

## ***Minimum Spending in Education and the Flypaper Effect***

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### **Abstract**

This study estimates the *flypaper* effect of intergovernmental transfers in the Brazilian education sector. Education funds in Brazil are comprised by local revenue and intergovernmental transfers, both tied to education, and other non-tied local revenue and intergovernmental transfers. By using the previous year's municipal enrollments relative to the state's enrollment in basic education as an instrument for the amount of funds received from intergovernmental grants, represented by FUNDEB,<sup>3</sup> we estimate the responses of the Brazilian municipal governments to three different types of revenues (locally collected versus state and federal transfers tied to education). We find that the elasticity of educational expenses for funds from state redistribution transfers is significantly greater than the elasticity of such government responses to funds collected locally, indicating a flypaper effect equal to 0.616. Interestingly, we do not find a flypaper effect for other intergovernmental transfers from the federal government that are done through individual agreements. We rely on the information hypothesis to explain our findings.

**Keywords:** Education finance; Flypaper Effect; Intergovernmental transfers

**Classification JEL:** H72; H75; I22; I26

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<sup>3</sup> FUNDEB stands for the Brazilian "Fund for the Maintenance and Development of Basic Education and Valorization of Education Professionals"

**Acknowledgements:** The authors are grateful for the contributions of Guilherme Araújo, Gustavo Fernandes, and for the workshop participants at IDados, EAESP/FGV, and the Lemann Center at Stanford University.

## 1. Introduction

In a decentralized education system, the understanding of how local governments use their budgets and how their budget decisions are influenced by the central government is of great importance to the design of education funding policies. In Brazil, there are two main national education-funding policies that have major implications in all local budgets for basic education: (1) the conditionality of minimum use of local taxes to education, and (2) the intergovernmental transfers dedicated to education.

Intergovernmental transfers and conditionalities in the use of resources are commonly employed as a way for local governments to meet the desires of the federal government, expanding certain services, equalizing local income and ensuring minimum quality for basic services, avoiding, therefore, a need for the federal government to assume the responsibilities of local governments to guarantee a minimum quality of services.<sup>4</sup> The Brazilian “Constitutional Minimum” refers to 25 percent of all local tax and transfer revenues, which are mandated to be spent on municipal and state public education systems. The intergovernmental transfers, on the other hand, includes transfers through the “National Development Fund for Education” – FNDE and, particularly, through the “Fund for the Maintenance and Development of Basic Education and Valorization of Education Professionals” – FUNDEB.<sup>5</sup>

Most of the intergovernmental transfers in basic education from the federal to the local governments in Brazil are done through the FNDE. FNDE is a federal authority attached to the Brazilian Ministry of Education. The FNDE transfers are dedicated to several education programs coordinated by the federal government, including the federal resources to the FUNDEB Funds. FUNDEB is a funding redistribution policy for education. FUNDEB has twenty-seven state Funds (one Fund per Brazilian state plus the Federal District), which are composed by resources originated from 20 percent of some of the local taxes and transfers (that are already tied to education by the Constitutional Minimum), as well as an additional financial portion originated from federal resources. All resources raised by the 27 Funds are redistributed within each state and are for exclusive use in basic education. Since FUNDEB funds are transferred from the state Funds to each education system, the funds received by each education system are external transfers conditioned to be spent in education.

This article estimates the local governments’ education spending responses to revenues from these two sources: local revenues conditioned to education, and intergovernmental

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<sup>4</sup> See Diniz (2012) for a discussion in this regard.

<sup>5</sup> In Portuguese, FNDE stands for *Fundo Nacional de Desenvolvimento da Educação* and FUNDEB stands for *Fundo de Manutenção e Desenvolvimento da Educação Básica e de Valorização dos Profissionais da Educação*.

transfers earmarked to education. It is well-established in the literature of public finance that intergovernmental transfers lead to greater public spending than an equivalent increase in local revenue – the so-called *flypaper effect* (Turnbull 1998; Gordon 2004; Inman 2008). The flypaper effect is characterized by a greater adherence of intergovernmental transfers than one would expect if the public manager were to maximize the preferences of the representative elector. Building over the theoretical model of the median voter, we present the flypaper effect model adapted to the Brazilian education financing policies by relaxing the hypothesis of complete information.

Our paper adds to public finance literature by specifying the differential effect of the flypaper when local revenue is conditioned to be spent in education. The Brazilian case is an informative example of both a minimum spending requirement on the local revenue and of intergovernmental transfers earmarked to education. We also analyze the responses of municipal governments to different types of intergovernmental transfers, earmarked to education. The existence of intergovernmental transfers with different characteristics – such as the FNDE transfers and the particular case of FUNDEB – allows for the empirical analysis of the flypaper effect with different types of intergovernmental transfers. Thus, this article not only enters the debate of the *flypaper* effect but mainly it adds to the discussion about spending conditionalities in a federative context.

A critical concern in the empirical analysis of flypaper effects is whether the elasticity of spending to changes in intergovernmental transfers is overestimated by the existence of unobserved municipal characteristics that affect both the amount received by intergovernmental transfers and the government's spending decisions. In order to reliably estimate the exogenous variation in intergovernmental transfers, we have first analyzed whether the amount of FNDE transfers is influenced by the political alignment of the mayors' coalition with the federal government (Bracco et al. 2015; Brollo and Nannicini 2012; Feld and Schaltegger 2005; Veiga and Pinho 2007). Secondly, we use an instrumental variable (IV) approach to estimate the amount of FUNDEB transfers received by each municipality that is solely explained by the relative number of enrolled students in basic education in the prior year.

We estimate the elasticities of education expenses to revenues from different sources limiting the analysis for those municipalities that are not bound by the minimum spending restrictions. That is, we analyze the elasticity of government spending of fungible funds, even though part of the budget is non-fungible. Another important contribution of our article lies in the rich database from 2006 to 2014 used in the estimations, allowing for the inclusion of important covariates in the models. In addition to municipal and time fixed effects, we control

our models for the political party of the mayor of the municipality over time – to deal with the mayors’ preference for higher government spending and the potential relationship to its political ability to receive higher intergovernmental transfers. We also control for the variations in educational expenses of other Brazilian municipalities weighted by the distance between the municipalities in question, and for efficiency indexes of government budget decisions.

We find that the flypaper effect is of great importance to the increases in educational expenses observed in Brazil between 2006 and 2014. However, we only find the flypaper effect for the FUNDEB transfers – the elasticity of education expenses to other FNDE transfers is similar to the elasticity to local resources. This result is similar to assert that the elasticity of education expenses to FUNDEB transfers is much greater than the elasticity of expenses to FNDE transfers, even though the other FNDE transfers also refer to intergovernmental transfers from the federal to local governments. We rely on the information hypothesis to explain this interesting finding, the greater elasticity of FUNDEB transfers suggest that voters are less aware of the amount of FUNDEB transfers, and therefore increases in such transfers lead to higher increases in education expenses than other types of revenues. Moreover, it indicates that mayors and voters take the FNDE funds as being similar to local resources.

The study is divided in seven sections, including this introduction. Section 2 briefly presents the context of Brazilian education financing. In the third section, we discuss the theoretical model for our empirical analysis, describing, in particular, the flypaper effect in the Brazilian education context. Section 4 describes the data used. The fifth section discusses our empirical strategy and the sixth section presents the results. Finally, in section 7 we draw the conclusions of this study.

## 2. Context

### *Education Financing in Brazil*

The 1988 Brazilian Federal Constitution established that all states, municipalities, and the federal government should invest a fixed portion of their tax revenues and transfers in the maintenance and development of education (MDE) of the public education system.<sup>6</sup> Such portion (henceforward called as the “constitutional minimum”) amounts to 25% in the case of states and municipalities, and to 18% in the case of the federal government, and the spending

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<sup>6</sup> “Maintenance and development of education” (MDE) is a concept defined by the Brazilian law n. 9.394, of 1996. This law determines what types of expenses can be considered as maintenance and development of education and what cannot be considered. The 25% constitutional minimum spending must be spent on any type of expenses defined by the 1996 law.

