University of Brasília (UnB)
Faculty of Economics, Administration, Accounting and Public Policy Management (FACE)
Department of Accountancy and Actuarial Science (CCA)
Post Graduate Program in Accounting (PPGCont)

LUCAS OLIVEIRA GOMES FERREIRA

CONSTITUTIONAL TAX TRANSFERS IN BRAZILIAN MUNICIPALITIES: the fiscal illusion and the flypaper effect

Brasília - DF
2021

Professor Dr. Márcia Abrahão Moura
Rector of the University of Brasília

Professor Dr. Enrique Huelva Unternbäumen
Vice-Rector of the University of Brasília

Professor Dr. Lúcio Remuzat Rennó Junior
Dean of Research and Graduate Studies

Professor Dr. José Márcio Carvalho
Director of the Faculty of Economics, Administration, Accounting and Public Policy Management

Professor Dr. Sérgio Ricardo Miranda Nazaré
Head of the Department of Accountancy and Actuarial Sciences

Professor Dr. Jorge Katsumi Niyama
Coordinator of the Post Graduate Program in Accounting

LUCAS OLIVEIRA GOMES FERREIRA

CONSTITUTIONAL TAX TRANSFERS IN BRAZILIAN MUNICIPALITIES: the fiscal illusion and the flypaper effect

Thesis submitted to the Post Graduate Program in Accounting, Department of Accountancy and Actuarial Sciences, Faculty of Economics, Administration and Accounting, University of Brasília.

Approved on August 6, 2021.

EXAMINATION BOARD

_____

President: Professor Dr. André Luiz Marques Serrano (Advisor)
University of Brasília - UnB

_____

Professor Dr. Federico Revelli (Co-Advisor)
University of Turim - Unito

_____

Professor Dr. Ducineli Régis Botelho
University of Brasília - UnB
Internal Member

_____

Professor Dr. Sérgio Naruhiko Sakurai
University of São Paulo - USP
External Member

_____

Professor Dr. Claudia Ferreira da Cruz
Federal University of Rio de Janeiro - UFRJ
External Member

_____

Professor Dr. Clóvis Neumann
University of Brasília - UnB
Internal Member

To my wife Júlia, to my son Heitor, to my parents Benjamim and Fátima, and to my sister Paula.

ACKNOWLEDGEMENTS

First of all, I would like to thank God for all the blessings and protection I've received throughout my journey.

To my advisor Prof. Dr. André Luiz Marques Serrano, for all the support and partnership, who became more than an advisor, being a father figure, friend and partner during these 4,5 years of research.

To my co-advisor Prof. Dr. Federico Revelli, for his hospitality and guidance during the sandwich doctorate in Turin, Italy, and to professor Roberto Zotti and the administrative staff Rossella Cacciatore and Anselmo Farina, for all their attention in Turin.

To the thesis qualification board Prof. Dr. Ducineli Régis Botelho and Prof. Dr. Sérgio Naruhiko Sakurai, for their insightful feedback.

To the Postgraduate Program in Accounting Sciences (PPGCONT) and to the University of Brasília (UnB), for our history together from birth thanks to my mother, Fátima, who has worked all her life in the University.

To all PPGCONT professors, for all the teachings during the courses and to the secretaries Sara and Inez, for their kindness and attention.

To my doctoral colleagues, especially Joaquim, with whom I discussed and debated so many topics during the journey.

To colleagues from the Federal Court of Accounts (TCU), especially Luiza Jacques, for all the technological help.

To my wife Julia, who always supported me during the research from the sandwich period in Turin to the end of the research, and who gave me the greatest gift: Heitor.

To my son Heitor, for serving as an inspiration to do whatever you want in your life, always seeking God's love, happiness, study, with bright eyes and integrity.

To my parents Benjamim and Fátima, who spared no efforts for our happiness and professional fulfillment, and who have always been an example for us.

To my sister Paula, with whom I shared so many moments, travels and laughs together.

To all my friends with whom I have shared so many special moments.

Finally, I gratefully acknowledge financial support from the Coordination for the Improvement of Higher Education Personnel (Capes).

LUCAS OLIVEIRA GOMES FERREIRA

CONSTITUTIONAL TAX TRANSFERS IN BRAZILIAN MUNICIPALITIES: the fiscal illusion and the flypaper effect

Thesis submitted to the Post Graduate Program in Accounting, Department of Accountancy and Actuarial Sciences, Faculty of Economics, Administration and Accounting, University of Brasília.

Advisor: Professor Dr. André Luiz Marques Serrano.
Co-advisor: Professor Dr. Federico Revelli.
Concentration Area: Accounting Measurement
Research Line: Accounting impacts on the Public Sector, Organizations and Society

Brasília – DF

2021

Ferreira, Lucas Oliveira Gomes.

CONSTITUTIONAL TAX TRANSFERS IN BRAZILIAN MUNICIPALITIES: the fiscal illusion and the flypaper effect / Lucas Oliveira Gomes Ferreira – Brasília, DF, 2021.

96 p.

Advisor: Professor Dr. André Luiz Marques Serrano.
Co-Advisor: Professor Dr. Federico Revelli.

Thesis (Doctor Degree) – University of Brasília (UnB). Faculty of Economics, Administration, Accounting and Public Policy Management – FACE. Post Graduate Program in Accounting (PPGCont)

1. Fiscal federalism. 2. Brazil. 3. Marginal cost of public fund. 4. Grants. 5. Flypaper effect.

SUMMARY

ABSTRACT

The present study analyzed the fiscal illusion and the flypaper effect phenomena in the scope of Brazilian states and municipalities. According to the theory of fiscal illusion, the government manages to hide from the median voter the real value received by transfers, leading the electorate to underestimate the real production cost of public goods. The flypaper effect phenomenon is one of the types of fiscal illusion and it is an empirical anomaly that receiving authorities convert intergovernmental transfers into public expenditures at a significantly higher rate than the increase of local private income. Therefore, three distinct and complementary studies aligned with the central subject were carried out. The first verified the occurrence of the flypaper effect in 476 Brazilian municipalities from 2005 to 2012, considering new variables as instruments of grants. Political alignment, party alignment, and the coalition of the mayor with the federal president and of the state governor were considered instruments. A municipal tax autonomy index was considered as a control variable, representing the percentage of local taxes in the municipal total revenues. The results lead to the conclusion that the flypaper effect exists in Brazilian municipalities and is intensified by the alignment of the representatives, as presented in theoretical (Hamilton, 1983; Hines & Thaler, 1995; Inman, 2008) and past empirical studies in Brazil. The second analyzed 5,568 Brazilian municipalities from 2006 to 2013 and found substantial evidence of the flypaper effect. Using the elasticity of the tax base regarding the municipalities' tax rates as a proxy of the marginal cost of public funds (MCF), we found evidence supporting the Dahlby (2011) hypothesis of a role of the distortionary nature of local taxation in the emergence of the flypaper effect. Finally, the third analyzed 27 Brazilian states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018 and verified the existence of the phenomenon. Concerning state data, an autonomous index was used as a proxy of the MCF, because it represents how much the municipality can survive by itself, representing the municipalities' independence from federal grants. Afterward, the MCF was calculated by the derivation of Proper Tax Revenue to the Total Revenues. 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 Ferede (2016) to Canadian provincial data. Concerning municipality data, a flypaper time series index was created to verify the municipalities most impacted by this phenomenon. The flypaper effect was evident in Brazilian states and municipalities, with the Southeast, Central-west, and South regions presenting the highest rates of flypaper effect.

