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THE EFFECTS OF GRANTS IN BRAZILIAN STATES AND MUNICIPALITIES: A BRAZILIAN FLYPAPER INDEX

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Abstract

The flypaper effect is the empirical anomaly by which intergovernmental grants tend to be transformed by recipient authorities into public expenditures at a considerably higher rate than local private resources. The objective of this research is to detect the existence and investigate the causes of the flypaper effect in the Brazilian states. Panel data evidence of 27 Brazilian states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018 indicates the existence of a large flypaper effect, with an estimated impact of grants on public expenditures. Considering there are some ways to calculate MCF proxies, first, an autonomous index was used as a proxy of the marginal cost of public funds (MCF), because it represents how much the municipality can survive by itself, representing the municipality's independency to federal grants. Second, the MCF was calculated by the derivation of Proper Tax Revenue to the Total Revenues. The state results show that the stimulative effect of grants on public spending increases with the MCF in both proxies, but it was stronger in the autonomous index proxy, in convergence to results of Dahlby and Ferede (2016) to Canadian provincial data. The municipalities results show the municipalities with more than 50,000 inhabitants had a greater flypaper effect when compared to smaller municipalities. The flypaper index highlighted the group of municipalities in the Southeast region with the greatest flypaper effect, followed by Central-west and South regions. At the same time, there is evidence that the constitutional function of the transfers to reduce regional inequalities is not being achieved in some municipalities.

Keywords: Brazilian states; marginal cost of fund, grants; flypaper effect.

JEL: JEL: C33; H77; H72.

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1 Introduction

The present study aims to analyze the Brazilian states and to test the hypothesis that the stimulative effects of intergovernmental grants increase with the marginal cost of public funds (MCF) of the recipient government, based on the research of Dahlby and Ferede (2016) using Canadian provincial data. Tax autonomous was used as a proxy of the MCF, considering the rate of proper taxes in relation to the total revenues of the state. Dahlby and Ferede (2016) found stimulative effects of lump sum grants on spending increase with the provincial government's MCF.

There are many unconditional and nonmatching grants in Brazil: the State Participation Fund (FPE), the Municipal Participation Fund (FPM) and percentages of the Rural Property Tax (ITR), the Financial Transactions Tax (IOF), the Tax on Circulation of Goods and Services (ICMS), the Motor Vehicle Tax (IPVA) and the Federal Value-Added Tax or Excise Tax on Manufactured Goods (IPI). However, the present study uses only the FPE as a proxy to unconditional and nonmatching grants (lump sum).

Even though the large literature about flypaper effect in Brazil (MATTOS; CARDIM; POLITI, 2018; MATTOS; ROCHA; ARVATE, 2011; PARMAGNANI; ROCHA, 2013), there is still no conclusive evidence on the size of the flypaper effect in Brazil, neither a study considering the MCF.

There is an association of distortionary taxes with the flypaper effect, considering transfers has a "price effect," as well as an "income effect, allowing the recipient government to reduce the tax rate and, consequently, lowering its marginal cost of public funds, maintaining the public service level (DAHLBY, 2011). Hence, the reduction of the effective price is the cause of boosting spending. By this way, receiving grants causes much larger effect on spending than an increase in personal income (DAHLBY; FEDERE, 2016).

Hence, the objective of the present paper is to analyze the existence of flypaper effect on the 27 Brazilian states from 1985 to 2010 and 5,568 municipalities from 2000 to 2018. Further, two ways to deal with Marginal Cost of Funds were developed to address the importance of it in the transfers within Brazil federalism. The first one was based on an autonomous index, which is how much autonomous with proper taxes are the states faced to all the taxes and grants they receive from the federal level. The second one is based on the residuals of proper revenues and total revenues as an equation.

Moreover, other ways were done in the same topic. Ferede and Islam (2015) employed an empirical methodology that is very similar to Dahlby and Ferede (2016) and identified that block grants have stimulative effects on provincial education expenditure.

The purpose of this paper was to carry out an aggregated analysis at the state and municipal levels through the most updated data available considering the research period. Even in 2021, GDP data at the municipal level is only available until 2018, because IBGE publishes this information with a lag of 3 years, as shown in topic 3.6.

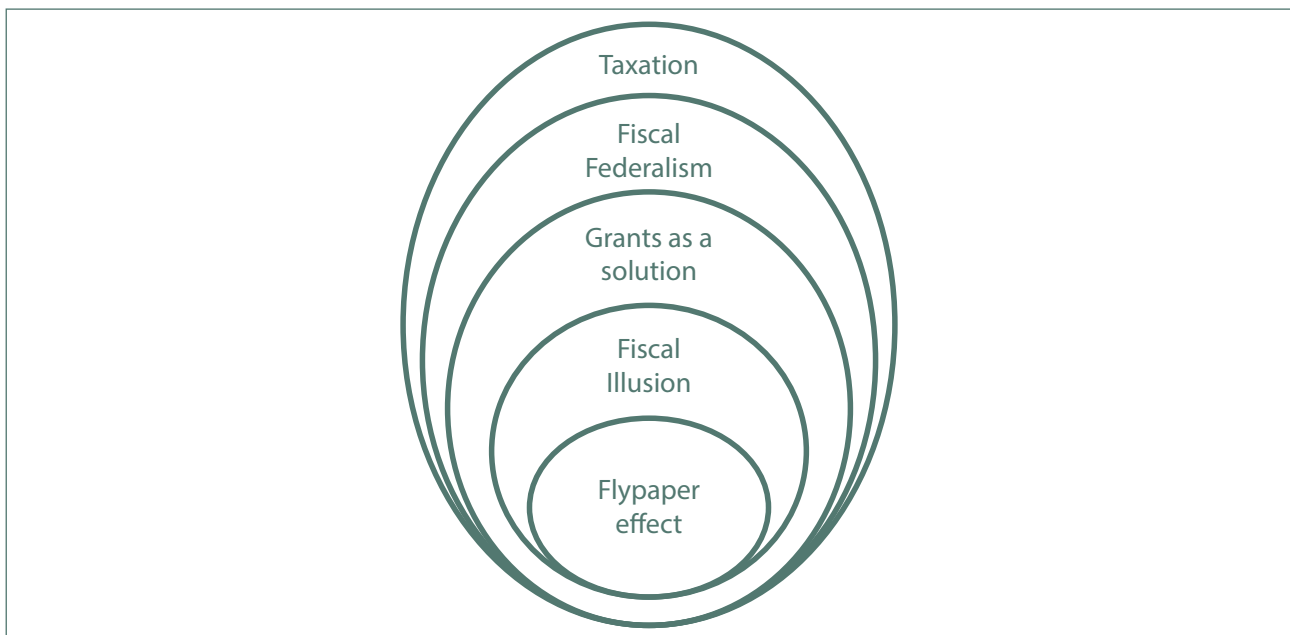
This paper is structured as follows. Section 2 discusses the state of the art of the evidence on the flypaper effect at the international and national level and presents Brazil's institutional and fiscal

structure details. Section 3 describes the methodology, while Section 4 reports and discusses the estimation results, and Section 5 concludes.

2 Theoretical Reference

Dollery and Worthington (1996) did an extent analysis of the empirical fiscal illusion studies and one of the forms is called flypaper effect. The flypaper effect has been largely studied (BAILEY; CONNOLLY, 1998; HINES; THALER, 1995) and is treated as an anomaly because it is inconsistent with the “equivalence theorem” (BRADFORD; OATES, 1971). The flypaper effect happens when an unconditional lump sum grant to a local government increases spending in a greater proportion than an equivalent raise in local income (ACOSTA, 2010; HINES; THALER, 1995). The phenomenon was first named by Arthur Okun because the money the government sends out “sticks where it hits”. Thus, taxation is at the top of the entire chain (Figure 3).

Figure 1 - Content Layers



Source: author.

Ferede and Islam (2015), for example, investigated the effects of block grants on education expenditures using panel data from Canadian provinces over the period 1982 to 2008 and found that block grants have stimulative effects on provincial education expenditure. A one dollar increase in federal grants per capita was associated with an increase in education expenditure per capita of about Can\$0.21, disclosing the flypaper effect in Canada.