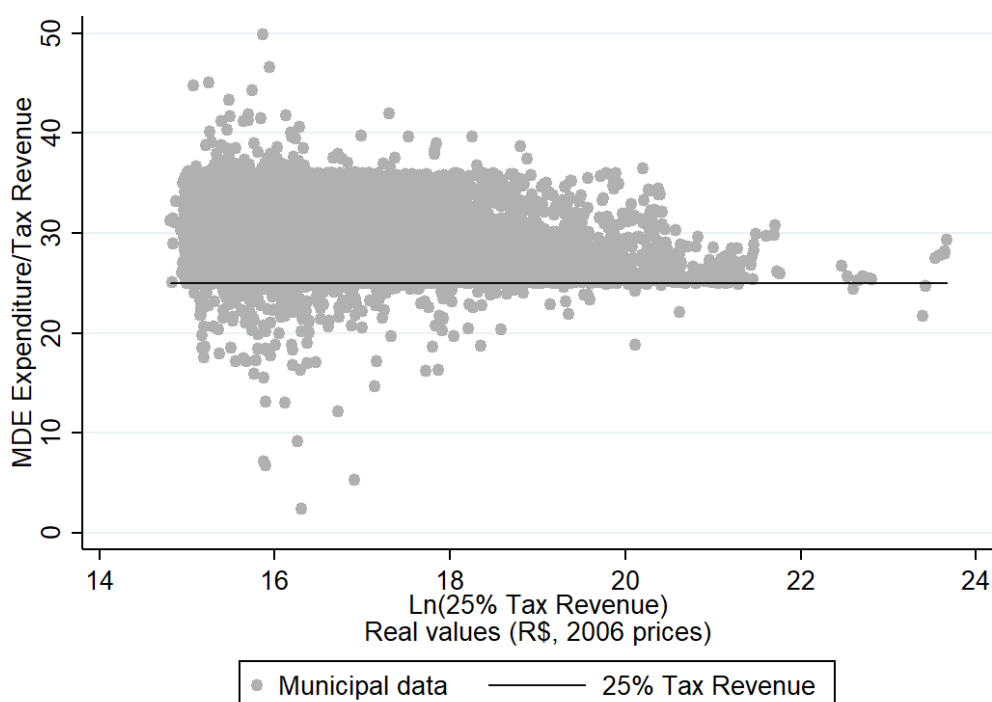
on any educational level, from kindergarten to higher education, would count toward this fixed portion.

Two situations are relevant when a compulsory minimum expense in education is defined. First, the conditioned minimum may be greater than the expense previously incurred. In this case, the minimum forces an increase in expenses by the amount necessary to achieve the minimum. Second, the minimum spending value does not change the total spending, as the budget is already higher than the minimum.

In Figure 1 we show, per municipality, the ratio of expenses in the MDE and tax collection (in the vertical axis), and the Ln of 25% of tax collection (which is the constitutional minimum, in the horizontal axis). As we see, almost all municipalities met the constitutional minimum between 2006 and 2014. We can also note that, in general, municipalities spend in MDE between 25% and 35% of their tax revenue. In addition, we observe higher shares of expenses in education for municipalities with lower tax revenues, and lower shares in municipalities with higher tax revenues, although the dispersion is also higher for lower levels of tax revenue.

Figure 1

Education Spending as a Proportion of Tax Revenue and the Constitutional Minimum by Municipalities, 2006 - 2014



Source: FNDE\SIOPE. Prices data are from FGV. Authors' elaboration.

Brazil adopts one of the most remarkable systems of conditioned subsidies for education in the world (Shah 2006). Despite being considered as a huge gain for education, this constitutional requirement generated large asymmetries with regards to per student expenses among public schools around the country, since the wealthiest municipalities and states had more to spend per student than the poorest ones (as argued by Menezes-Filho and Pazello (2007)). In response to such inequalities, the federal government announced, in September 1996, a reform of the funding model for the public primary school system, called FUNDEF, to be implemented as of January 1<sup>st</sup>, 1998 for a period of 10 years, which was in force between 1998-2006.<sup>7</sup>

In order to renew FUNDEF, FUNDEB was created. FUNDEB is also a Fund of accounting nature and works at the state level (one Fund per state plus the Federal District, which totals twenty-seven Funds), formed by resources originated from taxes and transfers tied to education from the states, the Federal District and the municipalities (20 percent of specific local taxes and transfers tied to education by the constitutional minimum), as well as having an additional financial portion originated from federal resources. Regardless of the source of origin, all resources raised by the 27 Funds are redistributed for exclusive use in basic education. Resources are then distributed within the scope of each state among the governmental entities located within its territory (state and municipal governments). There is no movement of resources from one state to another.

The FNDE is a federal authority responsible for most of the implementation of the Ministry of Education resources for basic education, with the objective of providing technical and financial assistance to states and municipalities. The Brazilian federal government is the main responsible for the higher education system and the municipal and state revenues are the main funders of basic education. Nevertheless, 28.16% of federal expenditures for 2015 on education were directed toward basic education. Almost all of the federal policies for basic education are linked to the FNDE, enabling the Union's supplementary and redistributive function to states and municipalities (Cruz 2011).

The FNDE's financing policy takes effect in three modalities: (1) direct, (2) automatic, and (3) voluntary. Direct transfers occur mainly through the distribution of goods, such as the federal textbook program. Transfers of major financial significance (largest amount of resources) are automatic transfers. The main characteristic of automatic transfers is the lack of

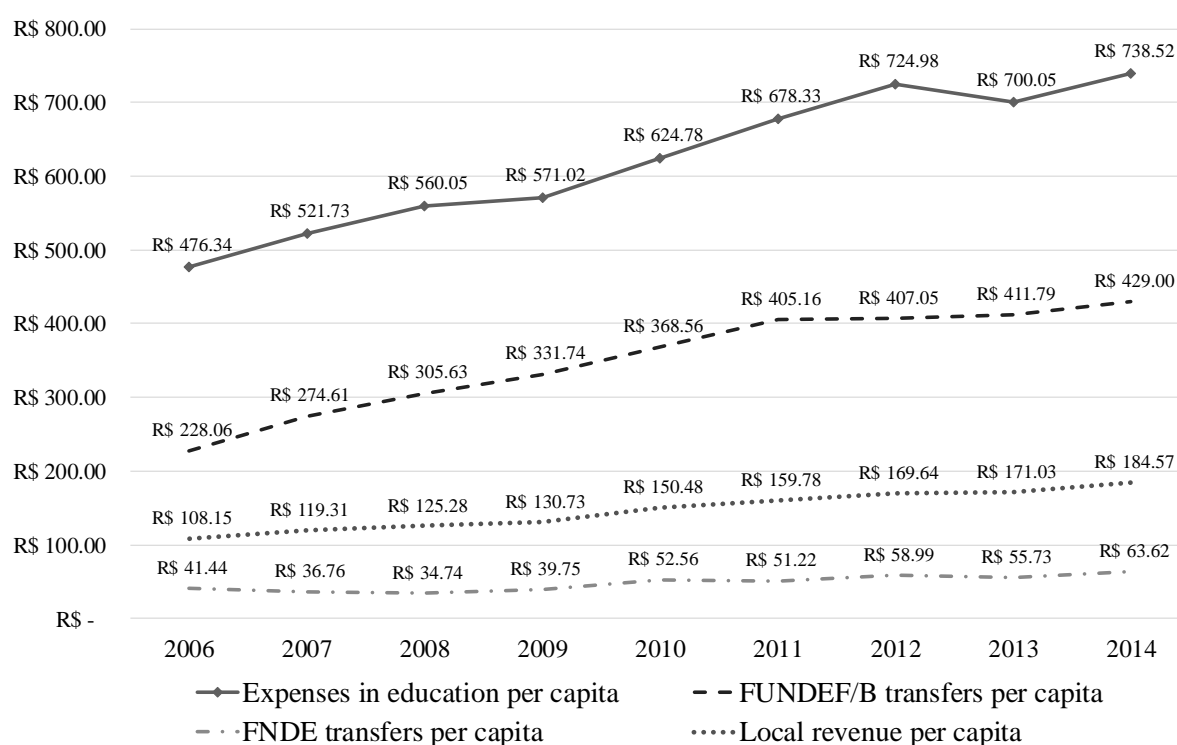
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<sup>7</sup> FUNDEF stands for "Fund for the Maintenance and Development of Fundamental Education and the Valorization of Education Professionals". The main objectives of this redistributive reform were to improve the working conditions of teachers in public schools and reduce inequalities in educational resources between regions (BRASIL 2003).