Keywords: Fiscal federalism. Brazil. Marginal cost of public fund. Grants. Flypaper effect.

RESUMO

O presente estudo analisou os fenômenos ilusão fiscal e efeito *flypaper* no âmbito dos entes estaduais e municipais brasileiros. De acordo com a teoria da ilusão fiscal, o governante consegue esconder do eleitor mediano o real valor recebido em transferências, induzindo o eleitorado a subestimar o real custo de produção de bens públicos. O fenômeno do efeito *flypaper* é um dos tipos de ilusão fiscal e consiste em anomalia empírica em que as transferências intergovernamentais são transformadas pelas autoridades receptoras em gastos públicos a uma taxa significativamente mais alta do que com o aumento da renda privada local. Nesse contexto, realizaram-se três estudos distintos e complementares alinhados ao tema central. O primeiro objetivou verificar o efeito *flypaper* em 476 municípios brasileiros com mais de 50 mil habitantes de 2005 a 2012, considerando novas variáveis como instrumentos às transferências. Alinhamento político, alinhamento partidário e de coligações do prefeito com o presidente da república e com o governador estadual foram considerados como instrumentos às transferências. Índice de autonomia tributária municipal foi considerado como variável de controle, que representa a porcentagem dos tributos municipais na arrecadação municipal total. Os resultados permitem concluir que o fenômeno existe nos municípios brasileiros e é intensificado pelo alinhamento dos representantes na mesma linha da teoria da ilusão fiscal e da escolha pública e dos estudos empíricos no Brasil. O segundo analisou 5,568 municípios brasileiros de 2006 a 2013 e encontrou evidências substanciais de efeito *flypaper*. Utilizando a elasticidade da base tributária em relação às alíquotas dos municípios como *proxy* do custo marginal de financiamento público (MCF), as evidências encontradas suportam a hipótese de Dahlby (2011) do papel da natureza disforme da tributação local no surgimento do efeito *flypaper*. Por fim, o terceiro analisou 27 estados brasileiros de 1985 a 2010 e 5,568 municípios brasileiros de 2000 a 2018 e também verificou a existência do fenômeno. Quanto dados estaduais, um índice de autonomia tributária foi utilizado inicialmente como *proxy* do MCF, porque representa quanto o município pode sobreviver por si só e sua independência em relação às transferências federais. Em seguida, o MCF foi calculado pela derivação da receita tributária própria em relação à receita total. Os resultados mostram que o efeito estimulante das transferências sobre os gastos públicos aumenta com o MCF em ambas as *proxies*, com efeito mais forte no índice de autonomia, em convergência com os resultados de Dahlby e Ferede (2016) para dados provinciais canadenses. Quanto dados municipais, foi elaborado um índice de *flypaper* em série temporal para verificar os municípios mais impactados por esse fenômeno. Restou evidente o efeito *flypaper* em estados e municípios brasileiros, sendo as de maiores índices de efeito *flypaper* as regiões sudeste, centro-oeste e sul.

Palavras-chave: Federalismo Fiscal. Brasil. Custo marginal de financiamento público. Transferências. Efeito *flypaper*.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BSPN	National Public Sector Balance
CIDE	Contribution of Intervention in the Economic Domain on fuels
Finbra	Finance System
Firjan	Industry Federation of the State of Rio de Janeiro
FNAS	National Social Assistance Fund
FNDE	National Fund for Educational Development
FPE	State Participation Fund
FPM	Municipal Participation Fund
Fundef	Fund for the Maintenance and Development of the Fundamental Education and Valuing of Teaching
GDP	Gross Domestic Product
IBGE	Brazilian Institute of Geography and Statistics
ICMS	Tax on Circulation of Goods and Services
IE	Export Tax
IEG	Extraordinary War Tax
IGF	Great Fortunes Tax
IGP-DI	General Market Price Index – Internal Availability
IFDM	Firjan Municipal Development Index
II	Import Tax
INCC	National Construction Cost Index
IOF	Financial Transactions Tax
IPA	Broad Producer Price Index
IPC	Consumer Price Index
IPEA	Institute for Applied Economic Research
IPI	Federal Value-Added Tax or Excise Tax on Manufactured Goods
IPIEx	Federal Value-Added Tax or Excise Tax on Manufactured Goods (exportation)
IPTU	Real Estate Tax
IPVA	Motor Vehicle Tax
IR	Income Tax
ISS	Tax on Services
ITBI	Tax on transfers of urban real estate
ITCMD	Tax on inheritances and donations
ITR	Rural Property Tax
LM	Lagrange multiplier
MCF	Marginal cost of public funds
MDB	Brazilian Democratic Movement
Pasep	Public Servant Patrimony Formation Program
PNAD	National Household Sample Survey
PT	Worker's Party
PSL	Liberal Social Party
RES	Residuals taxes
Siafi	Integrated System of the Federal Government Financial Administration
Siconfi	Accounting and Tax Information System of the Brazilian Public Sector
SUS	Unified Health System
STN	National Treasury Secretariat
TCU	Federal Court of Accounts
TSE	Superior Electoral Court

1. INTRODUCTION

The state has the power to impose and collect taxes, which is explained and justified by taxation theory, considering there are general interests of the population, such as national defense and the maintenance of welfare institutions (Smith, 2003). Hence, taxation capacity is the ability to tax, which only exists because of the supremacy of the state, with no other entity or private person being allowed the execution of the same functions of the state. Thus, taxation is at the top of the entire chain.

Following the layers, there are three different forms of state organization: federation, confederation, or unitary state. Federalism is the method of dividing powers so that the general and regional governments are each, within a sphere, co-ordinate and independent (Wheare, 1946). On the other hand of political science, economists are concerned about the allocation of resources and the distribution of income within an economic system, which is why Oates (1972) defines federalism as a public sector with both centralized and decentralized levels of decision-making, in which choices made at each level concerning the provision of public services are determined largely by the demands of the residents of each jurisdiction.

The author also considers to be always more efficient (or at least just as efficient) for local governments to provide Pareto-efficient levels of output for their respective jurisdictions rather than having the central government provide any specified and uniform level of output across all jurisdictions if the costs of providing each level of output of good in each jurisdiction are the same for the central or the respective local government.

The basic characteristic of a federalist regime is the preference for a more decentralized government structure, capable of internalizing all economic externalities existing in the production of public goods and services. In Brazil, fiscal federalism represents the transfer of responsibilities from the Federal (central government) to the states and municipalities (local governments), both main responsibilities of collecting certain taxes and providing goods and services, according to Oates (1972), Ahmad, Hewitt and Ruggiero (1997), Hemming and Spahn (1997), and Gramlich (1993).