There are evidence of flypaper effect all over the world (ACAR, 2019 – Turkey; AMUSA; MABUNDA; MABUGU, 2008 – South Africa; BAEKGAARD; KJAERGAARD, 2016 – DENMARK; BHANOT; HAN; JANG, 2018 – KENYA; BASKARAN, 2016 – German; BASTIDA; BENITO; GUILLAMÓN, 2009 – Spain; CANTARERO; PEREZ, 2012 – Spain; CÁRDENAS; SHARMA, 2011

– Mexico; CLARK; WHITFORD, 2011; COHEN, 2001 – US; COLBURN, 1992 – US; DAHLBY; FERREDE, 2016 – CANADA; DELLER; MAHER, 2005, 2006 – US; DENZAU; GRIER, 1984 – US; DE WIDT, 2016 – England & Germany; DEWORTOR; CHUI, 2019 – African countries; DICKSON; YU, 2000 – Canada; DOLLERY; WORTHINGTON, 1995a, 1995b – Australia; DOWNES, 2000 – US; LIM; LEE; KIM, 2017 – KOREA; MASIERO; SANTAROSSA, 2019 – Italy; PANAIO, 2020 – PHILIPPINES; SILVA; SUMARTO, 2015 – Indonesia; VEGH; VULETIN, 2016 – Argentina and Brazil).

In the South America, Acosta (2010) shows new estimates in the presence of spatial dependence, when local spending is not independent from its neighbor jurisdictions' behavior. By Argentinean county-level data (Buenos Aires), the study showed that while the “flypaper effect still holds true in the presence of spillover effects or mimic behavior across jurisdictions, it could be overestimated in the presence of spatial interdependence.

In Brazil, there are also many studies about flypaper. Cossio (2006) identified stronger flypaper effect in municipalities with larger geographic areas. It is consistent with a budget-maximizing bureaucracy explanation of the flypaper effect, considering larger municipalities' residents would not easily move to municipalities that might spend less on public services and offer lower taxes.

Sakurai (2013) searched a panel of Brazilian municipalities from 1989 and 2005 and found that grants have an asymmetric impact on public expenditure and this effect generates a recomposing between current expenses and investments. Moreover, the results indicate that municipal public spending are more sensitive to increases in government transfers than increases in local income, which means flypaper effect. Vegh and Vuletin (2016) searched Argentinean provinces and Brazilian states and identified the presence of flypaper effect.

Ferreira, Serrano and Revelli (2019b) searched 476 Brazilian municipalities from 2005 to 2012 and concluding that the flypaper effect exists in Brazilian municipalities and is intensified by the alignment of the representatives. Additionally, evidences of higher flypaper effect were found in municipalities with low tax autonomy.

Sepúlveda (2017) provides an explanation for the flypaper effect which is simply because public expenditures are cheaper when financed with intergovernmental transfers. A lump sum increase in income can lead to three effects on optimal government decisions. The first one is the net substitution effect, which represents a change in public expenditures due to the induced change in the tax base and the MCF. The second is the private-income effect, a change in public expenditures due to greater taxpayers' income. The last is the public-income effect, a change in public expenditures due to additional public funds available to purchase public goods. Considering intergovernmental transfers do not directly alter taxpayer's decisions about the tax base, they lead only to a public-income effect.

Brazil is a continental country, composed by the Union, 26 states, the Federal District and 5,568 municipalities. Regarding to transfers, the Federal Government distributes resources to the states and the municipalities, while the states also distribute resources to the municipalities, with an active competence to collect certain taxes. It is a simple system (LLOYD-SHERLOCK, 2006), although the

outcomes are complex to analyze effectiveness, as well as to verify the existence and respective reasons of occurrence of the flypaper effect.

There are several types of transfers in Brazil, matching and nonmatching. The flypaper is verified when it results from nonmatching grants, as is the case of FPM (MATTOS; POLITI; YAMAGUCHI, 2017). Nonmatching grants could be susceptible to resource allocation maneuvers, mainly due to electoral alignment (BAKER; PAYNE; SMART, 1999; KNEEBONE; MCKENZIE, 2001; RODRÍGUEZ-POSE; GILL, 2004), but as the formula is fixed, based on population and income per capita, this weakness should be minimized.

Furthermore, the percentages of FPE the states receive is defined every year by the Federal Court of Accounts (TCU), based on Population size and Gross Domestic Product (GDP):

Table 1: FPE Percentages

n	State	FPE Coefficient (%)	n	State	FPE Coefficient (%)
1	Acre	3.9531%	15	Paraíba	4.3835%
2	Alagoas	4.9123%	16	Paraná	6.3233%
3	Amapá	4.7290%	17	Pernambuco	4.4624%
4	Amazonas	3.9873%	18	Piauí	2.5740%
5	Bahia	8.4142%	19	Rio de Janeiro	1.2666%
6	Ceará	6.2473%	20	Rio Grande do Norte	3.7659%
7	Federal District	0.6585%	21	Rio Grande do Sul	2.9820%
8	Espírito Santo	1.9027%	22	Rondônia	3.4816%
9	Goiás	3.4509%	23	Roraima	1.2587%
10	Maranhão	6.8519%	24	Santa Catarina	1.2241%
11	Mato Grosso	5.1361%	25	São Paulo	3.6762%
12	Mato Grosso do Sul	1.5119%	26	Sergipe	0.8346%
13	Minas Gerais	2.0727%	27	Tocantins	3.4123%
14	Pará	6.5267%	Total		100%

Source: authors. The FPE coefficients the states receive are defined every year by the Federal Court of Accounts (TCU). This table presents the coefficients to 2021. Based on the Normative Decision 184/2020 – TCU – Appendix I FPE – Individual Participation Coefficients – Year 2021. Available on: <http://portal.tcu.gov.br/transferencias-constitucionais-e-legais/coeficientes-fpe-e-fpm/>.

Considering this situation and the difficulty of building a MCF proxy, it is possible to calculate the amount each state receives from grants and how much do they earn by local taxes. The result (called by us as Autonomous Index) fits as a MCF proxy because it represents exactly how much autonomous is the state in relation to the Federal level. It shows how much the municipality can survive only by itself, taxing and earning funds by its own. Thus, it is one of the ways to know the municipality's independency.

3 Methodology

3.1 Data

The sample consists of a panel of 27 states from 1985 to 2010 and 5,568 municipalities from 1985 to 2010. An additional analysis was done to states data excluding the Federal District, because it represents a hybrid entity accumulating state and municipality functions. Current expenditure and grants data were obtained from Finbra's Finance System, while GDP and population data were obtained from the IBGE database. The monetary variables were deflated based on the Appendix 1.

The period from 1985 to 2010 was tested because all the states variables were available, including the controls variables. Although there were some available data until 2016, it was preferable to use the data from 1985 to 2010 because all the controls were available, which is more reliable and stable considering the deflated applied to the data.

There are some similarities between Argentina and Brazil, because while Argentina is divided in 23 states or provinces and a Federal District (Buenos Aires City) and the province of Buenos Aires accounts for one third of total population and half of the GDP of the country (ACOSTA, 2010). On the other side, Brazil has 26 states and a Federal District and it accounts for 1.43% of total population (IBGE, 2019) and 3.8% of the GDP of the country (IBGE, 2017).

The period from 2000 to 2018 was tested because all the municipalities' variables were available. However, there are some available data until 2020, it was preferable to use the data until 2018 because all the complete data were available, which is more reliable and stable considering the deflated applied to the data.

This is one of the largest panel in the Brazilian literature presented in the Appendix 2 and one of the reasons previous works did not expand data is the reliable and consistent of data, which is widely discussed in the topic 3.6 Data Limitations.

3.2 Variables

Several previous works have studied the determinants of local public expenditures (DAHLBY; FERREDE, 2016). Concerning the states' data, current expenditure is used here as the dependent variable, and state GDP as a proxy for the private income variable. The nonmatching and unconditional (lump sum) grant that we use is the federal grants State Participation Fund (FPE). Therefore, some

authors have used grant proxies with more components as Cossio (2002) and Mendes (2005) and in general other studies consider FPM, IOF, ICMS and IPVA (COSSIO, 2002). All these kinds of transfers are not available during this long period, but the FPE is, besides being an unconditional and nonmatching (lump sum) grant.