an agreement between the federal and local governments. Automatic transfers may be constitutional (such as the FUNDEB transfers), legal transfers (such as the Brazilian School Feeding Program), or discretionary (arising from the “Articulated Action Plan” or other FNDE initiatives).<sup>8</sup> Voluntary transfers are usually not envisaged by law and involves the signing of agreements. Although the FUNDEB transfers from the federal government are done through the FNDE automatic transfers, most of its funds come from the redistribution within the states. Therefore, when we make a distinction between the FUNDEB transfers and the FNDE transfers, we are referring to all other FNDE transfers that are not going to the FUNDEB Funds.

Figure 2

Mean Revenues and Expenses in education, per capita – 2006-2014



Sources: FNDE\SIOPE & FGV. Prices 2014=100. Mean municipal values. We use a balanced panel with 5,380 municipalities. The missing data were imputed by a regression analysis.

Figure 2 presents the descriptive statistics from 2006 to 2014 of the municipal per capita expenses in education, the local revenues, the FUNDEF/B and other FNDE transfers. As we see, all monetary *per capita* variables used in our analysis present a real increase in the period studied. In 2014, the yearly average expenses of municipalities per inhabitant was R\$ 738.52 (the equivalent of US\$ 323.91 with an exchange rate of R\$ 2.28 per dollar), the mean FUNDEB

<sup>8</sup> For further information, check: Portal do FNDE (BRASIL, Ministry of Education)

revenue was R\$ 429.00, the mean FNDE revenue was R\$ 63.62, and the mean local revenue was R\$ 184.57. As we see, the mean values of FUNDEB transfers are significantly higher than the mean local revenues per capita.

The total tax revenue budget (local revenues + constitutional transfers) of Brazilian municipalities was R\$ 292 bi in 2014. Only a small proportion of this total is comprised by local revenue (R\$ 103 bi), and part of the local revenue goes to the FUNDEB state Funds to be redistributed across the municipal and state systems. The FUNDEB transfers totaled R\$ 70 bi for all municipalities in 2014. Therefore, the constitutional minimum spending in education represents 25% of the local (non-FUNDEB) revenue and other constitutional transfers, plus the FUNDEB transfers. It is interesting to note that the FUNDEB budget for all municipalities (R\$ 70 bi) is smaller than the local revenue budget for all municipalities (R\$ 103 bi), even though the mean municipal value per capita is much higher for the FUNDEB transfers compared to the mean municipal local revenue per capita. This difference suggests a very unequal distribution of tax collection across municipalities, and an important role of the FUNDEB redistributions in equalizing funds across municipalities. That is, the redistribution of FUNDEB funds increases the mean values transferred to the municipalities, even though the overall FUNDEB budget is lower.

#### *The Flypaper Effect in Brazil*

According to Inman (2008) “the flypaper effect results when a dollar of exogenous grants-in-aid leads to significantly greater public spending than an equivalent dollar of citizen income: Money sticks where it hits.” As presented by Inman (2008), if we consider the government as an agent for the representative citizen voter, this empirical result is an anomaly. However, if we consider the existing political institutions (in this case, Inman’s object of study is the USA), the *flypaper* effect is not an irregularity, but an effect of the incentives associated with the elected managers. Gordon (2004), for instance, shows that, over time, US federal funds originating from *Title I* (resources allocated in order to improve educational outcomes for disadvantaged students) are offset by a decrease in spending on other local funds that previously were to be used for disadvantaged students. Gordon (2004) suggests that in the first year of a further increase in federal subsidies, funds tend to “adhere” to the intended purpose, but this effect disappears over time.

Several authors have observed the presence of flypaper effects in Brazil (Almeida and Ribeiro 2016; Schettini 2012; Linhares, Simonassi, and Nojosa 2012). Almeida and Ribeiro



(2016) estimated the effect of an increase in transfers of the Municipal Participation Fund,<sup>9</sup> of the Circulation of goods and services Tax,<sup>10</sup> and of Municipal Gross Domestic Product on municipal expenditures. The authors find the typical flypaper effects; that federal transfers have bigger effects on spending than state transfers, which in their turn have bigger effects than local income. Schettini (2012) uses panel VAR methodology with data from total expenditures, tax revenues and intergovernmental transfers of all Brazilian municipalities from 2002 to 2010 and also finds evidence of a flypaper effect. According to Schettini (2012), municipal governments accommodate their expenses to the local tax collection, and that the intergovernmental transfers additionally influence the expenses (suggesting the existence of flypaper effects). In turn, tax revenues do not react to shocks in spending. Such results indicate that when faced with budget imbalances, municipalities adjust the expenses, rather than the tax collection. Linhares et al. (2012) analyze the revenues, transfers and government spending of Brazilian municipalities before and after the 2000 Fiscal Responsibility Law (C. C.-P. da R. BRASIL 2000). They find the existence of flypaper effects in both periods, although – differently from Schettini (2012) – their estimates suggest that there is fiscal synchronism between taxation and public expenditures after the fiscal responsibility law.

In contrast, the studies of Mattos et al. (2011) and Diniz et al. (2017) use a different concept of flypaper – as the differential effect that revenues coming from different sources have in affecting the efficiency of local governments. According to this concept, higher transfers from the federal government lead to lower efficiency compared to increases in private income. The two studies find a negative relationship between revenues coming from intergovernmental transfers and an efficiency index (the two authors use different efficiency measures). Moreover, they find a positive relationship between local revenue and the efficiency index. In specific, Diniz et al. (2017) analyze the FUNDEB intergovernmental transfers, and find that those municipalities that received more funds from the FUNDEB redistribution than how much they gave to the FUNDEB State Fund had lower efficiency scores.

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<sup>9</sup> The Municipal Participation Fund (in Portuguese, *Fundo de Participação Municipal*, or FPM), is the main way the Brazilian federal government transfers funds to municipalities, in amounts mainly determined by the proportion of the total Brazilian population living in the municipality, estimated annually by the Population Census from IBGE.

<sup>10</sup> The Circulation of goods and services Tax (in Portuguese, *Imposto sobre Circulação de Mercadorias e Serviços*, or ICMS) refers to taxes collected by the Brazilian states from any person or entity that performs operations of the circulation of goods, communication services or services of interstate and inter-municipal transportation, at a commercial level of frequency or volume. The states are required to distribute to their respective municipalities 25% of the collected value (on top of the 15% that is transferred through the FUNDEF/B transfers).

### 3. Theoretical Model

We consider the median voter model as the theoretical reference for the flypaper effect (Cossio (2002) and Turnbull (1998)), and show the characteristics of the Brazilian government spending in education according to this model. The Brazilian example is an interesting case for analyzing the flypaper effect of intergovernmental transfers that are part fungible and part non-fungible. Moreover, the different types of intergovernmental transfers to education allow for the estimation of variations in the flypaper effects for different transfer' characteristics.

#### *The median voter model*

Consider the following maximization problem, as a method of aggregating voter preferences to derive the demand for public spending:

$$(1) \text{Max}_{x,g} U^{MV}(x, g) \\ \text{s.t. } y^{MV} + t.A \geq x + t.g$$

In the equation above we have  $x$  as quantity of private good, and  $g$  as the quantity of public provided service consumption, which, in this model, is the same as government spending.  $y^{MV}$  is the median voter income, and  $t$  is the median voter tax share (assumed exogenous). That is,  $t.g$  is the payment of each voter to finance the consumption for each additional public spending.  $A$  are the intergovernmental transfers and  $t.A$  is the share of the intergovernmental transfers received by the local governments from higher-level governments.  $U^{MV}$  is the median voter utility, which is a non-decreasing function. The public good is produced at unit cost.