Thus, public goods should be provided by the level of government that is closest to the geographic area benefiting from them, as is the case of public lighting and pavement services that should be municipal (local government) responsibilities. Moreover, services with a national scope, such as defense, monetary stability, unemployment insurance, and international relations, should be left to the central government (Oates, 1972). According to Oates (2005), first-generation fiscal federalism theories established the government allocative function as the sphere of action that should be done by the subnational governments (municipalities), while the distribution and stabilization functions should be done by the central government.

Local governments may better reflect individual preferences, given that they are closer to the people (Gordon, 1983). An important virtue of decentralization is that it makes it easier to specify the demand for public goods from the final consumers or voters, revealing more precisely the preferences of a given community through voting, and allowing greater accountability to those who benefit from public goods. For Aghón (1993), decentralization promotes economic efficiency, a dominant view in the theory of public choice. Additionally, decentralization is more convenient to bring politicians and citizens closer together, allowing better information and better supervision by the electorate.

Olson's fiscal equivalence principle, which establishes the need for a link between fiscal responsibility and the balance between public spending and taxation at each level of government, complements this view (Affonso, 2003). Some authors oppose decentralization, such as Prud'homme (1995) and Tanzi (1995).

States around the world are structured by three types: federation, confederation, and unitary state. The federal state form is organized into subnational autonomous entities, characterized by their indissolubility, meaning they cannot secede from the federation. In the same manner, fiscal federalism means decentralization of attributions from the federal state to these subnational entities. They are given autonomy, as well as tax competence, to create and regulate certain types of tax, while the federal state holds sovereignty.

Mainly due to the gains in the scale of collection and inspection tax, the federal state usually centralizes the competence and collection of federal taxes. Meanwhile, subnational entities do not collect enough taxes to provide all goods and services to local communities. Therefore, the federal state transfers part of its tax revenue to subnational entities as compensation to supply goods and services to local entities.

Intergovernmental transfers produce consequences for both the federal state and subnational entities. The first of them is related to the theory of fiscal illusion, which establishes that the government manages to hide from the median voter the real value received by transfers, inducing the electorate to underestimate the real cost of production of public goods (Buchanan, 1967; Puviani, 1903). Through their ability to manipulate the fiscal structure, governors create illusions to the median voter (also called governed or taxpayers), who tend to believe that taxes are less onerous and that the benefits provided by the government are worth more than they do (Buchanan, 1967).

This attitude relieves some accountability from the policymakers, who act this way when they are not serving the interests of the general population, but those of a group of individuals, according to the theory of public choice (Buchanan & Tullock, 1962; Downs, 1957; Olson, 1965). By managing to "deceive" the median voter, the government can have more resources at its disposal, seeking to maximize its utility function (rather than the utility function of the median voter) with manipulations turning the transfers received public expenditure, and not leading to a reduction in tax collection (Nikanen, 1971).

The policymakers, representing the dominant class, design public tax and expenditure policies to minimize the resistance of the general population, using their power to promote their political projects. When the median voter is not aware of how much tax was paid or how many funds were transferred from the state, fiscal illusion happens. It is easy for the government to hide information from the taxpayer, who has no incentive to invest in obtaining information, as its vote does not have a significant impact on the results of public choices. Accordingly, the median voter rationally remains ill-informed (Buchanan & Wagner, 1977), resulting in an underestimation of the tax burden by voters, resulting in demand for government spending above the level that would be verified in the absence of fiscal illusion and excessive public spending.

The second consequence is another type of fiscal illusion, a phenomenon called the flypaper effect, which establishes that the receipt of unconditional and nonmatching grants (lump sum) increases local public expenditure proportionally greater than an equivalent increase in personal income (Hamilton, 1986; Hines & Thaler, 1995). This effect is based on empirical evidence regarding transfers from one government level to another tending to "remain" with the recipient, being used to provide services and not passed on to taxpayers through tax reductions (Ahmad & Craig, 1997). Consequently, transfers result in a higher level of public service delivered than would be if payment were made directly to individuals.

In Brazil, the decentralization process was consolidated with the Federal Constitution of 1988, which extended the powers and other characteristics of fiscal federalism to states and municipalities (subnational entities or local governments). The federal state (called Union in Brazil) centralizes taxes at the national collection level, transferring them to states and municipalities in the form of tax transfers or grants.

Although there is evidence of the flypaper effect in Brazil, its proof is not unanimous (Appendix 7). Furthermore, there is a gap in the known causes for this phenomenon. Without this knowledge, revising the tax distribution structure itself cannot reduce social and regional inequalities, one of the fundamental objectives established in the Federal Constitution.

1.1 Research Problem

The Brazilian federal government grants several unconditional and nonmatching transfers (lump sum) to the states and municipalities. The transfers to municipalities as established in the 1988 Federal Constitution are as follows: the Municipal Participation Fund (FPM), 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). Likewise, the transfers to the states are as follows: the State Participation Fund (FPE), the Financial Transactions Tax (IOF), the residuals taxes (RES), the Contribution of Intervention in the Economic Domain on fuels (CIDE), and the Federal Value-Added Tax or Excise Tax on Manufactured Goods destined to exportation (IPIEx).

Fiscal decentralization through transfers to subnational entities promotes economic efficiency based on the theory of public choice (Aghón, 1993; Gordon, 1983; Oates, 1972), improves social welfare (Oates, 1972; Tiebout, 1956), allows local governments to better manage resources based on the greater knowledge of their citizens' preferences (utilities) (Ahmad *et al.*, 1997; Gramlich, 1993; Hemming & Spahn, 1997; Oates, 1972), promotes better public decision-making (Oates, 1972) and allows for "checks and balances" between powers (Buchanan, 1995). However, some of their repercussions are not evident in Brazil, such as the impact on local taxation, local income, government programs, and voter satisfaction. This situation is intensified because these transfers are not linked to expenditures, as they are unconditional and nonmatching, which allows the receiving entity to spend them indiscriminately.

According to the economic theory (Wilde, 1971) and the median voter theory (Oates, 1988), the first consequence of transfers (lump sum) should be a reduction in the tax collection, as municipalities are already at the limit of tax expansion. Considering this context, the following research problem arises: what are the reasons for the flypaper effect in subnational entities in Brazil? Therefore, this research aims to verify the flypaper effect, as well as to understand the reasons that cause this phenomenon.

1.2 General and Specific Objectives

To answer the research problem, the general objective is to investigate the possibility of flypaper effect occurrence in subnational entities in Brazil, to identify the reasons causing this phenomenon. In consequence, to achieve the general objective, three surveys were developed with the following specific objectives:

i. To verify the flypaper effect of 476 Brazilian municipalities with more than 50 thousand inhabitants from 2005 to 2012. It considers as instruments of grants political alignment, party alignment, and coalition[1].
ii. To detect the existence and investigate the causes of the flypaper effect in 5,568 Brazilian municipalities from 2006 to 2013, using the elasticity of the tax base concerning the municipalities' tax rates as a proxy of the marginal cost of public funds (MCF)[2].

[1] Data available online: https://doi.org/10.6084/m9.figshare.12153483.v1
[2] Data available online: https://doi.org/10.6084/m9.figshare.12054138.v2

iii. To detect the existence and investigate the causes of the flypaper effect in 27 Brazilian states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018[3].