Regarding municipalities, long period data are not available. We use here current expenditure as the dependent variable, and municipality GDP as a proxy for the private income variable. The nonmatching and unconditional (lump sum) grant that we use is the federal grants Municipal Participation Fund (FPM). Some authors have used grant proxies with more components as Cossio (2002) and Mendes (2005) and in general other studies consider FPM, IOF, ICMS and IPVA (COSSIO, 2002). Similarly to the state data, the FPM is the only unconditional and nonmatching (lump sum) municipal grant that is available from 2000 to 2018.

3.3 Controls

The following variables were used as controls in the expenditure determination equation: Gini index, Theil index, citizen's income, water bodies and illiteracy rate.

Initially, we performed a detailed analysis of the classification of nonmatching unconditional (lump sum) grants in Brazil and considered only grants in congruence to the theory of flypaper effect, with is the FPE. There are evidences that states with political alignment receive more grants and have greater effect flypaper (SAKURAI; MENEZES FILHO, 2011), however, it was not done in the state level.

The database is from 1985 to 2010 because the control variables are available only until 2010 (gender, youth, elderly), since they are frequently discontinued in Brazil, and this was the longest observable time series of these variables. The data availability of these control variables was questioned in the Federal Government Transparency Portal, but it was informed the data and research were actually discontinued and there is no prospect of further updates. Another limitation refers to state GDP data, which are available only two years after the end of the year it refers to (IBGE, 2017).

The municipal tests have fewer control variables (see Table 2, models 9 to 14) and fewer controls were used than the states because the variables are not continuous. Several variables are measured only in the year in which the Census is carried out (for example 2000 and 2010), but it was not carried out in 2020 and 2021 due to budgetary issues added to the limitations imposed by the Covid-19 pandemic crisis¹.

3.4 State Econometric Model

The first econometric model was applied to the states and municipalities, with the difference

¹ According to IBGE, the Census did not happen in 2020 and 2021 and maybe cannot happen in 2022. More details are presented in the topic 3.6 Data Limitations. Source: <https://www.ibge.gov.br>

that control variables are available only in state data, because municipalities' control variables do not exist with an annual periodicity. The model considers:

$$Exp_{it} = \beta_0 + \beta_1 Grant_{it} + \beta_2 GDP_{it} + \beta_2 Controls_{it} + \epsilon_{it} \quad (1)$$

where Exp_{it} is the current expenditure of the state or municipality i in the year t , $Grant_{it}$ is the nonmatching and unconditional (lump sum) transfers of the state or municipality i in the year t . In the present study, the state tests consider $Grant_{it}$ as the federal transfer to the states called FPE, considering it is constitutional and clearly exogenous as the federal transfer to the states, according to Cossio (2002) and Mendes et al. (2008).

On the other side, the municipality tests consider $Grant_{it}$ as the federal transfer to the municipalities called FPM, considering it is constitutional and clearly exogenous as the federal transfer to the municipalities, according to Cossio (2002) and Mendes et al. (2008). GDP_{it} is the Gross Domestic Product of the municipality i in the year t , and Controls are dummies of capitals, of inequality (Gini and Theil indexes), citizen's income, water bodies and illiteracy rate, while ϵ_{it} are the residuos (States: $i = 27$ states and $t = 1985$ to 2010 and Municipalities: $i = 5,568$ municipalities and $t = 2000$ to 2018).

In the state data, an index of tax autonomy was used to test if financial constraints can be responsible for the flypaper effect. This index represents how much autonomous the states are in collecting their own taxes (AKAI; SAKATA, 2002; CORREIA et al., 2014; DAHLBY; FERED, 2016; HABIBI et al., 2003; MARTINEZ-VAZQUEZ; TIMOFEEV, 2009; PSYCHARIS; ZOI; ILIOPOULOU, 2016). This index is represented below:

$$MCF_{it} = \frac{\text{Proper Tax Revenue}_{it}}{\text{Total Revenue}_{it}} \quad (2)$$

Where Proper Tax Revenue_{it} represents the sum of the Current Tax Revenues and Contributions Revenues items, which includes all the five taxes that the STF stated, which are: taxes, fees, improvement contribution, compulsory loan, and contributions in general. Total Revenue_{it} is the sum of Current Revenues and Investment Revenues.

After calculating the index, equation (3) was estimated, which includes interactions of MCF and Grants:

$$Exp_{it} = \beta_0 + \beta_1 Grant_{it} + \beta_2 MCF_{it} + \beta_3 (MCF_{it} \times Grant_{it}) + \beta_4 GDP_{it} + \beta_4 Controls_{it} + \epsilon_{it} \quad (3)$$

where Exp_{it} is the current expenditure of the state i in the year t , $Grant_{it}$ is the nonmatching and unconditional (lump sum) transfers of the state i in the year t . In the present study, it is the federal transfer to the states called FPE, considering it is constitutional and clearly exogenous as a federal transfer to the states, according to Cossio (2002) and Mendes et al. (2008); GDP_{it} is the Gross Domestic Product of the state i in the year t , and Controls_{it} are Gini index, Theil index, citizen's income, water bodies and illiteracy rate; ϵ_{it} are the residuos; ($I = 27$ states and $t = 1985$ to 2010).

The model allows the stimulative effects of grants on government spending to depend on the MCF. The most important coefficient is β_3 , because it represents if the stimulative effect of grants on public spending increases with the MCF as predicted by Dahlby and Ferede (2016), we expect $\beta_3 > 0$.

The expected result is a positive and significant coefficient of the interaction variable between MCF and Grant (β_3) (DAHLBY; FEREDA, 2016). Also, the monetary variables (Exp, GDP, and Grant) were considered as per capita, deflated by the General Market Price Index – Internal Availability (IGP-DI), as with the previous analysis (COSSIO, 2002; FERREIRA; SERRANO; REVELLI, 2019b; MATTOS; CARDIM; POLITI, 2018; MENDES, 2005).

The data have a small cross-section (27 states), but a large time series of 26 years. Some tests do not make sense in short panels (GUJARATI, 2009; HAYASHI, 2000) as cointegration, normality (WILLIAMS et al., 2018), serial correlation (BHARGAVA et al., 1982) and multicollinearity (GOLDBERGER, 1991). In consequence, they were not done in the present study. Regarding collinearity, Cossio and Carvalho (2001) warned that ICMS state grants of ICMS in their model may have generated collinearity, since the collection of ICMS is determined by the state GDP. However, they argued that the importance of this type of transference is low in relation to the total grants. Another problem can be the high correlation between expenditure, GDP and grant variables. Future studies can deepen the theme and verify the interrelationship between these variables. Finally, regarding heteroscedasticity, it was not even possible to calculate according to the extent of the panel. Therefore, the econometric assumptions were followed and adopted based on the previous literature and according to the panel length.

According to Mattos, Cardim and Politi (2018), there is another way to calculate the MCF, which is presented in the following model:

$$MCF_d_{it} = \frac{\partial (\text{Proper Tax Revenue}_{it})}{\partial (\text{Total Revenue}_{it})} \quad (4)$$

Which is similar to the equation (2), but the new MCF_d is calculated by the derivation of Proper Tax Revenue to the Total Revenues. Thus, the residuals (ϵ_{it}) of the equation below are considered the new MCF_d:

$$\text{Proper Tax Revenue}_{it} = \beta_0 + \beta_1 \text{Total Revenue}_{it} + \epsilon_{it} \quad (5)$$

After calculating the MCF_d, equation (6) was estimated, which includes interactions of MCF_d and Grants, similar to equation (3):

$$\text{Exp}_{it} = \beta_0 + \beta_1 \text{Grant}_{it} + \beta_2 \text{MCF_d}_{it} + \beta_3 \text{MCF_d}_{it} \times \text{Grant}_{it} + \beta_4 \text{GDP}_{it} + \beta_5 \text{Controls}_{it} + \epsilon_{it} \quad (6)$$

Considering the different forms to calculate the MCF (DAHLBY, 2008), this procedure helps to guarantee the robustness of the study.

3.5 Municipality Econometric Model

Initially, the econometric model described in equation (3) must be carried out with the states and municipalities data, adapting the corresponding variables (FPM for municipalities and FPE for states) and the control variables available, which is available only for states. In addition, at the municipal level, a time series model 19 years was proposed (from 2000 to 2018) enables to calculate 5,568 regressions, according to the following equation:

$$Exp_t = \beta_0 + \beta_1 Grant_t + \beta_2 GDP_t + \epsilon_{it} \quad (7)$$

where Exp_t is the municipality current expenditure in the year t , $Grant_t$ is the nonmatching and unconditional (lump sum) transfers of the municipality in the year t , GDP_t is the Gross Domestic Product in the year t and ϵ_{it} are the residuos ($t = 2000$ to 2018).