The median voter problem refers to the maximization by the public sector bureaucrats of the median voter utility, subject to the restriction that its revenue (income and intergovernmental transfers) must be at least equal to the costs of its public and private consumption. Assuming that  $U^{MV}$  is non-decreasing and well-behaved, the budget constrain will hold with equality, so we can substitute  $x$  in the maximization problem and we have:

$$\text{Max}_g U^{MV}(y^{MV} + t.A - t.g, g)$$

To solve the problem, we calculate the first order condition by the total derivative in  $g$ , as presented in Appendix A. Using the Implicit Function Theorem, we have:

$$(2) \frac{\partial g}{\partial y^{MV}} = \frac{1}{t} \cdot \frac{\partial g}{\partial A}$$

$$\Leftrightarrow \frac{\partial g}{\partial A} = t \cdot \frac{\partial g}{\partial y^{MV}}$$

### *The Flypaper effect*

This theoretical result is generally not found in many empirical studies, as showed since early studies as by Henderson (1968), and more recent analysis of education intergovernmental transfers, as by Gordon (2004) and Ferede and Islam (2016), and in the Brazilian context as by Almeida and Ribeiro (2016), Schettini (2012), and Linhares et al. (2012). To understand this anomaly, called the *Flypaper effect*, some economists relax the hypothesis of complete information.<sup>11</sup> In this paper, we use the model presented in Turnbull (1998).

Turnbull's model of asymmetric information assumes that the goal of the public service supplier is to maximize the level of spending. It also assumes that voters perceive tax bill as a linear function of public goods consumption, as bellow:

$$(3) B = \alpha + \mu \cdot g$$

In this model,  $\mu$  is the voter's perception of the marginal tax price of  $g$ , that is, the weighted sum of true marginal tax price ( $t$ ) and average tax price ( $t \cdot \frac{(g-A)}{g}$ ), in terms of equation:  $\mu = (1 - \theta)t + \theta \cdot t \frac{(g-A)}{g} = t(1 - \frac{\theta A}{g})$ , and  $\alpha$  is the intercept. Under asymmetric assumption, the voter does not observe the entire amount of aid awarded to the locale. The term  $\theta$  signalizes what the voter cannot observe, where  $\theta = 0$  means full information,  $\theta = 1$  means complete illusion and  $\theta \in (0,1)$  is partial illusion.

Holsey (1993) argues that price illusion is not the only source of fiscal illusion. According to Holsey (1993), imperfect voter knowledge of intergovernmental grants also leads to significant increases in income illusion, as local governments must share the tax payments to pay for such grants. However, the redistributive aspect of the Brazilian intergovernmental grants – particularly the FUNDEB transfers – indicates that other municipalities are actually paying for the intergovernmental transfers received by a municipality and, therefore, the price illusion hypothesis is justifiable in this context.

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<sup>11</sup> Oates (1988) distinguishes the concept of imperfect information from the concept of fiscal illusion. According to Oates (1988), fiscal illusion refers to a systematic misperception of fiscal parameters, where imperfect information is a necessary but not sufficient condition to its existence. Turnbull's model (used in this study) broadens the notion of fiscal illusion to include systematic asymmetric knowledge of tax price.

When  $g = 0$ , the median voter perception of local taxes is its information of the share received through intergovernmental grants, which is  $t(1 - \theta)A$ . Therefore,  $\alpha = -t(1 - \theta)A$ , and the tax bill can be written as:  $B = -t(1 - \theta)A + \mu \cdot g$

The costs of its public and private consumption are  $x + B = x - t(1 - \theta)A + \mu \cdot g$ , and the voter budget constrain can be written as

$$(4) \quad y^{MV} = x - t(1 - \theta)A + \mu \cdot g$$

$$\Leftrightarrow x = y^{MV} + t(1 - \theta)A - \mu \cdot g$$

So we can substitute  $x$  in the maximization problem and we have:

$$(5) \quad \text{Max}_g U^{MV}(y^{MV} + t(1 - \theta)A - \mu \cdot g, g)$$

Using the Implicit Function Theorem, we have the following equation, where  $\partial$  is the flypaper effect:

$$(6) \quad \frac{\partial g}{\partial A} > \frac{\partial g}{\partial y^{MV}}$$

$$\Leftrightarrow \partial = \frac{\partial g}{\partial t \cdot A} - \frac{\partial g}{\partial y^{MV}}$$

The flypaper effect arises because aid ( $A$ ) reduces the perceived tax price ( $\mu = t(1 - \frac{\theta A}{g})$ ), leading to a price or substitution effect on the demand for public spending. Therefore, the elasticity of public service consumption to intergovernmental grants is greater than the elasticity of public service consumption to the median voter income, and this difference refers to the flypaper effect. That is, intergovernmental aid ( $A$ ) is more stimulative than voter income ( $y^{MV}$ ) on public spending.

### *Government Spending in Education*

As we enter a specific area of public sector, one needs to be aware of the non-fungibility of intergovernmental transfers and of other conditionalities in local income that are tied to specific areas. As discussed in Inman (2008) and Vegh and Vuletin (2015), a possible explanation for the flypaper effect is the fact that non-fungible conditional fiscal transfers, such as matching grants, are misclassified as unconditional ones.

Going back to the maximization problem under complete information, as presented in equation (1). Let us first introduce the Brazilian education funding policies in our equation – the constitutional minimum spending with education (ME) and the intergovernmental transfers

to education, particularly, the transfers received through the National Fund for the Development of Education (FNDE) and the FUNDEB transfers:

$$\text{Minimum spending with education (ME): } ME = 25\% \cdot y^{MV}$$

$$\text{Intergovernmental transfers to education (IE): } IE = FNDE + FUNDEB + A^{ed}$$

The government intergovernmental transfers ( $A$ ) can be written as the sum of intergovernmental transfers to education (IE) and other intergovernmental transfers that are not tied to education ( $A'$ ):

$$(7) A = FNDE + FUNDEB + A^{ed} + A'$$

$$\Leftrightarrow t \cdot A = t \cdot (FNDE + FUNDEB + A^{ed} + A')$$

Since government's spending in education must be greater than the sum of IE + ME, the budget constraint can be written as:

$$(8) y^{MV} + t \cdot (FNDE + FUNDEB + A^{ed} + A') \geq x + (t \cdot g - 25\% \cdot y^{MV}) + 25\% \cdot y^{MV}$$

$$\text{When } g > FNDE + FUNDEB + A^{ed} + 25\% \cdot y^{MV}$$

The maximization problem with complete information for the Brazilian median voter focusing on the education sector is:

$$\text{Max}_g U^{MV} (y^{MV} + t \cdot (FNDE + FUNDEB + A^{ed} + A') - t \cdot g + 25\% \cdot y^{MV} - 25\% \cdot y^{MV}, g)$$

$$(9) \frac{\partial g}{\partial (FNDE + FUNDEB + A^{ed} + A')} = t \cdot \frac{\partial g}{\partial y^{MV}}$$

$$\text{For } g > FNDE + FUNDEB + A^{ed} + 25\% \cdot y^{MV}$$

Introducing the asymmetry of information, where  $\theta \in (0,1)$  refers to partial illusion, the maximization problem is:

$$(10) \text{Max}_g U^{MV} (y^{MV} + t(1 - \theta)(FNDE + FUNDEB + A^{ed} + A') - \mu \cdot g, g)$$

$$\text{For } \mu = t \cdot \left(1 - \frac{\theta(FNDE + FUNDEB + A^{ed} + A')}{g}\right)$$

Therefore:

$$(11) \frac{\partial g}{\partial (FNDE + FUNDEB + A^{ed} + A')} > t \cdot \frac{\partial g}{\partial y^{MV}}$$

$$\text{For } g > FNDE + FUNDEB + A^{ed} + 25\% \cdot y^{MV}$$

$$\Leftrightarrow \partial = \frac{\partial g}{\partial t \cdot (\text{FNDE} + \text{FUNDEB} + A^{ed} + A')} - \frac{\partial g}{\partial y^{MV}}$$

In this model, we are assuming that funds from intergovernmental transfers tied to education are also fungible and could be used equally in other government sectors. This is only true when the intergovernmental transfer does not bind government spending. That is, in this specific case when the municipal government is already spending in education more than the total value tied to education, marginal funds are fungible.

