % increase in the probability of reelection.[11] In columns 4–6, we allow for the incumbent or incumbent party reelection, and in columns 7–9, we include the possibility that a party formerly in the incumbent's coalition wins the 2000 election. The results are quantitatively and qualitatively very similar for these two related outcome variables.

Overall, our results strongly suggest that voters reward politicians for increased educational spending. Moreover, an increase in education expenditures improves the reelection chances of mayors, parties, and party coalition members.

6. Conclusion

Public provision of education is an essential role of governments around the world. Therefore, one may expect electoral rewards associated with increasing education expenditures. The primary identification challenge to identify the impact of education expenditures on reelection chances is reverse causality. As politicians typically choose expenses to improve reelection chances, one needs an exogenous variation in education expenditures to estimate the causal effect of increasing education expenditures on reelection outcomes.

In this paper, we overcome this identification issue by exploiting the introduction of FUNDEF, an educational funding reform that took place in Brazil in 1998. We present evidence that Brazilian voters reward incumbent mayors for increased educational spending. Our results suggest sizeable effects: one percent increase in per capita education expenditures leads to a 1.45 percent increase in the probability of reelection. This result is consistent with school quality improvements related to FUNDEF reform that have been well-documented in the literature (e.g., Menezes-Filho & Pazello, 2007). These effects suggest an important role for local politicians in implementing educational reforms, especially with strict budgetary accountability.

[11] The coefficient is 0.0049232, and the mean of the reelection rate is 45.8 %.

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Appendix. Tables

Table 5. OLS estimates of simulated FUNDEF net transfers on other municipal expenditures

	Other expenditures p.c. 1998–2000										
	Housing	Health sanitation	Social security	Transport	Industry & trade	Agric.	Defense & safety	Energy	Regional dvlp.	Communic.	Other
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Net FUNDEF p.c. 1997	−0.016	0.156	−0.070	−0.206**	0.014	−0.006	0.041	−0.011	0.002	−0.002	−0.448
	(0.060)	(0.136)	(0.067)	(0.079)	(0.019)	(0.040)	(0.030)	(0.014)	(0.006)	(0.004)	(0.278)
Federal transfers p.c.	0.189**	0.077	0.015	0.092***	0.016***	0.072**	0.001	−0.001	0.000	−0.000	0.157*
	(0.073)	(0.072)	(0.017)	(0.028)	(0.006)	(0.033)	(0.006)	(0.004)	(0.002)	(0.004)	(0.091)
Tax revenue p.c.	0.099*	0.237**	0.238***	0.135***	0.019***	−0.028	−0.015*	0.026***	0.003	−0.005	1.273***
	(0.055)	(0.093)	(0.052)	(0.042)	(0.006)	(0.028)	(0.008)	(0.003)	(0.005)	(0.007)	(0.180)
State transfers p.c.	0.141***	0.285***	0.174***	0.097***	−0.003	0.030	0.015	0.005	0.001	0.005	0.626***
	(0.038)	(0.071)	(0.029)	(0.030)	(0.002)	(0.019)	(0.011)	(0.003)	(0.003)	(0.005)	(0.127)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471	1,471

Notes: Sample includes municipalities that were net recipients from FUNDEF, defined by "FUNDEF net transfers p.c. 1997" greater than zero, with data on tax and transfer revenues and expenditures. Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

Table 6. OLS estimates of simulated FUNDEF net transfers on other municipal taxes

	Municipal taxes p.c. 1998–2000			
Variables	Tax Revenue (1)	IPTU (2)	ISS (3)	ITBI (4)
Net FUNDEF p.c. 1997	0.226***	0.127**	0.087*	0.012
	(0.078)	(0.059)	(0.046)	(0.010)
Federal transfers p.c.	−0.218**	−0.051	−0.162***	−0.005
	(0.089)	(0.033)	(0.053)	(0.005)
State transfers p.c.	0.309***	0.083**	0.213***	0.013***
	(0.110)	(0.036)	(0.071)	(0.004)
Demographic controls	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes
Observations	1,461	1,461	1,461	1,461

Notes: Sample includes municipalities that were net recipients from FUNDEF, defined by 'FUNDEF net transfers p.c. 1997' greater than zero, with data on tax and transfer revenues and expenditures. Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

Table 7. Reduced-form estimates of simulated FUNDEF on the incumbent party's probability of reelection

	Incumbent party reelected						
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Net FUNDEF p.c. 1997	0.003***	0.002***	0.002***	0.003***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Federal transfers p.c.	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Young population (%)		0.591**	0.442*		0.775***	0.610**	0.668***
		(0.220)	(0.231)		(0.213)	(0.233)	(0.223)
Elderly population (%)		0.893*	0.792		0.710	0.525	0.590
		(0.518)	(0.501)		(0.563)	(0.538)	(0.526)
Urban population (%)		−0.094*	−0.135***		−0.121**	−0.172***	−0.190***
		(0.047)	(0.045)		(0.054)	(0.053)	(0.053)
Governor party			0.114***			0.110***	0.109***
			(0.018)			(0.019)	(0.019)
President party			0.149***			0.157***	0.156***
			(0.031)			(0.034)	(0.034)
Tax revenue p.c.							0.001***
							(0.000)
State transfers p.c.							−0.000
							(0.000)
Constant	0.325***	0.025	0.097	0.318***	−0.026	0.071	0.042
	(0.016)	(0.179)	(0.175)	(0.019)	(0.182)	(0.177)	(0.172)
Observations	5,221	5,221	5,221	4,002	4,002	4,002	4,002

Notes: Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.

Table 8. Reduced-form estimates of simulated FUNDEF on the incumbent coalition's probability of reelection

	Incumbent coalition reelected						
Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Net FUNDEF p.c. 1997	0.002***	0.001***	0.001***	0.003***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Federal transfers p.c.	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Young population (%)		0.552**	0.460**		0.797***	0.698***	0.721***
		(0.199)	(0.207)		(0.192)	(0.205)	(0.197)
Elderly population (%)		0.560	0.502		0.650	0.536	0.543
		(0.469)	(0.459)		(0.467)	(0.463)	(0.443)
Urban population (%)		−0.117***	−0.144***		−0.121**	−0.154***	−0.168***
		(0.039)	(0.037)		(0.045)	(0.044)	(0.043)
Governor party			0.066***			0.058***	0.058***
			(0.015)			(0.015)	(0.015)
President party			0.110***			0.112***	0.111***
			(0.025)			(0.026)	(0.026)
Tax revenue p.c.							0.000***
							(0.000)
State transfers p.c.							−0.000
							(0.000)
Constant	0.406***	0.174	0.217	0.403***	0.053	0.113	0.106
	(0.019)	(0.159)	(0.157)	(0.021)	(0.150)	(0.148)	(0.142)
Observations	5,221	5,221	5,221	4,002	4,002	4,002	4,002

Notes: Robust standard errors clustered at the state level are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%.