The studies address different perspectives of different Brazilian subnational entities (states and municipalities) based on international literature on the subject, to verify the flypaper effect and identify the reasons for this phenomenon. Therefore, this thesis is structured throughout this introductory chapter, followed by three chapters aligned with the central subject and composed of three distinct and complementary studies.

The first study, entitled "Effects of federal constitutional grants in Brazilian municipalities", was presented in the 2019 European Group for Public Administration XII Permanent Study Group Spring Workshop in Romania and published in the Review of Urban & Regional Development Studies (RURDS). A municipal tax autonomy index was also considered as a control variable, which represents the percentage of local taxes in the municipal total revenues.

The results show the flypaper effect exists in Brazilian municipalities, is intensified by the alignment of the representatives and there is evidence of a higher flypaper effect in municipalities with low tax autonomy. In these cases, money "sticks are where it hits" because municipalities do not have the possibility to expand taxes. Therefore, the theory that lump sum grants should represent a reduction in the tax collection of citizens is not applicable, as municipalities are already constrained and at the limit of tax expansion.

The second study, entitled "The marginal cost of public funds and the flypaper effect: evidence from Brazilian municipalities", is being analyzed by an international journal. Using tax base elasticity regarding the municipalities' tax rates as a proxy of the marginal cost of public funds (MCF), the study found evidence supporting the Dahlby (2011) hypothesis of the distortionary nature of local taxation in the emergence of the flypaper effect. The results point out that the tax structure and the assignment of revenue sources across levels of government can have significant consequences on local decision-making processes in fiscal matters, regarding the high sensitivity of local public spending to grants known as the flypaper effect, and that any proposal of fiscal decentralization reform should carefully consider the distortionary nature of the revenue sources to be assigned to local governments.

The third, entitled "The effects of grants and the marginal cost of public funds: Evidence from Brazilian states", is also under analysis in an international journal and it concluded the stimulative effect of grants on public spending increases with the MCF in both proxies: the autonomous index and the derivation of Proper Tax Revenue to the Total Revenues. However, the autonomous index proxy presented stronger evidence. Even with the consistency limitations of municipal granularity databases, the municipal analysis showed that the capitals are cities that actually benefitted from grants, with statistical significance in the flypaper effect test.

Each chapter has a theoretical foundation, a method used, results found, and conclusions. Then, the final considerations are presented, in which the answer to the research question is addressed. Finally, the bibliographical references are compiled.

1.3 Research Justification

Federalism is the state form of organization the federated entities have administrative, political, tax, and financial autonomy, joined together by the creation of a central government through a federative pact. In the case of Brazil, the Union (national entity) has sovereignty, while member states and municipalities (subnational entities) have merely autonomy. Federalism arose from the need to decentralize power, mainly in countries with large territorial extensions.

[3] Data available online: https://doi.org/10.6084/m9.figshare.14905689.v1

Some examples of federalism advantages are an efficient allocation of national resources (Inman & Rubinfeld, 1997), more efficient levels of public output (Ahmad *et al.*, 1997; Gramlich, 1993; Hemming & Spahn, 1997; Oates, 1972), local governments being closer to the people may better reflect individual preference (Gordon, 1983). However, there are some disadvantages, such as tax base competition and fiscal war (Gordon, 1983), as well as the central government's inability to create a transfer system in accordance with the normative theory (Inman & Rubinfeld, 1996, 1997).

The transfers are naturally included in the fiscal federalism scope, which is essential to reduce social and regional inequalities in Brazil and need to be distributed based on reasonable criteria. Currently, the distribution of the Brazilian transfers is essentially based on two aspects: population (directly proportional) and income *per capita* (inversely proportional). However, this methodology does not seem to contribute to the goal of reducing inequalities, because the Brazilian reality is increasingly showing worse indicators of inequalities.

Therefore, the research relevance is the verification of the flypaper effect and the reasons it exists in Brazilian subnational entities, being essential the criteria tax revenues are shared. The research opportunity is based on scientific research to develop the study's problem. The classical theory states that when resources are transferred between entities, recipients should reduce the incidence of local taxes balancing the consumption equation (Dollery & Worthington, 1996; Inman, 2008; Oates, 1988).

However, several empirical studies have verified the flypaper effect occurs, contrary to the economic theory, while 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 & Ferede, 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; Panao, 2020 – Philippines; Silva & Sumarto, 2015 – Indonesia; Vegh & Vuletin, 2016 – Argentina and Brazil), even in private sector firms (Aragón, 2013 – Peru; Choi, Laibson & Madrian, 2009 – US firms; Vallés-Giménez & Zárate-Marco, 2017 – Spain).

This context is also due to public choice theory, according to which states are governed by rulers solely and exclusively to serve their own needs (Buchanan & Tullock, 1962; Downs, 1957; Olson, 1965). Then, the fiscal illusion theory also supports the research, as the rulers choose procedures that blind taxpayer's perception (Buchanan, 1967).

In Brazil, evidence of the existence of the flypaper effect was found (Araújo & Siqueira, 2016; Castro & Mattos, 2021; Cossio, 2002; Cossio & Carvalho, 2001; Cruz & Silva, 2020; Diniz, Lima & Martins, 2017; Gadelha et al., 2017; Ferreira, Serrano & Revelli, 2019b, 2020; Freitas, Pereira, Lúcio & Gomes, 2019; Gonçalves, 2013; Guedes & Gasparini, 2007; Linhares et al., 2012; Litschig & Morrison, 2013; Mattos, Cardim & Politi, 2018; Mattos, Rocha & Arvate, 2011; Mendes, 2002; Nascimento, 2010; Pansani, 2018; Pansani, Serrano & Ferreira, 2020; Parmagnani & Rocha, 2013; Sakurai, 2013; Salomão Neto, 2020; Schettini , 2012, Severo Filho, 2012; Vegh & Vuletin, 2016). Some studies, however, did not verify the flypaper effect (Cardoso, Nascimento & Paixão, 2012; Correia, Diniz & Costa, 2014; Cossio, 1998; Costa, 2013; Costa & Castelar, 2015; Macedo & Corbari, 2009), but the majority of them pointed its existence.

Given these points, the phenomenon in Brazil and its reasons should be explored, as they can be essential for establishing the structure for sharing tax revenues between entities, helping Brazil to achieve the objective of reducing social and regional inequalities. Concerning

the data the papers applied, it was not possible to use the same number of municipalities and the same years in all the studies due to the availability of data, mainly the control variables. This is the reason why the first paper (Chapter 2) is about 476 Brazilian municipalities from 2005 to 2012, while the second (Chapter 3) is about 5,568 municipalities from 2006 to 2013 and the third (Chapter 4) deals with 27 states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018.

1.4 Research Contributions

The study deepened the analysis of intergovernmental transfers in Brazil, with the flypaper effect being empirically tested with the available databases, considering the limitations of Brazilian data (see topic 4.3.6). New analyzes were implemented with the addition of variables, such as political alignment, indexes of development, the election years, and also the MCF. A broad time series of Brazilian states and municipalities not previously analyzed by other surveys were tested.