Given this first assumption, we derive from this model that the elasticity of government spending is not affected by the constitutional minimum, after the minimum spending is satisfied. That is, when the minimum is a non-binding requirement, increases in local funds are characterized in our model as regular increases in median voter income ( $y^{MV}$ ), and do not change the elasticity of government spending to  $y^{MV}$ .

When we relax the complete information hypothesis, a single term  $\theta$  indicates that the voter observes different intergovernmental transfers in the same way. However, if the term  $\theta$  is different for the different types of intergovernmental grants ( $\theta^{FNDE} \neq \theta^{FUNDEB} \neq \theta^{A^{ed}} \neq \theta^{A'}$ ), then the elasticity of government spending to changes in these intergovernmental transfers also vary. Particularly, the higher is the  $\theta^i$  (where  $i$  represents the type of intergovernmental transfer), meaning that the population is less aware of the government transfer, the higher is the increase in government spending (this phenomenon is called as the “overspending hypothesis”, referring to the  $\frac{\partial g}{\partial \theta} > 0$ ). In this sense, we would expect that the higher the level of the transfer’ source, the higher is  $\theta^i$ . That is, we would expect that  $\theta^{FNDE} > \theta^{FUNDEB}$ , since FNDE refers to federal transfers and the FUNDEB includes (in some states) transfers from both the state redistribution and the federal top-off. However, voters may be less aware of certain types of intergovernmental grants depending on the characteristics of the transfers.

As discussed by several authors, the complex structure of government taxing and spending is associated to several sources of fiscal illusion which are unrelated to the intergovernmental grant system (Oates 1988; Holsey 1993; Turnbull 1998). The presence of corruption in managing education funds,<sup>12</sup> for example, may lead to greater voter uncertainty, as voters are uncertain about the tax rates that will be imposed to implement public programs, or what they will get for their tax money. The complexity of the Brazilian fiscal structure may

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<sup>12</sup> According to Ferraz et al. (2012), 35% of Brazilian municipalities audited by the Federal Comptroller General (CGU) experienced corruption in the management of education funds.

also be an important factor in determining uncertainty. As described by Turnbull (1998), uncertainty may additionally reinforce the systematic illusion effects to increase  $\partial$ , although uncertainty alone does not generate flypaper effect. Below we empirically estimate  $\partial$  – as presented in equation (11) – in the context of Brazilian education spending.

Another important point in this analysis is the fact that we are analyzing government spending in education specifically, and not overall government spending. One might worry, for example, about whether the budget shares spent in education are the most efficient options in allocating municipal funds (Diniz 2012). In a practitioner’s guide to intergovernmental grants, Shah (2006) indicates that the determination of conditionalities must also consider the externalities of the subsidized services. Our analysis aims to understand the effects of intergovernmental transfers on government spending in a context of a minimum spending regulation for local revenue; the efficiency or externalities of such effects is beyond the scope of our analysis.

#### 4. Data

We use annual data collected between 2006 and 2014 regarding total municipal *per capita* revenues and expenses, and municipal *per capita* revenues and expenses in education. Monetary data were obtained from the National Fund for the Development of Education (FNDE) using the Public Education Budgeting Information System (SIOPE).

The municipality’s total revenue refers to the sum of current and capital revenues. Municipal revenues earmarked for education include: (i) 25% of local tax revenue<sup>13</sup>; (ii) 25% of revenues from intergovernmental transfers originated from taxes (other than FUNDEB); (iii) revenue from transfers from the National Fund for the Development of Education (FNDE); (iv) the municipal balance from the Fund for the Maintenance and Development of Basic Education and Valorization of Education Professionals (FUNDEB)<sup>14</sup>; (v) 5% of the taxes and transfers that are part of FUNDEB but were not part of the redistribution; and (vi) other revenues earmarked to education.<sup>15</sup> Local municipal tax revenue, FUNDEB and FNDE revenues were

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<sup>13</sup> Local tax revenue corresponds to the sum of tax revenues, tax arrears and interests, interest and arrears on the active tax debts and the active tax debts.

<sup>14</sup> The municipal balance from the FUNDEB is comprised of the sum of taxes and transfers, the supplementation by the Federal government, minus the deductions in municipal shares of state and federal taxes. As shown above, FUNDEB started in 2007. Prior to 2007, FUNDEF was in force, which is also a fund for the redistribution of resources destined to Education, but restricted to Elementary Education and included transfers from fewer taxes.

<sup>15</sup> Other revenues earmarked to education include (i) current revenues originated from transfers from states, from abroad as well as from private and personal transfers, (ii) current revenues of transfers by the agreement between the federal government, the states and municipalities, (iii) capital revenues from external and internal credit operations, (iv) capital revenues originated from transfers of the Federal government, the states, and municipalities,

used separately in our estimations. The total expenses in education were estimated using the sum of total current and capital expenses to education according to the SIOPE.

We use the municipal estimated population information provided annually by the Brazilian Institute of Geography and Statistics (IBGE) in the calculation of *per capita* variables.<sup>16</sup> To deflate the monetary series we used the price index IGP-DI, produced and released by the Getulio Vargas Foundation (FGV). IGP-DI price index was chosen because it covers the sectors of services provided to families, construction industries and retail trade, thus encompassing the different agents of the school community.

As covariates, we use: (i) the political party of the mayor elected informed by the Electoral High Court (Tribunal Superior Eleitoral n.d.), (ii) the *per capita* sum of municipal expenses in the education of the neighboring municipalities weighted by the distance between each municipality, (iii) three different measures of spending efficiency provided by the FIRJAN system,<sup>17</sup> and (iv) the municipal basic education enrollment provided in the Census of Basic Education by INEP.<sup>18</sup>

The political party of the mayor that wins the election was considered to be the party of the mayor in the following three years. Bracco et al. (2015) presents the importance of a political alignment with the federal party in the receiving of federal transfers. We use information of candidates elected in first or second turn in regular municipal elections from the Electoral High Court.<sup>19</sup> Municipal elections happen every four years, therefore, we use the information of mayors' party in the 2004, 2008 and 2012 elections. On these three elections, twenty-three parties command Brazilian municipalities and PMDB party won most municipal' elections.

The distance between the municipalities was calculated by the geodesic distance of latitude and longitude of the cities (from the National Census, IBGE).<sup>20</sup> The three efficiency measures of municipal public spending used in the analyses were indexes of: (I) investments, (II) liquidity, and (III) debt burden. These three measures were calculated as part of the FIRJAN Fiscal Management Index (IFGF 2017).<sup>21</sup> The investments index measures the share of

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from abroad as well as from private and personal transfers, and (v) capital revenues from transfers by the agreement between the Federal government, the states and municipalities.

<sup>16</sup> The 2010 population data was provided by the Demographic Census (IBGE 2010).

<sup>17</sup> The FIRJAN System is a private non-profit organization that aims to promote business competitiveness, education and quality of life of the industry worker. (FIRJAN n.d.)

<sup>18</sup> INEP stands for *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira*, from the Brazilian Ministry of Education.

<sup>19</sup> We have excluded 50 municipalities where the regular elections were canceled and there was a new "supplementary" election in any of the analyzed years. Source: (Tribunal Superior Eleitoral n.d.)

<sup>20</sup> The geodesic distance calculates the length of the shortest curve between two points along the surface of a mathematical model of the earth.

