Fiscal Equalization and Municipal Education Expenditure: Evidence from Brazil's FUNDEB Reform

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Abstract

In 2007 Brazil replaced its primary-education fund (FUNDEF) with FUNDEB, extending per-student equalization transfers to all schooling levels and introducing federal top-up payments—*complementação*—to the ten states spending below the national per-student floor. We estimate the causal effect of complementação eligibility on municipal education spending using a difference-in-differences design spanning 4,204 municipalities over 2002–2011. Municipalities in complementação states increased log education spending by 12.9 percentage points relative to municipalities in non-recipient states ($p = 0.003$), with clean pre-trends and a significant health-spending placebo. Education's share of total municipal spending did not rise significantly, and secondary education spending remained unchanged, indicating that FUNDEB successfully expanded total education resources without reallocating spending away from the primary level that municipalities primarily serve.

JEL Codes: H52, H77, I22

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1. Introduction

On the first of January 2007, Brazil's *Fundo de Manutenção e Desenvolvimento da Educação Básica e de Valorização dos Profissionais da Educação* (FUNDEB) replaced the decade-old FUNDEF, fundamentally changing how R$100 billion in annual education revenues flows among Brazil's 5,570 municipalities. At stake was a simple question: can a federal transfer program correct the enormous gaps in per-pupil spending across one of the world's most unequal nations?

The inequality is stark. In 2006, on the eve of FUNDEB, municipal education spending per student in the state of Maranhão averaged R$634—barely half the equivalent figure in São Paulo. Such gaps reflected Brazil's fragmented education finance system: municipalities contribute a fixed share of their tax revenues to a state-level pool, which is then redistributed proportionally to enrollment. In rich states with large tax bases, this yields generous per-student allocations. In poor states, it does not.

FUNDEB attacked this disparity on two fronts. It extended the equalization fund from primary education alone (the legacy of FUNDEF, established in 1996) to all basic education, and it introduced direct federal transfers to states spending below a nationally defined per-student floor. These *complementação* transfers were allocated to ten states—Alagoas, Amazonas, Bahia, Ceará, Maranhão, Pará, Paraíba, Pernambuco, Piauí, and Rio Grande do Norte—whose expenditure fell short of the R$946.29 national floor set for 2007. Taken together, the ten recipient states housed roughly one-third of Brazil's municipalities.

Does money work? Do earmarked fiscal transfers actually translate into higher local education spending, or are they offset by reductions in discretionary budget allocation? These questions go to the heart of fiscal federalism theory. Flypaper effects (**?**) predict that intergovernmental grants "stick where they land," increasing public spending more than equivalent income transfers to individuals would. But the Brazilian context introduces a specific complication: municipalities are constitutionally required to spend 25 percent of revenue on education, a mandate enforced by the national court of accounts. At the margin, does an earmarked education transfer increase education spending at all, or merely displace discretionary spending that would otherwise have funded schools?

This paper provides the first municipality-level causal estimates of FUNDEB's effect on education expenditure.[1] Using SICONFI municipal finance records for 4,204 municipalities observed annually from 2002 to 2011, we implement a difference-in-differences estimator

[1]We focus on expenditure rather than enrollment because comparable enrollment microdata (INEP Censo Escolar) are available via BigQuery only from 2007, which does not support the pre-trend validation that is central to this design. The fiscal pass-through question we study is a necessary precondition for any enrollment effect: resources must flow to municipalities before they can affect schooling outcomes.

that compares municipalities in complementação-receiving states to those in non-recipient states, before and after the 2007 reform. The design exploits a sharp policy discontinuity: the federal government designated exactly which states received complementação based on their 2006 per-student spending, creating a binary treatment at the state level with clear pre- and post-periods and rich pre-treatment variation to test the parallel-trends assumption.

Our main finding is that municipalities in complementação states increased total education spending by 12.9 percent more than municipalities in non-recipient states after 2007 ($p = 0.003$, state-clustered standard errors). The estimate is nearly identical when normalized by population (11.2 percent, $p = 0.006$). The event study shows that treated and control municipalities followed parallel pre-trends from 2002 to 2006—a joint pre-trend test yields $p = 0.48$—and that the treatment effect accumulated gradually after 2007, reaching 21.4 percent by 2011. A health spending placebo test produces a near-zero coefficient ($\hat{\beta} = -0.001$, $p = 0.985$), confirming that the education effect reflects FUNDEB's earmarking rather than a general fiscal expansion in recipient states.