Evidence from previous studies of the flypaper effect still came up against the real reason for its cause. Thus, reasons for the occurrence of the phenomenon were presented, which were statistically confirmed. Among the reasons are electoral alignment, the MCF, and the transfer's dysfunctions.

The study contributes to scientific advancement, enabling the potential construction of a theory based on the evidence of the flypaper effect, which itself does not represent a theory because it is based only on empirical evidence from previous scientific studies. In the world, the empirical evidence of flypaper is secular, according to a survey carried out by Gramlich (1977), although the expression "flypaper effect" has been dubbed only in Courant *et al.* (1979) by Arthur Okun (Hines & Thaler, 1995).

In the field of education, the academy can propose alternatives to share tax revenues with the legislative authorities, as the distribution criteria in Brazil are based solely and exclusively on population and income *per capita*. State and regional perspectives were considered, as along with several characteristics based on economic, social, and development indexes that represent evidence of the consequences played by the way transfers are calculated and distributed in the country.

It is also possible to verify the contribution to accounting practice from a professional aspect. Several professionals are involved in this context, for example, the federal public manager responsible for tax collection, and the external control auditors. In this context, the Federal Court of Accounts (TCU) is responsible for calculating the distribution percentages of the State Participation Fund (FPE) and the Municipal Participation Fund (FPM). The accounting professional responsible for recording transfers and public accounts in each state and municipality is also relevant in the process.

Finally, social control can be best exercised based on recognizing the existence of the effect and other forms of fiscal illusion. If aware of these discrepancies in public accounts, society can require legislative changes that allow greater transparency of transfers by government agencies and authorities.

2. THE EFFECTS OF FEDERAL CONSTITUTIONAL GRANTS IN BRAZILIAN MUNICIPALITIES

Abstract

The objective of the present study is to verify the flypaper effect of 476 Brazilian municipalities from 2005 to 2012, considering the new variables as instruments of grants. Political alignment, alignment of the party and coalition of the mayor with the federal president and of the state governor were considered as instruments of grants. A municipal tax autonomy index was considered as a control variable, which represents the percentage of local taxes in the municipal total revenues. The results allow concluding the flypaper effect exists in Brazilian municipalities and is intensified by the alignment of the representatives in the same way of theoretical literature (Hamilton, 1983; Hines & Thaler, 1995; Inman, 2008) and previous empirical studies in Brazil. Moreover, evidence of a higher flypaper effect was found in municipalities with low tax autonomy.

Keywords: Brazilian municipalities; panel data; fiscal federalism, grants; flypaper effect.

JEL: C33; H77; H72.

2.1 Introduction

Fiscal federalism is the decentralization of competencies to subnational entities which have the tax jurisdiction of certain taxes and also competencies to provide goods and services to local communities with autonomy and non-sovereignty. In Brazil, this process was consolidated with the Federal Constitution of 1988. However, this type of state organization can create two phenomena: fiscal illusion and flypaper effect.

The illusion created by the rulers can be based on tax income and on government management expenses and these aspects connect voters to citizens to decision-makers in terms of the fiscal illusion (Gérard & Ngangué, 2015). For Puviani (1903), rulers create illusions using their capacity to manipulate the fiscal structure. Taxpayers tend to believe that taxes are less costly, and they are government-provided benefits, through public goods and services, are worth more than they are (Buchanan, 1967).

Recent studies on analytic fiscal illusion (Baekgaard, Serritzlew & Blom-Hansen, 2016) examined their influence on the government expenditure cycle (Abbott & Jones, 2016), their relationship with budget (Gérard & Ngangué, 2015), transparency (Afonso, 2014), and a possibility of raising fees or taxes due to illusion (Ross & Yan, 2013).

Furthermore, there is another phenomenon called the flypaper effect, which establishes the receipt of unconditional and nonmatching (lump sum) grants results in an increase of local public expenditure proportionally higher than an equivalent increase in personal income (Hamilton, 1986; Hines & Thaler 1995). The effect is based on empirical evidence that grants transferred from one government level to another tend to "stick" with the recipient being used for service provision and are not passed on to taxpayers in the form of lower taxes (Ahmad & Craig, 1997). Consequently, the grant leads to a higher level of service provision than would be the case if the payment was made directly to individuals.

There are many unconditional and nonmatching grants (lump sum) in Brazil: the Municipal Participation Fund (FPM), 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, there are three basic problems concerned with grants. The first one is that there are no sufficient studies to conclude that grants cause fiscal illusion and flypaper effect in Brazil, although there are studies that analyzed the topic (Araújo & Siqueira, 2016; Cardoso *et al.*, 2012; Correia *et al.*, 2014; Cossio, 1998; Cossio, 2002; Cossio & Carvalho, 2001; Costa, 2013; Costa & Castelar, 2015; Diniz *et al.*, 2017; Gadelha *et al.*, 2017; Gonçalves, 2013; Guedes & Gasparini, 2007; Linhares *et al.*, 2012; Macedo & Corbari, 2009; Mattos & Rocha; Arvate, 2011; Mendes, 2002; Nascimento, 2010; Parmagnani & Rocha, 2013; Sakurai, 2013; Schettini, 2012; Severo Filho, 2012). Second, the reasons for these anomalies are not consensual. Third, it is unclear the role accounting plays in making decisions of these transfer's allocation and whether it is properly performed.

Considering this context, the following research problem arises: Do unconditional and nonmatching (lump sum) grants, structured according to constitutional fiscal decentralization, cause flypaper effect in Brazil?

In an attempt to answer the proposed problem, the central objective of the research is to verify if grants derived from fiscal decentralization in public resources cause fiscal illusion and flypaper effect in Brazilian municipalities and to verify whether federal financial statements and systems exercise an important role in decision-making on resource allocations. If the phenomena observed are not according to the analyzed theories, the present study will propose solutions.

The present research is relevant, considering fiscal federalism is experiencing difficulties in the 21st century. Due to the macroeconomic instability experienced by Brazil, as a result of the fall in Gross Domestic Product (GDP), a decrease in tax revenues, and the various economic and political crises, this research will provide further analysis in such scenarios and the feasibility of fiscal federalism in mitigating such panorama. The present work is composed of the present introduction, followed by theoretical reference, methodology, results, and conclusions.

2.2 Theoretical Reference

2.2.1 The Flypaper Effect

The expression "the money that the government sends out sticks where it hits" was first used in Courant *et al.* (1979) by Arthur Okun, who was a professor at Yale University and the chairman of the Council of Economic Advisers and dubbed the "flypaper effect" (Hines & Thaler, 1995). Since then, the name is always used to describe the phenomenon that "nonmatching grants stimulate much more local spending per dollar of grant than does income going to private citizens within the community" (Courant *et al.*, 1979).

The flypaper effect goes against the theory[4] that establishes that nonmatching grants are assumed "to have an effect on local spending similar to that of any other change in private income in the community", whereas matching grants cause relative prices to change and are found to stimulate more spending per dollar of grant than nonmatching grants (Courant *et al.*, 1979). Therefore, when the expected equivalence between the effects of an increase in grants and private income on the public goods expenditure does not occur, it is called the flypaper effect (Hamilton, 1983; Oates, 1972; Hines & Thaler, 1995). Instead of such grants result in a decrease in local taxes, they truthfully cause a disproportionate increase in spending, which is contrary to the median voter model. Hence, there is a significantly higher propensity for recipients to increase public expenditure in response to lump-sum intergovernmental grants than in response to equivalent increases in private income (Oates, 1988).