<sup>21</sup> The FIRJAN index was built using the municipalities' fiscal results – of annual mandatory declaration. Source: National Treasury Secretariat.



investments in municipal budgets; the liquidity index measures the relation between deferrals of expenses and availability of cash, weighted by the size of the city's budget; and the debt burden index assesses the weight of the debt burden relative to actual net revenues.

We treated as missing values the 115 outliers in monetary *per capita* variables: education expenses, local revenue, FNDE revenue, FUNDEB revenue and total education revenue.<sup>22</sup> We gave the same treatment to six data points equal to zero, in FNDE and FUNDEB revenues. The missing data were imputed using a linear regression methodology on the mesoregion and the mayor's party on the year, so the results can be expanded to all Brazilian municipals. Subsequently, with a balanced panel we keep our data to 5,380 municipalities, where each have information on the mayor's party in the three election' years. Eighty seven municipalities were spending in the year before ( $t-1$ ) less than the minimum requirement in the year ( $t$ ). These municipalities were excluded from the sample, so we have 5,293 municipalities over nine years, summing to 47,637 observations.

## 5. Empirical Strategy

Several municipal revenues are mandatorily earmarked for education – such as 25% of all taxes and transfers (the constitutional minimum), all FUNDEB (and, formerly, FUNDEF) transfers, and other FNDE revenues. Such revenues earmarked to education are, therefore, the minimum expenses in education in the municipality. While the flypaper effect is a well-established phenomenon of public finance, it is not clear whether we observe higher elasticity of education expenses to intergovernmental transfers when part of the local revenues is non-fungible. That is, we are interested in understanding what happens to the flypaper effect when there is a spending conditionality on local taxes – as is the case for the Brazilian constitutional minimum spending on education.

Moreover, we are interested in analyzing the responses of municipal governments to different types of intergovernmental transfers, earmarked to education. As discussed above, if voters have different information about different types of intergovernmental grants (represented by the term  $\theta$  in equation 10), then the elasticity of government spending to changes in these intergovernmental transfers also vary.

A major concern on the estimation of the flypaper effect is whether  $\hat{\delta}$  (as presented in equation 11) is being overestimated. That is, whether the differential elasticity of government

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<sup>22</sup> We use the methodology proposed by Hidiroglou and Berthelot (1986), but considering two growth rates of an observation, one compared with the data in the year before and the other with the year after. We find 11 outliers in expenditures data, 97 in local revenue, 5 in FNDE revenue, one in FUNDEB revenue and one in total revenue earmarked to education.

spending to intergovernmental grants relative to the elasticity of government spending to local revenue reflects an endogenous relationship between receiving intergovernmental transfers and spending in education.

Several authors argue that political alignment is a crucial determinant of the amount of funds received by local government (Bracco et al. 2015; Brollo and Nannicini 2012; Feld and Schaltegger 2005; Veiga and Pinho 2007). Using Brazilian data of electoral terms from 1997 to 2010, Brollo and Nannicini (2012) find, for example, that municipalities with a mayor affiliated with the coalition of the president receive about one-third larger discretionary transfers for infrastructure during the last two years of the mayoral term. If being affiliated with the president coalition also facilitates greater spending in infrastructure, the higher elasticity of spending to intergovernmental transfers is not in fact showing a higher response from the government, but rather the effects of a political alignment.

This possibility may be due to the fact that mayors' preference for higher government spending is related to its political ability to receive intergovernmental transfers. To check for this possibility, we have estimated whether the amount of FNDE intergovernmental transfers received by the municipal governments' increases whenever the mayor's coalition is aligned with the president's political party – we consider that there is an alignment whenever the mayor's coalition includes the president's party. We did not find any statistical significant relationship between mayor's alignment with the president and the amount of funds received through the FNDE transfers.<sup>23</sup> We also control for the mayors' political party in all of our estimations.

In addition to the FNDE transfers, one may worry that municipal governments may increase student enrollment in order to receive higher FUNDEB transfers. This may be due to the fact that the amount of FUNDEB funds received by each government entity is determined by the number of students in each municipality relative to the number of students in the state. Cruz (2015) argues that municipalities that have received lower net FUNDEF transfers have increased the number of enrolled students. This possibility can be problematic if municipalities that are more successful in increasing enrollment have greater preference for higher education expenses.

Even though student enrollment in Brazil is much less of bargaining chip today than during the FUNDEF period, it is still the only possibility that mayors have to increase its FUNDEB transfers. Other than increasing student enrollment, the amount of funds received by each municipality is exogenously determined by the tax collection of all government entities in

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<sup>23</sup> During the period under study (2006 to 2014), the president's party was always PT (Workers' Party).

the state. In order to deal with this possibility – of an endogenous increase in funds to changes in student enrollment – we use an instrumental variable (IV) approach to estimate the amount of FUNDEB transfers received by each municipality that is explained by the relative position of student enrollment in the previous year (the number of students enrolled in basic education in the year before relative to the state’s enrollment). In addition of being strongly related to the amount of FUNDEB funds received, a relatively small municipality in one state may be a relatively large municipality in another. Therefore, this instrument allows for a reliably exogenous variation in the amount of funds received through FUNDEB transfers.

Equation (12) shows the naïve model, without the instrumental variable, and equation (13) shows our preferred model, using the relative student enrollment in the year before as an instrumental variable for the FUNDEB transfers. In both models,  $i$  refers to municipalities and  $t$  to years. The estimations are restricted to those municipalities where the government education spending in year  $t-1$  is greater than the total mandatory spending on education in year  $t$ , as determined by the constitutional minimum and the intergovernmental grants earmarked to education. This restriction indicates that we are only analyzing the effect of fungible money, since government spending in education is not forced to increase in order to fulfill the mandatory minimum spending determined by the constitutional minimum and the intergovernmental transfers labeled to education.

Another important aspect of our models is the inclusion of several control variables to deal with potential endogeneities. First, we include a control variable of expenses for other Brazilian municipalities, weighted by the distance in relation to the municipality under analysis. Municipal expenses can be influenced by the expenses of their neighbors, both by an increase in the income of the region in which municipality  $i$  is located and by an “imitation” effect, as pointed out by Almeida and Ribeiro (2016) and Baicker (2005). Voters can change their demands towards the municipal manager by observing what is being done in the surrounding municipalities, with the distance between municipalities indicating the importance of that influence. For example, if the municipality next to a municipality  $i$  increases its public spending on education, and thus, there is an improvement in the quality of schools, voters in municipality  $i$  may demand increases in education expenses, even if there has not been an increase in local income. On the other hand, an increase in expenses in surrounding municipalities of municipality  $i$  may decrease the spending of municipality  $i$  by a decrease in the demand for education services. For example, an improvement in the education quality of a neighbor municipality may attract students to the neighbor municipality, leading to a decrease in education spending of municipality  $i$ .