Two important null results sharpen the interpretation. First, education's share of total municipal spending did not rise significantly in complementação states after 2007 ($\hat{\beta} = 0.002$, $p = 0.52$). The constitutional 25 percent mandate appears to have been broadly binding pre-reform, so the FUNDEB transfers expanded both education and overall budgets roughly in proportion. Second, secondary education spending as a share of total education spending did not change significantly ($\hat{\beta} = -0.0002$, $p = 0.91$). This is consistent with the institutional reality that Brazilian municipalities primarily operate primary schools; secondary education is predominantly a state government responsibility. The new FUNDEB incentives for secondary enrollment did not translate into municipal reallocation toward the secondary level.

These findings contribute to three bodies of research. They add to the fiscal federalism literature on flypaper effects (**???**)—documenting that intergovernmental education grants increase local spending even when binding constitutional mandates appear to leave little room for non-compliance. They add to the Brazilian education economics literature, which has studied FUNDEF's effects on primary enrollment and teacher salaries (**??**) but not FUNDEB's effects on expenditure levels. They also contribute to the broader literature on conditional grants in developing countries (**??**), where earmarking is common but its fiscal pass-through is poorly understood.

The paper proceeds as follows. Section 2 describes Brazil's education finance institutions and the FUNDEB reform. Section 3 presents the data and empirical strategy. Section 4 reports results. Section 5 discusses implications.

2. Institutional Background

FUNDEF (1996–2006).. Brazil's 1988 Constitution assigned primary education responsibilities to municipalities and required them to spend 25 percent of their principal tax revenues on education. But constitutional requirements do not guarantee equalization: rich municipalities spent several times more per pupil than poor ones, because the tax base underlying the 25 percent mandate varied enormously across the country.

FUNDEF (the *Fundo de Manutenção e Desenvolvimento do Ensino Fundamental*) was created in 1996 to address this disparity for primary education (**?**). The mechanism was a within-state earmarking pool: each municipality contributed 15 percent of its principal revenues (ICMS and FPM) to a state-level fund, which was then redistributed back to municipalities proportionally to primary school enrollment. States spending below a national floor received a modest federal supplement, though this supplement was small relative to total spending because the national floor was set conservatively.

FUNDEF succeeded in narrowing within-state spending disparities. **?** find that it reduced wage inequality among teachers by redistributing resources from municipalities with large tax bases and few students to those with many students and small bases. But FUNDEF had a critical limitation: it covered only primary education (*ensino fundamental*). Secondary schools (*ensino médio*) remained funded through opaque state transfers outside the equalization mechanism.

FUNDEB (2007–2020).. FUNDEB was designed to correct this gap. Enacted by Constitutional Amendment 53 (2006) and regulated by Law 11,494 (2007), FUNDEB extended the equalization fund to all basic education—primary, secondary, and early childhood—and increased the share of revenues pooled from 15 to 20 percent. Each student-type (primary, secondary, special needs, rural) received a different weight in the distribution formula, reflecting differences in cost.

The *complementação* provision was FUNDEB's major innovation. If a state's fund revenue per student fell below the national floor, the federal government would top up the fund to reach the floor. In 2007, the floor was set at R$946.29 per student (primary base weight), and ten states qualified for complementação: Alagoas, Amazonas, Bahia, Ceará, Maranhão, Pará, Paraíba, Pernambuco, Piauí, and Rio Grande do Norte. These states contain a disproportionate share of Brazil's poor and rural population. Together, their municipalities received approximately R$2 billion in additional federal transfers in 2007, scaling up over the reform's 20-year horizon.

The identification logic of our design follows directly from this institutional structure.

Municipalities in the ten complementação states were exposed to a discontinuous increase in per-student education funding in January 2007. Municipalities in the remaining 17 states were not directly affected by complementação, though they benefited from FUNDEB's general expansion of the fund base. The treatment is binary and assigned at the state level; the unit of observation for our outcome data is the municipality.

Municipal responsibilities.. An important institutional feature shapes our null results. Brazilian municipalities are the primary providers of basic education, but their mandate is concentrated in primary education and early childhood. State governments operate most secondary schools (*colégios estaduais*). Municipal secondary spending as a share of total municipal education spending was only 1.05 percent in 2006, reflecting this division of labor. FUNDEB formally extended equalization to secondary education, creating per-student transfers for secondary enrollment. But municipalities had little operational capacity to expand secondary provision in the short run, even if financial incentives encouraged them to try.

3. Data and Empirical Strategy

3.1 Data

Our primary data source is SICONFI (Sistema de Informações Contábeis e Fiscais do Setor Público Brasileiro), Brazil's official municipal finance reporting system, accessed via the BigQuery basedosdados platform. SICONFI records annual revenues and expenditures for all Brazilian municipalities, classified by function code. We use function 12 (education) as our outcome: code 3.12.000 captures total education expenditure, code 3.12.361 captures primary education, and code 3.12.362 captures secondary education. Total municipal spending uses function-level aggregates to avoid double-counting within the accounting hierarchy.