Under those circumstances, the flypaper effect index was generated. The elasticities of $Grant_t$ in relation to the variable GDP_t , adopting as a premise the statistical significance of the β_1 and β_2 coefficients. Therefore, the total of 5,568 regressions were performed to obtain the elasticity of each of the Brazilian municipalities.

$$Índice\ Flypaper_i = \frac{\frac{\partial Grant_t}{\partial Exp_t}}{\frac{\partial GDP_t}{\partial Exp_t}} = \frac{\partial Grant_t}{\partial Exp_t} \times \frac{\partial Exp_t}{\partial Grant_t} = \frac{\partial Grant_t}{\partial GDP_t} = \frac{\beta_1}{\beta_2} \quad (8)$$

The coefficients β_1 and β_2 that were not statistically significant were considered equal to zero. The elasticity can be positive, null or negative, because the impact of the variation of the GDP_t and $Grant_t$ variables on the Exp_t variable can be either positive or negative. Finally, the index was normalized, according to the equation below, to reduce the range between the maximum and minimum values of the index for each of the municipalities:

$$Normal\ Flypaper\ Index_i = \frac{Flypaper\ Index_i - min\ (Flypaper\ Index)}{(max\ (Flypaper\ Index) - min\ (Flypaper\ Index))} \quad (9)$$

where $Normal\ Flypaper\ Index_i$ is the result of equation 8 of the municipality i , max is the maximum flypaper index value, and min is the minimum flypaper index value.

3.6 Data Limitations

The present study has some limitations. The first is the time series horizon, as IBGE only has municipal GDP data available from before 2018, even though the research was completed in 2021. This situation happens because IBGE works with an interval of 3 years for municipal data collection, as explained by the IBGE in response to the information request in the transparency portal (Appendix 3). In addition, the last census happened in 2010 and did not happen again in 2020 budgetary reasons and maybe will not happen in 2022. Therefore, the interpolation to update the population and GDP indicators of the municipalities is hampered due to these facts.

Another limitation is the absence of control variables because these data in Brazil is not continuous, and some databases are unreliable. Some examples of lack of data continuity are data from Datasus, the IFDM index carried out by Firjan, socioeconomic variables such as sewer rate, family's income, and illiteracy. The census is only made every 10 years bring out this problems.

The unreliable databases are also a relevant research limitation. An example is the Datasus database, which has a metric for masonry houses. In some years this number increases, in others it is zero, while also decreasing to the same municipality. No reason was identified for decreasing this variable, unless a disaster strikes the municipality, destroying all brick houses. When questioned through the Federal Government Transparency Portal, the Ministry of Health, responsible for the database and for the survey, answered the complaints are precedent and the abrupt variable variation has no justification, which may happen by database information error and typing error. The variable brick house was searched in the municipality Japeri – RJ, that do not have data for the years 2005, 2006 and 2007 and from 2002 to 2004 the variable decreased.

Another example of unreliable data is the databases Siconfi and Fibra. As they are based on self-declaration by states and municipalities, there are several information problems. This fact is also addressed in the National Public Sector Balance (BSPN), in which the explanatory notes alert that several states and municipalities have inconsistent data or simply did not send the information to the National Treasury. Otherwise, the National Treasury decided not to include those municipalities into the consolidation. Research by Ferreira, Serrano and Revelli (2019a) showed that since 2000 any BSPN has covered 100% of Brazilian states and municipalities. Albeit Brazil has 5,568 municipalities, only 5,046 were included in the National Balance of 2020 (BRASIL, 2021).

Some intrinsic characteristics of the variables end up limiting the data as well. In the case of the FPE and FPM coefficients, as they use population database, some municipalities have filed for justice to maintain the previous number of people in the database. Therefore, even if it is not real, the number remains because justice determined it. In 2021, a total of 17 municipalities had legal approval: Ipixuna – AM, São Gonçalo do Amarante – RN, Benjamin Constant – AM, Guajará – AM, Lábrea – AM, Tabatinga – AM, Urucurituba – AM, Ipixuna – AM, Jutáí – AM, Parintins – AM, Barcelos – AM, Caapiranga – AM, Santo Antônio do Içá – AM, Uarini – AM, Barreiros – PE, Teresina – PI and Boa Vista – RR.

These limitations affect the present research, which could not deepen more the analysis and conclusions regarding the reasons of the flypaper effect. Therefore, it was decided to obtain fewer correct results than more doubtful or wrong results, which can lead to compromising inferences, especially for public policies and government transfers.

4 Empirical Results

Descriptive statistics of the variables used in the model are shown in Appendix 4. The results show the Federal District contributes to higher the mean and average of the monetary variables, mainly because it accumulates state and municipality functions. It is possible to observe also that the Gini index increases when the Federal District is added to the sample, indicating the inequality increasing, which is true, because the Federal District has high Gini indexes.

The municipality panel data tests were performed using fixed effects, based on Hausman test ($\chi^2(16) = 375.78^{***}$). The results of equations (1), (3), (6) and (7) are presented by the following table, distinguished by state and municipality results. The flypaper is present in both states and municipalities, as the Grant coefficient is statistically significant and higher than the GDP coefficient in models (1), (5) and (9).

The flypaper is higher in municipalities with more than 50,000 inhabitants, contrary to the expected results, the smallest municipalities have the greatest flypaper effect as they do not have their own income and are highly dependent on federal grants. One of the reasons for this finding is the way the FPM is calculated and distributed, which is directly proportional to population and inversely proportional to income per capita.

Table 2: Statistic Tests of flypaper effect constitutional grants

Variable/ Model	States								Municipalities					
	Without Federal District				With Federal District				(9) Pool	(10) Pool	(11) Pop<3k	(12) Pop<50k	(13) Pop>50k	(14) Panel
	(1) Pool	(2)	(3)	(4)	(5) Pool	(6)	(7)	(8)						
GDP	0.092*** (0.003)	0.045*** (0.008)	0.125*** (0.006)	0.060*** (0.008)	0.109*** (0.008)	0.092*** (0.007)	0.111*** (0.005)		0.029*** (0.000)	0.026*** (0.000)	0.030 (0.002)	0.027*** (0.001)	0.036*** (0.000)	0.014*** (0.001)
Grant	0.836*** (0.028)	0.447*** (0.038)	0.126* (0.071)	0.153 (0.066)	0.860*** (0.469)	0.552*** (0.059)	0.176* (0.103)	0.153 (0.104)	1.310*** (0.026)	1.207*** (0.033)	1.441*** (0.058)	1.418*** (0.011)	2.101** (0.069)	1.116*** (0.127)
MCF			-0.731*** (0.128)	-0.736*** (0.120)			-1.521*** (0.188)	-1.582*** (0.185)						
MCF*- Grant			1.096*** (0.275)	1.159*** (0.274)			1.485*** (0.413)	1.354*** (0.439)						
Capital										177.180*** (14.672)				
Gini		2.306*** (0.696)		1.746** (0.766)		2.834** (1.152)		0.969 (1.254)						
Theil		-0.922*** (0.272)		-0.726*** (0.277)		-1.346*** (0.459)		-0.779* (0.463)						
Citizen's Income		0.001*** (0.000)		0.000*** (0.000)		0.000 (0.000)		0.000 (0.000)						
Water bodies		-0.263 (0.180)		-0.510*** (0.195)		-0.296 (0.281)		-0.287 (0.301)						
Illiteracy		-1.663*** (0.432)		-2.012*** (0.443)		-1.361** (0.683)		-1.651** (0.680)						
Years	No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes
Obs	672	672	672	672	698	698	698	698	105,783	100,224	9,442	84,816	11,514	100,260
States/Mun.	26	26	26	26	27	27	27	27	5,568	5,568	476	4,428	666	5,568
R ²	0.660	0.748	0.551	0.751	0.688	0.886	0.926	0.930	0.202	0.194	0.048	0.308	0.628	0.606
F test/ Wald	654.94***	785.28***	561.64***	817.66***	195.61***	503.08***	516.45***	611.56***						

Source: authors. FE: Fixed Effects. Obs: Observations. (1): Pool, F(2, 695) and equation 7. (2): Wald $\chi^2(7)$ and equation 1. (3): Wald $\chi^2(4)$ and equation 3. (4): Wald $\chi^2(9)$ and equation 3. (5): Pool, F(2, 695) and equation 7. (6): Wald $\chi^2(7)$ and equation 1. (7): Wald $\chi^2(4)$ and equation 3. (8): Wald $\chi^2(9)$ and equation 3. (8): equation 17. (4): Panel data – fixed effects and equation 1. Robust standard errors are in parentheses. N States = from 1985 to 2010. N Municipalities = from 2000 to 2018. ***p< .01; **p< .05; *p< .1.