We also include three variables to control for management efficiency: an index for the proportion of public investment, an index for budget liquidity, and an index for debt burden. The importance of including such efficiency measures is to control for the municipalities' intrinsic characteristics in terms of management ability (or preferences). For example, municipalities that are more efficient in managing resources may decide to spend FUNDEB resources differently from local resources. If such choices on how to administer the resources is related to the amount received from local and/or intergovernmental transfers, than our results could be biased by the managers' ability (rather than representing the flypaper effect). The inclusion of manager's efficiency variables control for this possibility.

$$(12) \quad \ln(g_{it}) = \beta_0 + \beta_1 \ln(y_{it}) + \beta_2 \ln(FNDE_{it}) + \beta_3 \ln(FUNDEB_{it}) + \beta_i + \beta_t + \beta_4 P_{it} + \beta_5 DI_{it} + \beta_6 Index\ inv_{it} + \beta_7 Index\ liq_{it} + \beta_8 Debt\ burden_{it} + \beta_9 \ln(E_{it}) + \beta_{10} \ln(E_{it-1}) + \varepsilon_{it}$$

$$\text{For } g_{it-1} > FNDE_{it} + FUNDEB_{it} + A_{it}^{ed} + 25\% \cdot y_{it}^{MV}$$

In this model, the variable  $\ln(g_{it})$  refers to the  $\ln$  of the *per capita* expense in education of municipality  $i$  in year  $t$ , and  $\ln(y_{it})$  is the  $\ln$  of the *per capita* local revenue of municipality  $i$  in year  $t$ . The intergovernmental transfers are divided in two categories: (i) federal transfers from the FNDE (other than FUNDEB), and (ii) FUNDEB transfers. The variables  $\ln(FNDE_{it})$  and  $\ln(FUNDEB_{it})$  refer to the  $\ln$  of the *per capita* intergovernmental transfers in municipality  $i$  and year  $t$  of these types of intergovernmental transfers.  $\beta_i$  is the fixed effect of municipality  $i$ , and  $\beta_t$  is the time fixed effect. As covariates, we have  $P_{it}$  as dummies for the mayor's party of the of municipality  $i$  in year  $t$  (for each mandate);  $Index\ inv_{it}$ ,  $Index\ liq_{it}$ , and  $Debt\ burden_{it}$  referring to management efficiency proxies;  $\ln(E_{it})$  and  $\ln(E_{it-1})$  referring to the  $\ln$  of student enrollment in basic education in  $t$  and  $t-1$ ; and  $DI_{it}$ , which refers to the sum of the *per capita* expenses of neighboring municipalities weighted by the distance of each municipality  $i$  in year  $t$  to all other municipalities of the sample. Standard errors are clustered at the mesoregion level,<sup>24</sup> as we believe that errors may be correlated across some municipalities with similar socioeconomic characteristics.

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<sup>24</sup> The mesoregions are a partition of the Brazilian territory in regions that congregate several municipalities with economic and social similarities in the states. It was created by IBGE (IBGE n.d.) and is used for statistical purposes only.

(13) *First-stage:*

$$\begin{aligned} \ln(FUNDEB_{it}) &= \mu_0 + \mu_1 \frac{E_{it-1}}{\sum_j E_{it-1}} + \mu_2 \ln(FNDE_{it}) + \mu_3 \ln(y_{it}) + \beta_i + \beta_t + \mu_4 P_{it} + \mu_5 DI_{it} \\ &+ \mu_6 Index\ inv_{it} + \mu_7 Index\ liq_{it} + \mu_8 Debt\ burden_{it} + \mu_9 \ln(E_{it}) + \varepsilon_{it} \end{aligned}$$

*Second-stage:*

$$\begin{aligned} \ln(g_{it}) &= \beta_0 + \beta_1 \ln(\widehat{FUNDEB}_{it}) + \beta_2 \ln(FNDE_{it}) + \beta_3 \ln(y_{it}) + \beta_i + \beta_t + \beta_4 P_{it} + \beta_5 DI_{it} \\ &+ \beta_6 Index\ inv_{it} + \beta_7 Index\ liq_{it} + \beta_8 Debt\ burden_{it} + \beta_9 \ln(E_{it}) + \varepsilon_{it} \end{aligned}$$

For  $g_{it-1} > FNDE_{it} + FUNDEB_{it} + A_{it}^{ed} + 25\% \cdot y_{it}^{MV}$

The instrumental variable  $\frac{E_{it-1}}{\sum_j E_{it-1}}$  refers to the student enrollment in municipality  $i$ , year  $t-1$  relative to the sum of student enrollment of all municipalities  $i$  in state  $j$  ( $i \in j$ ). Our assumption in using this instrument is that after controlling for municipal and time fixed effects, and for our control variables (particularly the political party of the mayor over time, and the ln of student population), the variations in the relative student population in the year before are not determined by an effort of the mayor to increase its FUNDEB transfers in the next year. Our assumption is supported by two main reasons: First, the fact that municipalities do not have control over the efforts of other municipalities in the same state. Second, because a mayor in year  $t$  cannot affect its enrollment in the year before (any persistent trend in enrollment over time is already being controlled by  $\ln(E_{it})$ ).

In the median voter model, the elasticity of education expenses to changes in revenue is constant regardless of the type of revenue. It is expected that the public manager rearrange its budget to maintain the same proportion of the budget invested in educational expenses despite the source of revenue. In other words, if the municipal manager is maximizing the preferences of the median voter, as presented in equations (1) and (2), the elasticity estimated in  $\beta_3$  of model (12) and the second-stage of model (13) should equal the elasticities estimated in  $\beta_1$  and  $\beta_2$  (given the restriction that the municipality is already spending more in education than the mandatory minimum expenditure).

In order to analyze the existence of a flypaper effect, we estimate the increase in education expenses in response to increases in local revenues (represented by  $\beta_3$ ) and compare with the increase in education expenses in response to intergovernmental transfers (represented

by  $\beta_1$  and  $\beta_2$ ). We interpret the estimated difference as the flypaper effect ( $\partial = \beta_{1 \text{ or } 2} - \beta_3$ ). Next, we estimate the increase in educational expenses in response to different types of intergovernmental transfers (represented by  $\beta_1$  and  $\beta_2$ ). Particularly, we test whether the elasticity of FNDE transfers ( $\beta_2$  in models (12) and (13)) is higher than the elasticity of the FUNDEB transfers ( $\beta_1$ ).

## 6. Results

The purpose of this study is to analyze the flypaper effect in the use of educational resources of Brazilian municipalities, considering the existence of spending' conditionalities. The results of the estimates discussed above are in Tables 1 and 2. In summary, we find the known flypaper effect for revenues conditioned to education only between FUNDEB and local resources. The elasticity of education expenses to FNDE intergovernmental transfers is similar to the elasticity to local revenues, and, therefore, is lower than the elasticity of FUNDEB resources.

Table 1 shows the estimated results of regression (12). Column [1] shows the regression estimations without controlling variables. Column [2] presents results controlling only for year fixed effects. Column [3] includes municipalities fixed effects and the weighted mean of municipal neighbors' *per capita* expenses in education. Column [4] includes mayors' party over time and the management efficiency proxies, and in column [5] municipal enrollment in the same and in the previous year is finally included as a control.

Considering the most restrictive estimation (column [5] of Table 1), a 1% increase in local revenue leads to a 0.059% increase in *per capita* educational expenses. Surprisingly, we find that a 1% increase in FNDE revenue is related to a 0.062% increase in educational *per capita* expenses. These coefficients are statistically similar, suggesting the inexistence of a flypaper effect for the FNDE transfers. On the other hand, we estimate that a 1% increase in FUNDEB revenue is related to a 0.481% increase in educational per capita expenses, thus, we find a significant flypaper effect in the differences of elasticities for local and state revenues.

Table 2 shows the estimated results of the second-stage of regression (13), using the relative enrollment of the previous year as an instrument to the FUNDEB revenue. Column [1] shows the results controlling for municipal and year fixed effects. Column [2] includes the weighted mean of municipal neighbor's *per capita* expenses in education, the mayor's party and the management efficiency proxies, and column [3] controls for the municipal enrollment in year  $t$ . All the estimations present a statistically significant coefficient at 1% to the instrument in the first-stage of the IV regression. Specifically, we find the coefficients of 4.685 (SE =

1.501), 5.046 (SE = 1.279) and 1.973 (SE = 0.670) in the three first-stage estimations, respectively.

The results shown in Table 2 are close to those presented in Table 1. As we see in column [3] of Table 2, a 1% increase in local revenue increase is related to a 0.062% increase in the *per capita* educational expenses. The surprising result persists; we find that a 1% increase in FNDE revenue is related to a 0.039% increase in educational *per capita* expenses. That means that in the IV estimation the elasticity of expenses to local revenues is greater than the elasticity of expenses to FNDE resources, although this statistical difference between the coefficients of local and FNDE resources is not observed in column [1] of Table 2. Also agreeing with the interpretations to the naïve results, but with even higher elasticity, we estimate that a 1% increase in FUNDEB revenue is related to a 0.678% increase in educational *per capita* expenses.