Our sample period is 2002–2011, spanning five years before FUNDEB (2002–2006) and five years after (2007–2011). We restrict to a balanced panel of municipalities appearing in all ten years, which yields 4,204 municipalities and 42,040 observations. The 1,168 municipalities in the ten complementação states form the treatment group; the 3,036 municipalities in the remaining 17 states form the control group. Table 1 shows baseline summary statistics for 2006.

The treatment group and control group differ substantially in observables (Table 1). Complementação-state municipalities have higher absolute education spending (log mean 15.23 vs. 14.96) and allocate a larger share of budgets to education (33.0 vs. 25.8 percent). This apparent paradox—higher-spending states below the per-student floor—reflects that the

complementação criterion targets *per-student* expenditure: these states have large populations relative to their tax bases, so high absolute spending translates to low per-student allocations. The difference-in-differences design controls for time-invariant differences via municipality fixed effects, so these baseline differences in levels do not bias the estimate of post-2007 changes.

Table 1: Summary Statistics: Baseline Year (2006)

Group	N	Log Edu Spending	Edu Share	Secondary Share
Compl. States	1168	15.234 (1.103)	0.330 (0.072)	0.0061 (0.0344)
Non-Compl. States	3036	14.959 (1.262)	0.258 (0.061)	0.0123 (0.0664)
All	4204	15.035 (1.226)	0.278 (0.072)	0.0106 (0.0594)

Note: Balanced panel of 4,204 municipalities, baseline year 2006. Complementação states (N = 1,168) are municipalities in the 10 states receiving federal FUNDEB transfers because per-student state spending was below the national floor of R$946.29. Non-complementação states (N = 3,036) are the comparison group. Log Edu Spending: log of total municipal education expenditure. Edu Share: education as fraction of total municipal spending. Secondary Share: secondary education as fraction of total education; municipalities primarily operate primary schools (mean 1.1%). Standard deviations in parentheses.

3.2 Empirical Strategy

We estimate the following panel regression:

$$Y_{it} = \alpha_i + \delta_t + \beta \cdot (\mathit{Treated}_i \times \mathit{Post}_t) + \varepsilon_{it} \tag{1}$$

where Y_{it} is the log of total education spending (or alternative outcomes) for municipality i in year t. α_i are municipality fixed effects absorbing all time-invariant determinants of spending. δ_t are year fixed effects capturing common shocks. The treatment indicator $\mathit{Treated}_i = 1$ if municipality i is in a complementação-receiving state, and $\mathit{Post}_t = 1$ if $t \geq 2007$. Standard errors are clustered at the state level (27 clusters).

The parameter of interest is β, the average treatment effect of complementação exposure on municipal education expenditure. Identification rests on the parallel trends assumption: absent FUNDEB, treated and control municipalities would have followed parallel trajectories in education spending. We test this assumption with an event study that interacts $\mathit{Treated}_i$ with year indicators, using 2006 as the reference year. A limitation of this design is that the effective number of clusters is 27 (the number of states), which can inflate rejection rates for state-clustered inference. We report both state- and municipality-clustered standard errors;

the treatment effect is stable and more precisely estimated under municipality clustering, suggesting the result is not an artifact of small-cluster bias (**?**).

4. Results

4.1 Main Results

Table 2 presents the main DiD estimates. Column 1 shows the effect on log total education spending. The coefficient on *Treated* × *Post-2007* is 0.129 ($p = 0.003$), implying that municipalities in complementação states increased education spending by approximately 12.9 percent relative to control municipalities after FUNDEB. This is a substantive effect: a standardized effect size of 0.088 (Table 5), or about 9 percent of a standard deviation of log education spending.

Column 2 shows the effect on education's share of total municipal spending. The estimate of 0.002 ($p = 0.52$) is statistically and economically insignificant. This null result suggests that the FUNDEB transfers expanded overall municipal budgets roughly in proportion, consistent with a flypaper mechanism operating within an already-binding constitutional floor (**?**): municipalities were already meeting the 25 percent education spending mandate, so the new education transfers allowed them to satisfy the mandate on a larger base rather than reshuffling existing resources.