One of the reasons of this phenomenon is because "bureaucrats and politicians find it easier to avoid cutting taxes when the government receives revenue-sharing monies than they

[4] Wide explained by Wilde (1971).

do to raise taxes when some exogenous event raises the income of the community" (Courant *et al.*, 1979). The normative theory of fiscal decentralization is based on the assumption that rulers meet the preferences of the median voter (Oates, 1972). Although the flypaper effect may occur due to inadequate econometric procedures in measuring elasticities (Chernick, 1979; Fisher, 1982; Hines & Thaler, 1995; Megdal, 1987; Moffitt, 1984), it is more probable that governors do not respond to the median voter (rejection of the hypothesis that governors respond to the median voter). Several models emerged based on the concept of budget-maximizing bureaucrat model (Niskanen, 1971), or based on politicians who seek to maximize their own utility (rather than the median voter utility function); where there are maneuvers to transform received grants into public expenditures and not into taxes reduction.

Besides the flypaper effect (the empirical observation that unrestricted grants to localities from higher levels of government stick where they hit), as an anomaly in the local public finance literature, Hamilton (1983) points out also that dead weight loss of taxation may be a possible cause of the flypaper effect. In other words, the grants of the Federal level make the municipalities inefficient in their own collection, which has already been verified also by other studies (Cossio, 1998; Costa, 2013; Dahlberg, Mörk, Rattso & Hanna, 2008; Heller, 1975; Iqbal, 1997; Khan & Hoshino, 1992; Ribeiro, 2005; Ribeiro & Schwengber 2000; Ribeiro & Shikida, 2000; Schettini, 2012; Veloso, 2008; White, 1994; Zhang & Wu, 2009).

According to Fisher (1982) and Ingberman & Inman (1987), if the coefficient of lump sum grant is greater than the GDP (or income), it is the flypaper effect, which represents the expansive effect of transfers on public expenditure. In summary, according to Saruc & Sagbas (2008), the possible conclusions from the econometric results are:

Table 1: Outcomes Interpretations

Condition	Result	Implication	Relation to local tax effort	Author basis
If $\beta_2 > \beta_1$	Flypaper effect	The parameter of lump-sum transfer exceeds the parameter of income	Lesser local tax effort	Courant *et at.* (1979)
If $\beta_2 > 1$	Stimulation effect	A unit intergovernmental transfer induces more than a unit increase in local spending	Higher local tax effort	Inman (1979)
If $\beta_2 < 1$	Substitution effect (Grant displacement effect)	Intergovernmental transfers have substitution effect with varying degrees according to the value of β_2. Transfers substitute local revenues.	Lesser local tax effort	Inman (1979), Gramlich (1977)
If $\beta_2 < 1$ and If $\beta_2 > \beta_1$	Flypaper effect and Substitution effect (Grant displacement effect) together	-	Lesser local tax effort	Inman (1979), Gramlich (1977)
If $\beta_2 > 1$ and If $\beta_2 > \beta_1$	Flypaper effect and Stimulation effect together	-	uncertain	Inman (1979)
If $\beta_2 = 0$	Substitution effect (Grant displacement effect)	The substitution is complete.	Lesser local tax effort	Inman (1979), Gramlich (1977)
If $\beta_2 = 1$	Neutral effect	Neither substitution nor stimulation effect is determined	Lesser local tax effort subject to existence of the flypaper effect	Inman (1979)

Source: Adapted from Sagbas & Saruc (2004), which model is: $PCEXP = \beta_0 + \beta_1 PCGDP_i + \beta_2 PCRES_i + \beta_3 POP_i + u_i$, where $PCEXP_i$: expenditure *per capita* of municipality *I*; $PCGDP_i$: local GDP *per capita* of municipality *I*; $PCRES_i$: revenue *per capita* sharing of municipality *I*; POP_i: population of municipality *I*; u_i: random disturbance terms.

At the international level, many studies have empirically verified nonmatching grants stimulate much more local spending per dollar than income does going to private citizens within the community (Gramlich, 1977; Gramlich & Galper, 1973; Fisher, 1982; Karnik & Lalvani, 2008; Strumpf, 1998).

At the national level, Cossio & Carvalho (2001) verified that the federal constitutional grants destined to the municipalities provoked an increase of municipal public expenditures significantly higher than increases in income *per capita* of taxpayers in a sample of more than 3,500 Brazilian municipalities in 1996. Souza (2003) found that small municipalities and receivers of royalties are the least efficient, with a worse relation between total revenue and public services offered.

Cossio (2002) verified the existence of flypaper effect in the Brazilian municipalities, which means that the public sector is increasing in the economy, since the resource transferred to states and municipalities becomes an additional local expense in each entity instead of resulting in a local tax cut.

Mendes (2002) identified that the capture of resources by Brazilian municipalities is more intense in cities benefited from the grants sharing criteria, especially small cities and those receiving a high amount of oil royalties. High available resources with no efficient spending option generate surplus available resources to be captured by high wages, unnecessary buildings and other inefficient expenditures. Mendes (2005) analyzed the capture of transfers received by local interest groups and results showed it increased with the raising of fiscal illusion, low bargaining power of the voter, over-financing of some local governments and the raising of degree of poverty, as established in the literature.

Mattos, Rocha & Arvate (2011) verified that transfers to Brazilian municipalities negatively affect the collection efficiency and positively the private income, opposite of what the flypaper effect establishes. In a more recent study, Diniz *et al.* (2017) verified that the municipalities in the state of Paraíba that have higher own revenues are the most efficient, while those that receive more resources than they send to the Maintenance Fund for the Maintenance and Development of Basic Education and for the Appreciation of Education Professionals (Fundeb) are less efficient.

2.2.2 Fiscal Federalism in Brazil

Brazil is a federation, which means impossibility dissociation of any subnational levels (any state or any municipality). Hence, the subnational levels have only autonomy to exercise certain activities, not sovereignty, and are subordinated to the supreme of the Constitution of the Federative Republic of Brazil, but all the states have their own constitution, while all the municipalities have their own organic law.

The president is elected by vote for a 4 years tenure (republic) and represents the Union and also the government (presidentialism), without a different person as a prime minister. His accountability refers to the society about his actions and expenditures and his accounts are annually judged by the National Congress based on the prior opinion of the Brazilian Court of Audit. Brazil's democracy is classified as semi-direct because the representatives can legislate, but also the population initiates the legislative process by their own ways, as through a popular action[5].