4.1 State Results

In the same way of Dahlby and Ferede (2016), the results show the stimulative effect of grants on public spending increases with the MCF and $\beta_3 > 0$ is positive and significant in all the models the MCF variables are included (2, 3, 5, 6), as expected initially. Hence, it can be concluded that the stimulative effect of grants on public spending increases with the MCF. The above results of $\beta_1 > 0$ do not indicate the effects of grants on government expenditures due to the presence of the interaction term.

Related to equation (6), to verify another way of estimating the MCF, the results are presented below:

Table 3: Identified flypaper effect constitutional grants (robust) with MCF_d

Variables/Models	Without Federal District		With Federal District	
	(7)	(8)	(9)	(10)
Grant	0.816 (0.079)***	0.726 (0.087)***	0.831 (0.121)***	0.845 (0.147)***
MCF_d	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
MCF_d*Grant	0.000 (0.000)***	0.000 (0.000)***	0.000 (0.000)**	0.000 (0.000)*
GDP	0.093 (0.007)***	0.046 (0.008)***	0.099 (0.005)***	0.096 (0.007)***
Gini		2.803 (0.708)***		3.307 (1.195)***
Theil		-0.937 (0.269)***		-1.366 (0.463)***
Citizen's Income		0.000 (0.000)***		-0.000 (0.000)
Water bodies		-0.434 (0.196)**		-0.308 (0.301)
Illiteracy		-1.876 (0.442)***		-1.463 (0.693)**
Dummy Years	No	No	No	No
States fixed effect	No	No	No	No
Year fixed effect	No	No	No	No
Obs	670	670	696	696
States	26	26	27	27
R ²	0.506	0.738	0.895	0.901

Source: authors. Robust standard errors are in parentheses. N = from 1985 to 2010. ***p < .01; **p < .05; *p < .1.

The results are aligned to Dahlby and Ferede (2016), considering the results show $\beta_3 > 0$ is positive and significant in models 7 and 8, while they are not strong significant in models 9 (at 5%) and 10 (at 10%). Any of the coefficients were less than 0, which support the results are aligned to the

expectations. However, considering they were not so higher than zero, the results show the many ways to calculate and estimate MCF (DAHLBY, 2008; AURIOL; WARLTERS, 2012) can lead to different results. The MCF proxy as index of tax autonomy (equation 2) show results totally aligned to the results of Dahlby and Ferede (2016).

Although, the MCF proxy as the derivation of Proper Tax Revenue to the Total Revenues (equation 4) show results aligned to Dahlby and Ferede (2016), but not so strong, because the coefficient is closer to zero, and not higher than zero. Finally, it can be concluded that the stimulative effect of grants on public spending increases with the MCF.

4.2 Municipality Results

The results show evidence of the flypaper effect in Brazilian municipalities (see Table 2, models 9 to 14), validating previous studies (ARAÚJO; SIQUEIRA, 2016; CRUZ; SILVA, 2020; DINIZ et al., 2017; FERREIRA; SERRANO; REVELLI, 2019b; FREITAS et al., 2019; GADELHA et al., 2017; MATTOS; CARDIM; POLITI, 2018; PANSANI; SERRANO; FERREIRA, 2020; PARMAGNANI; ROCHA, 2013; SALOMÃO NETO, 2020; VEGH; VULETIN, 2016).

At the national level, the distribution of the Flypaper Index (equations 18 and 19) on the map is represented below:

Figure 4: Flypaper Effect Index Map



Source: authors, by the Software Stata.

Interpreting the distribution of the flypaper index on the map, the dark spots represent the higher indexes, in other words, the greater the impact on current expenditures due to an increase in government transfers rather than an increase in the municipality's income. The map may be confusing at a first look, as the dark spots partly represent the concentration of municipalities in these areas. However, when analyzing the generated index data, it is clear the darker areas admittedly have the highest flypaper indexes.

Table 4: Larger and Lesser Municipalities Index

n°	Municipality	Flypaper Index	n°	Municipality	Flypaper Index
1°	São Paulo – SP	1.00	5,554°	Amapá – AP	0.01
2°	Duque de Caxias – RJ	0.90	5,555°	Alto do Rodrigues – RN	0.01
3°	Araporã – MG	0.75	5,556°	Santo Antônio do Leverger – MT	0.01
4°	Porto Real – RJ	0.52	5,557°	Santa Helena – PR	0.01
5°	Betim – MG	0.45	5,558°	Campina Grande – PB	0.01
6°	São Gonçalo do Rio Abaixo – MG	0.31	5,559°	Cascavel – PR	0.00
7°	Osasco – SP	0.29	5,560°	Gurupi – TO	0.00
8°	Cairu – BA	0.27	5,561°	Ananindeua – PA	0.00
9°	Itatiaiuçu – MG	0.26	5,562°	Serranópolis – GO	0.00
10°	São José da Barra – MG	0.23	5,563°	Campo Grande – MS	0.00

Source: authors. Not all the 5,568 municipalities had the flypaper index calculated for lack of data for the entire time series from 2000 to 2018.

The improvement in the analysis of the time series is to scale and verify which municipalities are outliers from the perspective of the flypaper effect. Analyzing the largest municipality in Brazil, São Paulo, the increase of R\$1.00 in the municipality's income (GDP) practically does not generate an increase in expenditure, as the coefficient is close to zero, while the increase in the same amount of transfers has a representative impact on expenditure. Therefore, São Paulo is the city with the biggest flypaper effect in Brazil.

Most of the following municipalities are not capitals (there are 27 state capitals in Brazil), with Belo Horizonte appearing only in the 26th position. The other municipalities in the table are in the Southeast region (Duque de Caxias – RJ, Araporã – MG, Porto Real – RJ, Betim – MG, São Gonçalo do Rio Below – MG, Osasco – SP, Itatiaiuçu – MG and São José da Barra – MG), with the exception of Cairu – BA located in the Northeast. The variables analyzed were per capita and deflated. Overall, it is necessary to individually analyze each one of the municipalities.

In addition to this individual analysis, we clustered municipalities by state and by region to enhance the analysis of the flypaper effect:

Table 5: Municipal Flypaper Index by Region and State

Region	Flypaper Index	State	Flypaper Index
North	0.16	Acre	0.17
		Amapá	0.01
		Amazonas	0.15
		Pará	0.07
		Rondônia	0.17
		Roraima	0.10
		Tocantins	0.15
Northeast	0.00	Alagoas	0.12
		Bahia	0.13
		Ceará	0.07
		Maranhão	0.02
		Paraíba	0.02
		Pernambuco	0.08
		Piauí	0.06
		Rio Grande do Norte	0.13
Central-West	0.66	Sergipe	0.16
		Distrito Federal	0.00
		Goiás	0.14
		Mato Grosso	0.38
Southeast	1.00	Mato Grosso do Sul	0.34
		Espírito Santo	0.22
		Minas Gerais	0.27
		Rio de Janeiro	1.00
South	0.61	São Paulo	0.34
		Paraná	0.20
		Santa Catarina	0.25
			0.26

Source: authors.

Clustering the municipalities by state and region enable to certify the cluster of municipalities in the Southeast region are the municipalities with the greatest flypaper effect. This result is perfectly consistent with Figure 4, which shows dense dark spots in the southeast region. It is noteworthy that the analysis presented here is not of regions or states, but of municipalities, which can be grouped by regions or by state.

One reason that can justify or intensify the occurrence of the flypaper effect in Brazilian municipalities is the way in which the FPM coefficients are calculated. The income per capita predicted in equation 7 is a measure at the state level, not at the municipality level, mainly because this data is not timely available at the municipal level (3-year interval, as explained in the topic 3.6). Therefore, all municipalities in a given state are considered to have the same income per capita, and in reality, there are municipalities with different realities within the same state.