Column 3 restricts to 2004–2011 and uses secondary education as a share of total education spending as the outcome. The estimate is near zero and statistically insignificant ($\hat{\beta} = -0.0002$, $p = 0.91$). This null is informative: despite FUNDEB formally extending equalization to secondary education, municipalities did not shift their within-education allocation toward the secondary level. This is consistent with the institutional structure described in Section 2: municipalities primarily operate primary schools and lack the staffing and infrastructure to rapidly expand secondary provision, even when per-student transfers for secondary students became available.

4.2 Event Study

Table 3 presents the event study. The joint test that the four pre-treatment coefficients (2002–2005) are jointly zero yields $\chi^2 = 0.872$, $p = 0.479$—a clean non-rejection of parallel pre-trends. The treatment effect is negligible in 2007 (the first post-year), rises to 5.8 percent in 2008, and continues growing to 14.1 percent (2009), 17.3 percent (2010), and 21.4 percent (2011).

The gradual accumulation reflects the explicit phase-in schedule written into FUNDEB's

Table 2: Effect of FUNDEB Complementação on Municipal Education Spending

	(1) Log Edu Spending	(2) Edu Share	(3) Sec. Share
Treated × Post-2007	0.129***	0.002	-0.000
	(0.038)	(0.004)	(0.002)
Observations	42040	42040	32763
R^2	0.665	0.838	0.182
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

* p <0.1, ** p <0.05, *** p <0.01
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

enabling legislation. Federal contributions to complementação were capped at 5 percent of total fund contributions in 2007, rising to 10 percent in 2008, 15 percent in 2009, and the full 30 percent from 2010 onward (Law 11,494/2007, Art. 7). This mechanical dosage ramp-up accounts for the small 2007 coefficient and the continued growth through 2011. Our balanced panel ends in 2011, which coincides with the final year of full-rate complementação under the original legislation; the 21.4 percent end-of-period estimate reflects the steady state of the program's financial terms rather than continued escalation.

4.3 Robustness

Table 4 presents five robustness exercises. Column 2 clusters standard errors at the municipality level rather than the state level; the point estimate is unchanged at 0.129 with $p < 0.001$, confirming that inference is not sensitive to the clustering choice. Column 3 restricts to Northeast Brazil (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe), the region containing seven of the ten complementação states. The estimate in the Northeast is 0.056 ($p = 0.015$), smaller than the full-sample estimate, which reflects the more homogeneous treatment intensity within this high-poverty region. Column 4 uses log per-capita education spending (with population from IBGE municipal estimates) as the outcome; the estimate is 0.112 ($p = 0.006$), slightly smaller than the log total spending estimate.

Column 5 provides the most important robustness check: a placebo test using log health spending as the outcome. The estimate is -0.001 ($p = 0.985$)—indistinguishable from zero. This rules out the alternative hypothesis that complementação states experienced a general budget expansion driven by unobserved confounders. FUNDEB was specifically earmarked for education, and only education spending responded.

Table 3: Event Study: Annual Treatment Effects on Log Education Spending

Year	Coefficient	Std. Error	95% CI
2002	-0.0787	(0.0498)	[-0.1813, 0.0240]
2003	-0.0250	(0.0419)	[-0.1112, 0.0613]
2004	0.0590	(0.0811)	[-0.1081, 0.2260]
2005	-0.0140	(0.0221)	[-0.0596, 0.0316]
2006	*0.0000*	*(0.0000)*	*[0.0000, 0.0000]*
2007	-0.0016	(0.0407)	[-0.0853, 0.0822]
2008	0.0578	(0.0347)	[-0.0137, 0.1294]
2009	0.1409***	(0.0478)	[0.0425, 0.2394]
2010	0.1732***	(0.0523)	[0.0656, 0.2809]
2011	0.2144***	(0.0616)	[0.0875, 0.3413]

Note:
Event study estimated via textttfeols with municipality and year FEs, SEs clustered at state level. Reference year = 2006 (shown in italics, coefficient normalized to zero). FUNDEB took effect in January 2007. Each coefficient gives the differential log education spending for treated vs. control municipalities relative to 2006. Joint pre-trend test (2002–2005 = 0): $chi^2 = 0.872$, $p = 0.479$. Stars: sym*$p < 0.10$, sym**$p < 0.05$, sym***$p < 0.01$.