Geographically Brazil has 26 states, 1 Federal District and 5,568 municipalities, and in 2018 it had approximately 208 million inhabitants. In the legislative scope, Brazil has the National Congress, which is divided into two parliamentary houses: the Chamber of Deputies and the Federal Senate. The first is formed by federal deputies who are representatives of the

[5] Brazil, 1988, art. 61, Paragraph 2: The initiative of the people may be exercised by means of the presentation to the Chamber of Deputies of a bill of law subscribed by at least one percent of the national electorate, distributed throughout at least five states, with not less than three-tenths of one percent of the voters in each of them.

citizens, elected by proportional vote, while the second (Senate) is made up of senators, who are representatives of the states. Each of the 26 states and the federal district have a governor and each of the municipalities have a mayor and also a number of councillors proportional to the amount of inhabitants. Thus, Brazil has the following number of parliamentarians:

Table 2: Number of parliamentarians

Politicians	n.
President	1
State Governators	27
Senators	81
Federal Deputies	513
Mayors	5,568
Councilmen (Councillor)	56,810

Source: authors.

Therefore, Brazil is organized by the fiscal federalism, where the Federal level collects most of the taxes while the states and municipalities collect the taxes of their tax jurisdiction. The Constitution establishes the tax competency and jurisdiction by levels:

Table 3: Taxes in Brazil by levels

Federal (CF art. 153/154)	States (CF art. 155)	Municipalities (CF art. 156)
1. Import Tax (II)	1. Tax on Circulation of Goods and Services (ICMS)	1. Tax on Services (ISS)
2. Export Tax (IE)	2. Motor Vehicle Tax (IPVA)	2. Real Estate Tax (IPTU)
3. Federal Value-Added Tax or Excise Tax on Manufactured Goods (IPI)	3. Tax on inheritances and donations (ITCMD)	3. Tax on transfers of urban real estate (ITBI)
4. Financial Transactions Tax (IOF)		
5. Income Tax (IR)		
6. Rural Property Tax (ITR)		
7. Great Fortunes Tax (IGF)		
8. Extraordinary War Tax (IEG)		
9. Residuals Tax (Ires)		

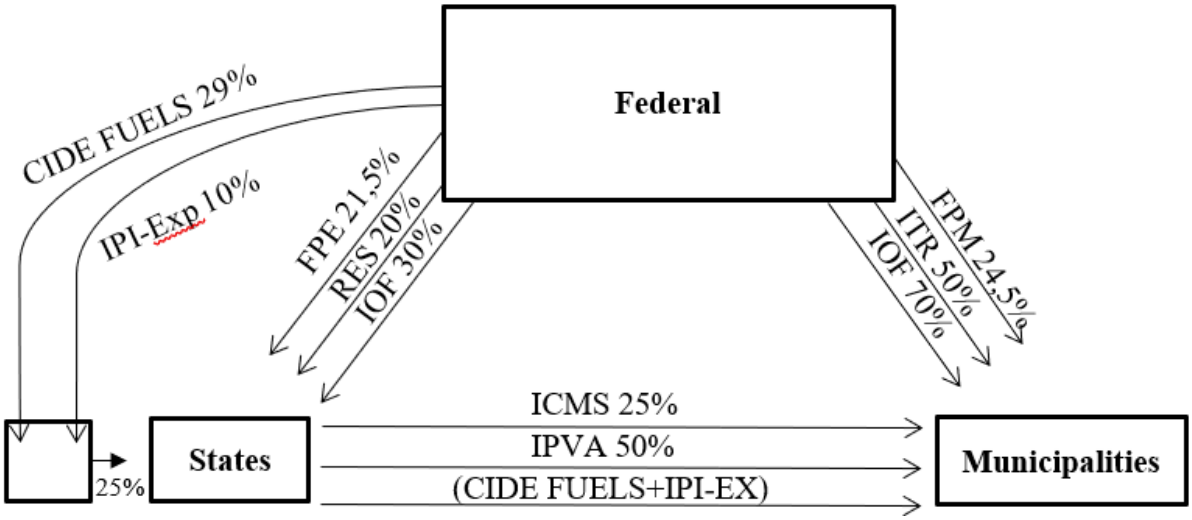
Source: Federal Constitution of 1988.

The Brazilian tax framework is congruent with Oates's decentralization theorem and the optimal-sized jurisdiction, which is developed also by other authors (Ahmad *et al.*; Gramlich, 1993; Hemming & Spahn, 1997; Oates, 1972), that the consumption of a public good will always be more efficient (or at least as efficient) for local governments to provide the Pareto-efficient levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions (Oates, 1972). This fact is proven by the quantity and amount of taxes that the Brazilian federal level accumulates (Figure 1).

According to the decentralization theorem (Ahmad *et al.*, 1997), municipalities are responsible for local services such as street lighting, paving, urban zoning, transportation, and regulation of local commercial activities. On the other hand, the federal government would provide national services such as defense, monetary stability, unemployment insurance, international relations.

In addition to the tax competence, the distribution of tax revenues in Brazil is also set prescribed by the Federal Constitution. The amount of resource transferred by the federal and state level to municipalities (local level) is representative, about 65.9% (IBGE, 2018), and many municipalities survive only with the mandatory and unconditional grants. The tax distribution flow chart is shown following:

Figure 1: Constitutional Grants in Brazil



Source: authors. States Participation Fund (FPE), Municipal Participation Fund (FPM), Rural Property Tax (ITR), Financial Transactions Tax (IOF), Tax on Circulation of Goods and Services (ICMS), Motor Vehicle Tax (IPVA), Federal Value-Added Tax or Excise Tax on Manufactured Goods (IPI), Residuals Taxes (RES), Contribution of Intervention in the Economic Domain on fuels (CIDE FUELS), Federal Value-Added Tax or Excise Tax on Manufactured Goods destined to exportation (IPI-Exp). The FPM percentage is 24.5% since 2016, according to the Constitutional Amendment nº. 84/2014, while the previous percentage was 23.5%. The FPE percentage is 21.5% since 1993, according to the Federal Constitution of 1988.

Consequently, the present study considered as unconditional and nonmatching (lump sum) grants the FPM, the ITR, the IOF (federal grants to municipalities) and the ICMS, the IPVA and the IPI (state grants to municipalities) as shown below:

Table 4: Constitutional Grants

Financial Source	Regulation	Typology	Unrestricted lump sum?	%
		Federal to Municipalities		
FPM	CF art. 159, I b, d, e	Unconditional, mandatory, nonmatching and redistributive.	Yes	23,5%
ITR	CF art. 153, VI and art. 158, II	Unconditional, mandatory and nonmatching.	Yes	50% or 100%
IOF	CF art. 153, V and §5°	Unconditional, mandatory and nonmatching	Yes	70%
		States to Municipalities		
ICMS	CF art. 158, IV	Unconditional, mandatory and nonmatching, disconnected from the tax location.	Yes	25%
IPVA	CF art. 158, III	Unconditional, mandatory and nonmatching	Yes	50%
IPI-exp	CF art. 159, III, § 4º	Unconditional, mandatory and nonmatching.	Yes	25%

Source: authors.

From the total net revenue of IR and IPI, the Federal level transfers 21.5% to the 27 states constituting the FPE and 24.5% to the 5,568 municipalities constituting the FPM, according to the following equation:

$$FPM_t = 24.5\% \, (IR + IPI)_t - PASEP_t - Fundeb_t \quad (1)$$

Where *IR* is the federal income tax revenue in the year *t*; *IPI* is the Federal Value-Added Tax revenue in the year *t*; *PASEP* is a fund to stimulate savings, correct distortions in income distribution and other objectives[6]; and *Fundeb* is a fund to help the basic education[7].