Although we confirmed evidence of the flypaper effect in Brazil, as observed in the results, its verification is not unanimous (Appendix 2). Consequently, it is important to deepen the study of the phenomenon in order to improve intergovernmental transfers and reduce social and regional inequalities, one of the fundamental objectives established in the Federal Constitution of 1988.

As presented by Ferreira, Serrano and Revelli (2019b), the calculation of the FPM is directly proportional to the population and inversely proportional to income per capita. In addition, one of the FPM objectives is reducing regional inequalities. Several studies under this theme identified several troubles into the FPM formula (FERREIRA; SERRANO; SOUZA NETO, 2019; MENDES, 2011; ROCHA, 2011).

Furthermore, the first observation that the time series allowed us to verify in this research was the relationship between transfers and income. According to the survey data, there is evidence that these assumptions (directly proportional to population and inversely proportional to income per capita) are not actually met. Therefore, the constitutional function of the FPM to reduce regional inequalities is probably not achieving the objective in some municipalities.

5 Conclusions

The research about flypaper effect shows the empirical anomaly that intergovernmental grants tend to be transformed by recipient authorities into public expenditures at a considerably higher rate than local private resources. The marginal cost of public funds (MCF) is one of the reasons flypaper effect exists, as many authors found relation between them. Dahlby and Ferede (2016), for example, show that the stimulating effect of grants on public spending increases with the MCF.

The objective of this research is to detect the existence and investigate the causes of the flypaper effect in the Brazilian states, by two proxies of MCF. The first is an autonomous index used as a proxy of the marginal cost of public funds (MCF), because it represents how much the municipality can survive by itself, representing the municipality's independency to federal grants. Second, the MCF was calculated by the derivation of Proper Tax Revenue to the Total Revenues.

Panel data evidence from 27 Brazilian states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018 indicates the existence of a large flypaper effect, with an estimated impact of grants on public expenditures. The results show that the stimulative effect of grants on public spending increases with the MCF in both proxies, but it was stronger in the autonomous index proxy, in convergence to results of Dahlby and Ferde (2016) to Canadian provincial data.

By an extensive and long database, it was found that the flypaper effect is present in both states and municipalities, regardless of the form of analysis, whether pooled or panel data. Municipalities with more than 50,000 inhabitants had a greater flypaper effect occurrence when compared to smaller municipalities. The flypaper index highlighted the group of municipalities in the Southeast region with the greatest flypaper effect, followed by Center-west and South regions. At the same time, there is evidence that the constitutional function of the FPM to reduce regional inequalities is not being achieved in some municipalities.

According to the survey data, there is evidence that these assumptions (directly proportional to population and inversely proportional to income per capita) are not actually met. The detailed analysis of the flypaper index can deepen the analysis of the municipalities. Future studies can test other proxies of MCF or other relations related to the flypaper effect and fiscal illusion. There are many ways to estimate the MCF, which highlight the need of studying the actual meaning and faithful of them. As there are many ways and also many models to consider MCF as a reason to the flypaper effect, other variables need to be considered, as population, social-economic characteristics, geographical considerations, as functions of the local governments to the community and to the whole country.

It is suggested to consider the flypaper index created in this research in other databases and statistical analyzes to improve the understanding of the phenomenon in Brazilian states and municipalities. Research in these areas can help to improve the way Brazilian transfers are structured, especially regarding to the metrics used in the distribution formula.

Political aspects can also be considered, especially in Brazil, with a large number of political representatives and a complex electoral system, as the vote count is based not only on the number of votes a candidate received, but also the votes for their party. Moreover, the grants from the federal level to state level are also complex as they consider many kinds of tax, as explained by Ferreira, Serrano and Revelli (2019b). With due consideration of these aspects, future researchers can deep this analysis in the context of the flypaper effect.

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Appendixes

Appendixes 1: IGP-DI Index

year	State Data	Municipality Data	
	Deflation Index	IGP_DI	Multiplicator
1985	3,417,402,846.02	-	-
1986	1,194,970,774.62	-	-
1987	409,207,452.50	-	-
1988	62,191,009.50	-	-
1989	3,964,141.28	-	-
1990	157,532.03	-	-
1991	36,403.64	-	-
1992	3,892.72	-	-
1993	162.96	-	-
1994	7.23	-	-
1995	3.63	-	-
1996	3.06	-	-
1997	2.65	-	-
1998	2.43	-	-
1999	2.28	-	-
2000	2.14	193.97	17.056
2001	2.03	214.14	15.450
2002	1.85	270.69	12.222
2003	1.56	291.46	11.351
2004	1.48	326.83	10.122
2005	1.35	330.84	1
2006	1.37	343.38	0.9635
2007	1.26	370.49	0.8930
2008	1.09	404.19	0.8185
2009	1.03	398.41	0.8304
2010	1.00	443.43	0.7461
2011	-	465.59	0.7106
2012	-	503.28	0.6574
2013	-	531.06	0.6230
2014	-	551.15	0.6003
2015	-	610.13	0.5422
2016	-	653.95	0.5059
2017	-	651.21	0.5080
2018	-	697.45	0.4743

Source: authors.

Appendix 2: Flypaper Effect researches in Brazil

n	Autor	Sample	Methodology	Dependent Variable	Independent Variable	FE*?
1	Cossio (1998)	26 Brazilian states and capitals in years 1970, 1975, 1980, 1985 and 1990.	Concluded that increasing intergovernmental transfers or reducing the weight of tax revenues provokes the expansion of public expenditures and the reduction of the fiscal effort of tax collection.	Potential States tax income	National Tax charge; National income; State GDP; National GDP.	No
2	Cossio and Carvalho (2001)	3,500 municipalities in 1996	Monte Carlo – Markov Chain with cross-section data.	Expenditures per capita	Expenditure with neighboring municipalities; Total per capita income; Proportion of transfers in total income; Urbanization index; Population density; Other transfers	Yes
3	Cossio (2002)	4,300 municipalities in 1991	It was analyzed the use of intergovernmental transfers as a financing mechanism for lower levels of government and identified the presence of the flypaper effect in the finances of Brazilian municipalities and their regional differences.	Municipality Total Expenditure	Price of public goods (or tax price); Total income of the median voter; Intergovernmental Constitutional Transfers; Participation of income from intergovernmental transfers on the total income of the median voter; Population; Demographic density; Degree of urbanization; Proportion of population under 14; Proportion of population over 65; Proportion of population that is illiterate; Proportion of black population.	Yes
4	Mendes (2002)	4,974 municipalities in 1996	It was identified: 1) the transfers are more subject to the capture than the tax revenue; 2) the elasticity of the capture in relation to transfers based on the derivation principle (ICMS) is less than in relation to transfers based on distribution formulas (FPM); conclusions consistent with the theoretical fiscal illusion and bargaining power. The capture is also higher in the poorest municipalities and those most benefited by the sharing of transfers.	Municipalities' legislative expenditure; and Current Expenditures	Tax Revenue; ICMS transfers; FPM transfers; Dummy of municipalities that received royalties; Living Conditions Index (LCI); Population; Number of councilmen; GDP; Current Expenditure; State Dummy; Region Dummy;	Yes