Table 1 – Elasticities on education expenses

	ln(Expenses in educ) <sub>it</sub>				
	[1]	[2]	[3]	[4]	[5]
ln(FUNDEB) <sub>it</sub>	0.448 [0.025]***	0.441 [0.026]***	0.416 [0.018]***	0.416 [0.018]***	0.481 [0.024]***
ln(FNDE) <sub>it</sub>	0.190 [0.018]***	0.194 [0.019]***	0.056 [0.005]***	0.054 [0.005]***	0.062 [0.002]***
ln(Local revenue) <sub>it</sub>	0.108 [0.006]***	0.106 [0.006]***	0.067 [0.005]***	0.064 [0.005]***	0.059 [0.005]***
ln(Expenses in other munic) <sub>it</sub>			-2.476 [0.128]***	-2.463 [0.137]***	-2.120 [0.183]***
Index % investment <sub>it</sub>				0.056 [0.004]***	0.059 [0.004]***
Index % liquidity <sub>it</sub>				0.002 [0.002]	-0.003 [0.002]
Index debt burden <sub>it</sub>				0.034 [0.008]***	0.035 [0.008]***
ln(Enrollment) <sub>it</sub>					0.058 [0.013]***
ln(Enrollment) <sub>it-1</sub>					-0.121 [0.024]***
<i>R</i> <sup>2</sup>	0.62	0.62	0.69	0.69	0.66
<i>N</i>	47,637	47,637	47,637	47,637	42,344
Year FE	No	Yes	Yes	Yes	Yes
Municipal FE	No	No	Yes	Yes	Yes
Mayor's Party <sub>it</sub>	No	No	No	Yes	Yes

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

Source: FNDE\SIOPE. Standard errors are clustered at the mesoregion level. Column [5] refers to 2007-2014.



Table 2 – Elasticities on education expenses, Second stage of IV estimate

	ln(Expenses in educ) <sub>it</sub>		
	[1]	[2]	[3]
ln(FUNDEB) <sub>it</sub>	0.372 [0.024]***	0.526 [0.038]***	0.678 [0.089]***
ln(FNDE) <sub>it</sub>	0.076 [0.005]***	0.049 [0.004]***	0.039 [0.007]***
ln(Local revenue) <sub>it</sub>	0.058 [0.005]***	0.059 [0.005]***	0.062 [0.005]***
ln(Expenses in other munic) <sub>it</sub>		-2.331 [0.167]***	-2.123 [0.170]***
Index % investment <sub>it</sub>		0.060 [0.004]***	0.059 [0.004]***
Index % liquidity <sub>it</sub>		-0.003 [0.002]**	-0.005 [0.002]**
Index debt burden <sub>it</sub>		0.037 [0.008]***	0.038 [0.008]***
ln(Enrollment) <sub>it</sub>			-0.132 [0.052]**
<i>N</i>	42,344	42,344	42,344
Year FE	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes
Mayor's Party <sub>it</sub>	No	Yes	Yes

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

Source: FNDE\SIOPE 2007-2014. Standard errors are clustered at the mesoregion level.

Therefore, our results indicate the presence of flypaper effects between local and FUNDEB transfers – equal to 0.616. However, we do not find any difference in elasticities between local resources and FNDE federal transfers. These results indicate that mayors respond to increases in FNDE transfers similarly as they do to increases in local revenue. This result is particularly interesting given the fact that FUNDEB transfers refer to state transfers with resources from the redistribution of state and local funds plus federal transfers, while other FNDE transfers refer to transfers of only federal funds. It indicates, therefore, that the level of the government responsible for the transfer is less of an issue to the flypaper effect in this context.

If we interpret the results considering the maximization problem presented in equation (10) – where  $\theta \in (0,1)$  refers to the illusion level regarding the amount of intergovernmental transfers – the greater elasticity of FUNDEB transfers suggests that voters are less aware of the FUNDEB transfers than they are of the FNDE transfers. The particularities of the FNDE transfers – such as the fact that part of its transfers occur via voluntary agreements between the municipality and the federal government – may justify such results. The value of  $\theta$  is probably

lower when there is a voluntary agreement for the transfer. Another important characteristic of the FNDE transfers to support our findings is the fact that many voluntary agreements determining the FNDE transfers occur directly with the schools, which may also decrease the “illusion” regarding the amount of funds received.

Moreover, several authors argue that the complexity of the tax structure is an important factor for the fiscal illusion (Turnbull 1998; Oates 1988; Dollery and Worthington 1996). In this sense, the complexity of the FUNDEB redistributive structure ratifies the argument that there is greater illusion regarding FUNDEB’s resources.

## 7. Conclusion

Externally collected transfers (as it is the case with intergovernmental transfers) only generate increases in expenses when local governments do not offset the amount received via grants by reducing other expenses that use local resources. However, an empirical phenomenon called “*the flypaper effect*” is commonly observed in intergovernmental subsidies and happens when the intended purpose of such a transfer is not the “optimal allocation” of funds to the local government.

In Brazil, conditionalities for resources to education are present both in local revenues, such as the constitutional minimum spending requirement, and in intergovernmental transfers, such as the FUNDEB and the FNDE transfers. In order to analyze the existence and characteristics of the flypaper effect in a context where both the intergovernmental grants and the local resources have conditionalities to be spent in education, we estimate the elasticity of *per capita* expenses in education to local resources, to the FUNDEB, and to the FNDE intergovernmental transfers. We restrict our analyses to those municipalities that are not bound by the minimum spending in education, given these conditionalities.

In our preferred model, we use the relative student population in the previous year as an instrumental variable to the FUNDEB transfers in the year. The results suggest that local resources have a smaller influence on educational expenses than the external transfers represented by the FUNDEB funds. However, we did not find the existence of *flypaper* effects from the FNDE federal transfers, suggesting that voters have more information about the funds coming from this source compared to the FUNDEB transfers.

Our results suggest an important role of FUNDEB funds in increasing educational expenses in recent years in Brazil. If the goal of the federal government is to encourage municipalities to invest more in basic education, our estimates suggest that intergovernmental transfer policies are more effective for this purpose than policies of minimum spending from

local resources. In other words, the evidence of a flypaper effect ratifies the importance of FUNDEB as a policy capable of increasing educational investments, rather than minimum spending requirements. However, we highlight that this possibility may not be the decision that most please the median elector, but rather it indicates a lack of complete information regarding education intergovernmental transfers.

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## 9. Appendix A: Flypaper Model

Assuming that  $U^{MV}$  is non-decreasing and well-behaved, the budget constrain will hold with equality, so we can substitute  $x$  in the maximization problem and we have:

$$\text{Max}_g U^{MV}(y^{MV} + t.A - t.g, g)$$

To solve the problem, we calculate the first order condition by the total derivative in  $g$ , as shown below.

$$-t.U_x^{MV}(y^{MV} + t.A - t.g, g) + U_g^{MV}(y^{MV} + t.A - t.g, g) = 0$$

$$\Leftrightarrow t.U_x^{MV}(y^{MV} + t.A - t.g, g) = U_g^{MV}(y^{MV} + t.A - t.g, g)$$

Using the Implicit Function Theorem, we have:

$$\frac{\partial g}{\partial A} = - \frac{-t^2 U_{xx}^{MV}(\cdot) + t.U_{gx}^{MV}(\cdot)}{t^2 U_{xx}^{MV}(\cdot) - 2.t.U_{gx}^{MV}(\cdot) + U_{gg}^{MV}(\cdot)}$$

$$\frac{\partial g}{\partial y^{MV}} = - \frac{-t U_{xx}^{MV}(\cdot) + U_{gx}^{MV}(\cdot)}{t^2 U_{xx}^{MV}(\cdot) - 2.t.U_{gx}^{MV}(\cdot) + U_{gg}^{MV}(\cdot)} = \frac{1}{t} \cdot \frac{\partial g}{\partial A}$$

$$\Leftrightarrow \frac{\partial g}{\partial A} = t \cdot \frac{\partial g}{\partial y^{MV}}$$