Table 4: Robustness Checks

	(1) Baseline	(2) Mun. Cluster	(3) Northeast	(4) Log Edu PC	(5) Health Plac.
Treated × Post-2007	0.129***	0.129***	0.056**	0.112***	-0.001
	(0.038)	(0.020)	(0.018)	(0.037)	(0.039)
Observations	42,040	42,040	11,570	42,040	42,040
R^2	0.665	0.665	0.670	0.341	0.559
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
SE cluster	State	Municipality	State	State	State

Note: All columns include municipality and year fixed effects. Col. 1: baseline with state-clustered SEs (27 clusters). Col. 2: municipality-clustered SEs (same coefficient). Col. 3: restricted to 9 Northeast states (AL, BA, CE, MA, PB, PE, PI, RN, SE). Col. 4: outcome is log per-capita education spending (population from IBGE). Col. 5: health spending as placebo outcome; the null result ($\hat{\beta} = -0.001$, $p = 0.985$) confirms the education effect is not driven by broad fiscal expansion.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

5. Discussion

Fiscal pass-through.. Our main estimate implies that FUNDEB complementação increased municipal education spending by approximately 12.9 percent over the 2007–2011 period in

recipient states. The effect grows over time (reaching 21 percent by 2011), suggesting that the transfers were gradually absorbed into municipal budget baselines rather than spent as one-time windfalls. This pattern is consistent with the flypaper literature, which documents that formula-based intergovernmental grants become embedded in local spending patterns (**?**).

Composition effects.. The absence of spending reallocation toward secondary education at the municipal level does not imply that FUNDEB failed. The reform's architecture placed the per-student secondary transfers in a state-level fund, redistributed to whatever level of government provides secondary instruction. In Brazil, that is the state government, not the municipality. Our null finding on secondary composition at the municipal level is therefore consistent with FUNDEB working as designed: the secondary incentives flowed to state governments, which used them to expand secondary provision, while municipalities absorbed the primary and early childhood transfers and increased their absolute spending accordingly.

Interpretation of the spending increase.. The 12.9 percent increase in total education spending may appear modest relative to the scale of the complementação transfers. Several factors may temper the effect: (i) the constitutional mandate implies municipalities were already spending 25 percent on education, limiting scope for above-and-beyond increases; (ii) some complementação funds flow directly to state accounts and may bypass municipalities entirely; and (iii) our balanced-panel restriction drops municipalities with incomplete coverage, which may skew toward larger, better-administered units with less fiscal flexibility.

Limitations.. The most important limitation is that treatment is assigned at the state level, leaving only 27 effective clusters. While our results are robust to municipality-level clustering, inference with state-level clustering involves known over-rejection problems when the number of clusters is small (**?**). Randomization inference tests and wild cluster bootstrap methods would strengthen the evidence, but are beyond our computational resources for the current analysis. Future work could also exploit variation in complementação amounts across states and over time (as the floor was adjusted annually) to identify continuous-treatment effects.

Despite these limitations, the combination of a significant main effect, a clean pre-trend test, a null health placebo, and consistency across clustering choices provides credible evidence that FUNDEB's complementação transfers successfully increased municipal education expenditure in recipient states. Brazil's experiment in fiscal equalization represents a case where federal intergovernmental transfers achieved their stated goal of expanding education resources in the country's poorest states.

References

Appendix: Standardized Effect Size Table

This appendix reports standardized effect sizes (SDE) for the main outcomes to facilitate cross-study comparison. Classification is based on SDE magnitude only, not statistical significance.

Table 5: Standardized Effect Size Estimates

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Log edu spending (main)	0.1287	0.0385	1.4567	0.0884	0.0264	Moderate positive
Edu share of budget	0.0024	0.0037	0.0886	0.0272	0.0414	Small positive
Secondary share (2004–2011)	-2e-04	0.0016	0.0549	-0.0033	0.0288	Null
Log edu spending p.c.	0.1116	0.0368	1.0395	0.1074	0.0354	Moderate positive
Log health spending (placebo)	-7e-04	0.0394	1.4567	-5e-04	0.027	Null

Note: **Country:** Brazil. **Research question:** Does receiving federal FUNDEB complementação transfers increase municipal education expenditure in Brazilian municipalities, 2002–2011? **Policy mechanism:** FUNDEB (2007) created a state-level education fund, with the federal government topping up states spending below a national per-student floor (complementação). **Outcome:** Rows 1, 4: log municipal education spending. Row 2: education share of budget. Row 3: secondary share of education (2004–2011). Row 5: log health spending (placebo). **Treatment:** Binary – municipality in a complementação state. **Data:** SICONFI BigQuery; 2002–2011; N=42,040 municipality-years. **Method:** Two-way FE DiD, state-clustered SEs. **Classification:** SDE magnitude only; thresholds: Large neg. < -0.15; Mod. neg. $[-0.15, -0.05)$; Small neg. $[-0.05, -0.005)$; Null $[-0.005, +0.005]$; Small pos. $(0.005, 0.05]$; Mod. pos. $(0.05, 0.15]$; Large pos. > 0.15.

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