5	Guedes and Gasparini (2007)	26 Brazilian states agrouped by their municipalities from 1998 to 2001	It was verified the presence of fiscal illusion and flypaper effect, although the main objective of the study was the relation between the size of the government with fiscal decentralization. In addition, it was found a positive relation of the participation of the transfers in the total revenues of the municipality with the size of the government (vertical imbalance).	Government Size	Self-financing capacity; Expenditure's decentralization; Vertical imbalance; Transfers per capita; Urbanization; Public debt; Schools; Teachers per student; Garbage collection rate; Unemployment rate; Water supply.	Yes
6	Macedo and Corbari (2009)	111 municipalities with more than 100 thousand inhabitants from 1998 to 2006	Intergovernmental transfers influence negatively the fiscal performance of the beneficiary municipalities, as a result of the low fiscal effort to generate own revenues and/or by the current public spending expansion of the received entities.	Municipal debt	Debt lag; Capital structure; Liquidity; Dependency Degree; Staff Expenditures; Investment expenditures.	No
7	Nascimento (2010)	5,119 municipalities in 2007	OLS and 2SLS methods with cross-section data.	Demand for municipal expenditure; and Tax collection per capita	Tax collection per capita; Transfers; Income; Demographic density; Proportion of votes received in the 2004 election; Dummy mayor, right, left, and equal governor.	Yes
8	Mattos, Rocha and Arvate (2011)	3,335 municipalities (OLS), 3,242 municipalities (OLS), 3005 municipalities (linear model) and 2996 municipalities (log model) in 2004.	Concluded that unconditional grants affect negatively the efficiency in tax collection as opposed to consumer's income, leading to a reinterpretation of the flypaper effect. Local governments in Brazil should seek additional revenues in their own resources. This does not mean though to implement some new taxes, but to exploit more efficiently the existing tax base.	EffScore; Tax Revenue; Ratio Between Formal and Informal Workers-Tax Base	Transfers; Income; Controls.	Yes
9	Linhares et al. (2012)	Panel data of Brazilian municipalities from 1995 to 2006	Vector autoregressive models (VAR) with panel data composed by information on own revenue, current expenditure and current transfers tested by Granger causality.	-	Own revenues; Current expenditures; Current transfers.	Yes

10	Schettini (2012)	VAR-panel of 5,544 municipalities in 2010.	The work estimates a VAR-panel using data and a sequence of hypotheses investigated through the statistics of the overidentification test.	-	Total expenditures; Tax revenues; Current transfers.	Yes
11	Cardoso, Nascimento and Paixão (2012)	Panel data of 27 Brazilian states from 2000 to 2008	It was verified that the conditional and unconditional grants present expansive effect on the Brazilian states public expenditures and the transfers analyzed did not present an expansive effect and neither a flypaper effect.	Expenditure	Conditional transfers; Unconditional transfers; GDP; Tax Revenue; Population; Population ² ; Dummy surplus/ deficit.	No
12	Severo Filho (2012)	Ceará state municipalities in 2000	A threshold model that, through groups, with samples of three sets of municipalities, for each of the two variables used as threshold: wages and political strength. Almost all municipalities of Ceará state the flypaper effect exists and results from distortions of intergovernmental transfers.	Total budget expenditure per capita	Price of the public good or tax price; Total income of the median voter; Income from intergovernmental transfers over the total income of the median voter; Illiteracy; Demographic density; Population above 65 years; Life expectancy of the inhabitants; Distance from the capital; Threshold; Number of coalition city councilors and total number of city council members; Percentage families that earn up to 2 minimum wages.	Yes
13	Costa (2013)	5,293 municipalities from 1999 to 2009	It was used Auto Regressive Vectors (PVAR) and quantile equations for panel data and verified a negative relation between transfers and fiscal effort of the Brazilian municipalities was verified, but not evidences of flypaper effect.	Fiscal effort; and Total expenditure	Population; Transfers; GDP; Tax Collection.	No
14	Sakurai (2013)	4,846 municipalities from 1989 to 2005	It was found that government transfers cause an asymmetric impact on local public expenditure and municipal public spending is more sensitive to increases in transfers than increases in local income.	Budget expenditure; Current expenditure; Investment expenditure; Social expenditure;	Total income; Government transfers; Dummy revenue fall; Proportion of young people; Proportion of the elderly; Rates of urbanization; Total population.	Yes

15	Parmagnani and Rocha (2013)	5,565 municipalities from 2002 to 2008	It was initially estimated a panel model with fixed effects, using linear and logarithmic specification. The regressions were estimated using robust inference, being controlled by municipalities clusters of the same microregion. It was identified a tendency of flypaper effect increasing and consequent fungibility effect decreasing, as higher is the health expenditure level in the municipalities for all the linear models of quantile regressions employed, indicating that the results are robust.	Health expenditures	GDP; PAB Transfers; Other transfers; FPM; Royalties; Other current transfers; Population; Proportion of young people; Proportion of elderly; Proportion of women; Families served by the program; Houses with water; Houses with garbage collection; Houses with sewage; Houses with water at home; Houses with electricity; Dummies alignments governor and mayor.	Yes
16	Gonçalves (2013)	4,077 municipalities from 2000 to 2009	It was analyzed the effects that fiscal transfers on the Brazilian municipalities expenditures.	Total expenditure; Current expenditure; Investment expenditure.	GDP; Conditional Transfers; Unconditional Transfers	Yes
17	Litschig and Morrison (2013)	391 municipalities from 1982 to 1988	Extra transfers in Brazil increased local government spending per capita by about 20 percent over a 4 year period with no evidence of crowding out own revenue or other revenue sources. Test flypaper effect was not the objective of the research, but the results has shown evidences of it.	Total public spending per capita	County income per capita; average years of schooling for individuals 25 years and older; poverty headcount ratio; illiterate percentage of people over 14 years old; infant mortality, enrollment of 7–14-year-olds; and percent of population living in urban areas.	Yes
18	Correia et al. (2014)	184 municipalities of Ceará state from 1999 to 2009	It was analyzed whether the behavior of public expenditure in the municipalities of Ceará state coincurs with the practice defined in the literature as a flypaper effect.	Total expenditure	Inhabitants; Current Transfers; GDP; Taxes own collection	No
19	Costa and Castelar (2015)	5,293 municipalities from 1999 to 2009	Panel with tax collection variables, GDP, population, current transfers and expenditures was used to verify the flypaper effect. The results highlight that conditions do not exist to confirm the practice of the flypaper effect by the municipal public administration in Brazil.	Total expenditure	Tax collection; GDP; Population; Transfers.	No

20	Araújo and Siqueira (2016)	5,249 municipalities in 2010	The demand function for local public goods was estimated based on the model of the median voter. Inserting variables that capture the fiscal illusion, it was found that the expansion of local public spending in Brazil is partly a consequence of the fiscal illusion clearly manifested in the flypaper effect and in the absence of simplicity of the local tax system.	Current expenditure	Medium income; Tax share; Population; Transfers per capita; Fiscal simplicity; Child mortality; Ratio of dependency; Aging rate; School attendance rate; Gini Index; IDHM – education; Dummy regions.	Yes
21	Vegh and Vuletin (2016)	26 Brazilian states from 1985 to 2005 and also 23 Argentinian provinces from 1963 to 2006	Tested and found a positive association between the size of the flypaper effect and the level of the tax rate; and the lower (higher) the elasticity of substitution between private and public spending, the higher (lower) the flypaper effect. It is more efficient, from the point of view of the local fiscal authority, to spend more out of intergovernmental transfers (which is distortion-free money) than from private income (which can only be spent after securing it through distortionary taxation).	Government spending	Output; Fiscal transfers; Socio-economic/geographical controls.	Yes
22	Diniz, Lima and Martins (2017)	208 Paraíba state's municipalities from 2009 to 2011	Building of a municipal efficiency score and subsequent application of the Generalized Least Squares (OLS) to measure the effects of the flypaper effect.	Municipality efficiency score	Rate of own revenues directed to basic education in relation to total expenditures of basic education; Dummy variable represented by the losses and gains in the division of the FUNDEB resources of the municipality.	Yes
23	Gadelha et al. (2017)	State panel data from 2000 to 2013 and municipality panel data from 2002 to 2013	By Granger's bi-causality relationship between transfers and public expenditures, the author corroborated the existence of the flypaper effect. A time series greater than 10 years was runned, which justified the use of the dynamic model by GMM System.	Net Consolidated Debt	Transfers; Tax Revenue; Expenditures; GDP; Population; Demographic density; Gini index; Houses with water; Houses with wall; Houses with energy; Houses with garbage collected; Dummy crisis 2008.	Yes

24	Pansani (2018)	26 Brazilian states from 2004 to 2015	With the use of a fixed-regression model with panel data and the use of robust errors, evidence is found of the Flypaper effect and partly of the illusion caused by the complexity of revenue.	Public Expenditure per capita	Median Income; Tax share; Population; Intergovernmental transfers per capita; Fiscal Simplicity; Herfindahl-Hirschman Index; Visibility Index; Infant Mortality; Dependency Ratio; Aging rate; School attendance fee; Gini Index.	Yes
25	Mattos, Cardim and Politi (2018)	5,565 municipalities in Brazil from year 2006 to 2012	Empirical evidence on price-effect caused by lump sum grants for local governments in Brazil between 2006 to 2010. An increase in R\$ 1.00 in per capita unconditional transfers reduces the local price effect (MCF) around 0.07%, but this result is not consistently estimated across all subsamples.	Marginal Cost of Fund	Total FPM transfers revenues; Total service tax revenue; Total payroll costs for firms in service sector; Human Development Index; Number of firms in service sector; Natural logarithm of employees in the service sector; State grant from VAT (ICMS) normalized; Average effective tax rate (ISS revenue/ payroll costs); Marginal costs of public fund; Binary variable (=1) if municipality is in metropolitan area; Natural logarithm of local population; Populational density; Individuals from 5 to 15 years old; Individuals above 60 years old.	Yes
26	Ferreira, Serrano and Revelli (2019b)	476 Brazilian municipalities from 2005 to 2012	The flypaper effect exists in Brazilian municipalities and is intensified by the alignment of the representatives in the same way of theoretical literature. Moreover, evidences of higher flypaper effect were found in municipalities with low tax autonomy.	Current expenditure	Grants; Gross Domestic Product; percentages of woman, youth, and elderly people above 60 years; populational density; the employment and income Municipal Development Firjan Index (IFDM).	Yes
27	Pansani, Serrano and Ferreira (2020)	26 Brazilian states from 2004 to 2015	With the use of a fixed-regression model with panel data and the use of robust errors, evidence is found of the Flypaper effect and partly of the illusion caused by the complexity of revenue.	Public Expenditure per capita	Median Income; Tax share; Population; Intergovernmental transfers per capita; Fiscal Simplicity; Herfindahl-Hirschman Index; Visibility Index; Infant Mortality; Dependency Ratio; Aging rate; School attendance fee; Gini Index.	Yes

28	Salomão Neto (2020)	Uberlândia municipality from 2005 to 2019	The evidence points to a series of structural problems, such as the excessive dependence on transferred revenues causing tax illusion, the increase in public spending showing the flypaper effect, in addition to the capture of public resources by interest groups organized in the municipality.	-	-		Yes
29	Castro and Mattos (2021)	4,200 municipalities with up 30,000 inhabitants from 2002 to 2012	The analysis of FPM effects on budget expenditure, by the function or area of administration, shows increases in education and urbanization expenditures, indicating that public goods in these functions are complementary between bordering jurisdictions. The flypaper effect in local economies can be partially explained by bordering municipalities' grants-roughly 20 percent.	Jurisdiction spending and FPM		Population, Budget spending, Health care, Education, Urbanism, Sanitation, Housing, Budget revenue, Tax revenue.	Yes

Source: author. *FE: Confirmed evidences of Flypaper effect.

Appendix 3: Datasus Query (in portuguese)

Dados do Pedido

<p>Protocolo 25820007125201875</p>
<p>Data de Abertura 08/11/2018 11:47 Orgão Superior Destinatário MS – Ministério da Saúde Orgão Vinculado Destinatário Prazo de Atendimento 10/12/2018 Situação Respondido Status da Situação Acesso Concedido (Resposta solicitada inserida no e-SIC) Forma de Recebimento da Resposta Pelo sistema (com avisos por email) Resumo Problemas base Datasus Detalhamento</p>
<p>Prezados, Ao acessar dados do datasus pelo link a seguir e colocando os parâmetros Linha - Município, Coluna - Não ativa, Conteúdo - Tip.Casa Tijolo, observei 2 problemas: 1- alguns municípios (330227 - Japeri - RJ, por exemplo), não aparecem dados em alguns anos (Japeri não aparece nos anos de 2005, 2006 e 2007, por exemplo). 2- O mesmo caso do município Japeri - RJ, em 2002 ele tinha 4974 Tip.Casa Tijolo, em 2003 ele tinha 4491, em 2004 ele tinha 951, os 3 anos seguintes ele não aparece, em 2008 ele reaparece com 3330 Tip.Casa Tijolo e em 2009 passa para 5281. Como pode ter diminuído o número de casas com tijolo? Há alguma explicação para isso? Observei que acontece com outros municípios também e que vários não estão na base de dados de alguns anos, que é o problema da minha primeira questão apresentada. Segue o link que extrai as informações. http://tabnet.datasus.gov.br/cgi/deftohtm.exe?siab/cnv/SIABCbr.def</p>

Dados da Resposta

<p>Data de Resposta 10/12/2018 12:34 Tipo de Resposta Acesso Concedido Classificação do Tipo de Resposta Resposta solicitada inserida no e-SIC</p>
<p>Resposta Prezado senhor Em atenção à vossa demanda, junto ao serviço de informação ao cidadão SIC/MS, na qual informa inexistência e divergências de dados em pesquisas realizadas no link: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?Siab/cnv/siabcbr.def, passamos os seguintes esclarecimentos: Os dados disseminados pelo tabnet na consulta em referência são oriundos de um antigo Sistema de Atenção Básica - SIAB, o qual foi substituído pelo E-SUSAB/SISAB. Desde de dezembro de 2016, as informações ali contidas não são mais alteradas no tabnet, apenas refletem o que está gravado nas bases que o tabulador consulta. Procedemos diligência de consulta às bases do SIAB, que são tabuladas pelo tabnet e constatamos que, procedem as reclamações, isto é, não existem os dados de Japeri e há divergências de informações conforme os filtros e seleções utilizados. Em relação ao primeiro questionamento, constatou-se por meio do histórico do Departamento de Atenção Básica - DAB que, nos anos de 2005, 2006 e 2007, o município de Japeri/Rj não possuía implantado Equipe de Saúde da Família (ESF) e agentes comunitários de saúde (ACS), não sendo possível envio de produção das equipes. Por esse motivo, não aparecem os dados do município nos referidos anos. O segundo questionamento mostra redução dos dados nos anos entre 2002 e 2004 e aumento do valor em 2008 para a variável tipo casa tijolo. Esta variável não era de preenchimento obrigatório no sistema. Na época, era orientada a atualização dos dados ao final de cada ano. O preenchimento obrigatório da variável somente ocorreu a partir do ano de 2008. É importante ressaltar que os dados são alimentados diretamente pelos municípios, dessa forma, podendo ocorrer também erro na informação e erro na digitação. Para que seja verificado a acurácia do dado, o demandante deverá entrar em contato com o município em questão e verificar o registro da informação na ficha a (ficha para cadastramento das famílias) e o dado digitado no sistema local. Responsável pela Resposta Departamento de Atenção Básica e Departamento de Informática do SUS Destinatário do Recurso de Primeira Instância: Secretário de Atenção à Saúde e Diretor Executivo</p>

Source: author.

Appendix 4: Descriptive Statistics

Variables	Without Federal District				With Federal District				Municipalities			
	Mean	Avg	Std.Dv	Obs	Mean	Avg	Std.Dv	Obs	Mean	Avg	Std.Dv	Obs
Exp	1.491	1.593	.802	698	1.536	1.752	1.213	672	1087.24	964.613	1159.66	105,783
GDP	9.855	11.560	5.490	702	10.150	12.939	8.869	672	9001.463	6457.19	10415.62	105,830
Grant	0.269	0.496	0.651	698	0.260	0.483	0.643	672	419.541	323.118	315.446	105,830
MCF	0.461	0.447	0.209	697	0.458	0.445	0.210	671				
MCF*Grant	0.117	0.144	0.126	697	0.108	0.141	0.125	671				
MCF_d	-25.640	-2.86e+09	9.25e+09	699	22.864	-2.81e+09	9.09e+09	673				
MCF_d *Grant	-1.11e+09	-4.90e+08	2.27e+09	696	-1.06e+09	-4.58e+08	2.22e+09	670				
Controls												
Gini	0.556	0.552	0.065	701	0.559	0.554	0.065	675				
Theil	0.636	0.647	0.150	701	0.643	0.649	0.148	675				
Citizen's income	618.40	648.64	260.94	701	630.45	679.16	306.209	675				
Water	0.802	0.753	0.204	701	0.815	0.761	0.204	675				
Illiteracy	0.133	0.165	0.104	702	0.130	0.161	0.104	676				

Source: authors. All monetary variables are per capita and deflated to 2010 (States) and to 2005 (Municipalities) by the General Market Price Index – Internal Availability (IGP-DI).