After the calculation of the FPM, it is segmented into three parts: 10% is delivered to the capitals of the states (FPM-Capitals), 3.6% to the most populous municipalities (more than 142,633 inhabitants) (FPM-Reserve), and 86.4% to other municipalities (FPM-Interior). Based on equation (1), the first part regards to the capitals of the states and the calculation is represented by the following equation:

$$FPMCap_{it} = 10\%FPM_t \times \frac{CIFPMCap_{it}}{\sum CIFPMCap_{it}} = 10\%FPM_t \times \frac{(PopCapFactor_{i(t-1)} \times IncomeFactor_{i(t-2)})}{\sum(PopCapFactor_{i(t-1)} \times IncomeFactor_{i(t-2)})} \quad (2)$$

FPMCap is the FPM amount to be distributed to the capital *I* in the year *t*. *CIFPMCap* is the individual participation coefficient of the capital *I* in the year *t* and expresses the product of two factors (population factor and income factor *per capita*), according to the National Tax Code[8]; *PopCapFactor* is the population factor, calculated by the relationship between the corresponding factor and the total of factors that are extracted from the National Tax Code (art. 91, §1, a), based on the population of each capital *I* and the sum of the population factor of the capitals in the year *t*-1; *IncomeFactor* is the income factor *per capita*, calculated by the relationship between the corresponding factor and the total of factors that are extracted from the National Tax Code (art. 90), based on the inverse of the relationship between the income *per capita* of each state the capital *I* belongs to and the national income *per capita* in the year *t-2*.

The second coefficient regards to the most populous municipalities (more than 142,633 inhabitants), as equation (3):

$$FPMRes_{it} = 3.6\%FPM_t \times \frac{CIFPMRes_{it}}{\sum CIFPMRes_{it}} = 3.6\%FPM_t \times \frac{(PopResFactor_{i(t-1)} \times IncomeFactor_{i(t-2)})}{\sum(PopResFactor_{i(t-1)} \times IncomeFactor_{i(t-2)})} \quad (3)$$

FPMRes is the FPM amount to be distributed to the reserve municipality *I* in the year *t*. *CIFPMRes* is the individual participation coefficient of the reserve municipality *I* in the year *t* and expresses the product of the two factors (population factor and income factor *per capita*), according to the National Tax Code; *PopResFactor* is the population factor, calculated by the relationship between the corresponding factor and the total of factors that are extracted from the National Tax Code (art. 91, §1, a), based on the population of each reserve municipality *I* and the sum of the population factor of the reserve municipalities in the year *t*-1; *IncomeFactor* is the income factor *per capita*, calculated by the relationship between the corresponding factor and the total of factors that are extracted from the National Tax Code (art. 90), based on the inverse of the relationship between the income *per capita* of each state the reserve municipality *I* belongs to and the national income *per capita* in the year *t-2*.

Finally, the municipalities smaller than 142,633 inhabitants are called interior municipalities and all the municipalities, except the capitals, receive the *FPMInt*. Accordingly, the reserve municipalities receive the *FPMInt*, besides the quote calculated by the *FPMRes*, which is calculated as equation (4):

$$FPMInt_{it} = 86.4\%FPM_t \times \frac{CIFPMInt_{it}}{\sum CIFPMInt_{it}} = 86.4\%FPM_t \times \frac{PopIntFactor_{i(t-1)}}{\sum PopIntFactor_{i(t-1)}} \quad (4)$$

FPMInt is the FPM amount to be distributed to the interior municipality *I* in the year *t*. *CIFPMInt* is the individual participation coefficient of the interior municipality *I* in the year *t* and expresses the corresponding factor that is extracted from the National Tax Code (art. 91,

6 Complementary Law 26/1975.
7 Law 11.494/2007.
8 Law 5.172/1966.

§2), based on the population of each reserve municipality *I* in the year *t*-1; *PopIntFactor* is the population factor, extracted from the National Tax Code (art. 91, §2), based on the population of each interior municipality *I* in the year *t*-1.

Shah (1994) highlights that the principal merits of the FMP are the consistency of its design with objectives of transparency, predictability, and local autonomy. Although it addresses some fiscal equalization objectives, it also has design flaws that inhibit achievement of its objectives, because state income *per capita* is an imperfect guide to the ability of a state or municipality government to raise taxes, considering a significant proportion of income can accrue to non-resident owners of factors of production. In addition, only a small portion of total state revenues is raised from income taxes and estimates of state income *per capita* are subject to significant errors, besides the available data only after a long delay. To sum up, these problems diminish the usefulness of income *per capita* as a determinant to such an important fund there is FPM to Brazilian fiscal federalism.

The ITR collection is distributed to the municipalities in the proportion of 50% of the total if the municipality does not have agreement with the Federal Revenue of Brazil (RFB) regarding the delegation of inspection and supervision the collection activity. Otherwise, if the municipality has the agreement, it takes 100% of the ITR tax of the properties located in its boundaries. In consultation to the RFB, 2117 municipalities have the agreement, which represents 38% (2,117/5,568) of all Brazilian municipalities, and in the sample of the present study it represents 59% of the 476 municipalities.

From the total collection of IOF, 30% is destined to the states and 70% to the Municipalities. This transfer was determined by the Federal Constitution (article 153), according to the origin of the gold financial asset, so only the municipality or state the asset came from receive the transfer. The identification is made by the tax documentation of the operation, whose compilation and sending of information to the competent institutions is responsibility of the RFB.

The distribution criterion of ICMS tax collection by states is based on fixed percentages stablished by Complementary Law 87/1996, which defined that 25% is destined to the municipalities according to the percentages defined by each state. As for IPVA tax, 50% of its total collection is destined to municipalities based on the criterion of vehicles licensed in each municipality.

Finally, 10% of IPI exportation total collection is destined to the states in proportion to the value of the respective exports of industrialized products (LC 61/1989, art. 1, caput). As established by LC 65/1991, art. 4, it is considered only the value of industrialized products exported in the proportion of ICMS that is no longer required due to the non-impact arising from the export of goods and services (CF, art. 155, § 2, X, a) concerning tax credits arising from the transit of goods and services between states before being exported (CF, article 155, § 2, XII, f). The participation of each state is limited to 20% of the amount to be distributed and the eventual excess redistributed among the other participants in proportion to the respective participations (CF, article 159, and LC nº 61/1989, art. 1, § 4).

There are various researches about Brazilian fiscal federalism and grants transferred from federal level to local levels. Sakurai & Menezes Filho (2011) analyzed data from more than 2,500 municipalities from 1989 to 2005 and verified a decrease in the fiscal surplus during election years, which occurs because current local expenditures increase and local tax revenues decline. Brollo & Nannicini (2012) used capital transfers as proxy to analyse political reasons in the allocation of intergovernmental transfers in a federal state, considering those transfers are discretionary and actually subject to greater volatility. Nascimento (2010) also carried out a study considering political alignment to identify flypaper effect in the Brazilian municipalities.

Hence, the present study approaches political alignment as an instrument variable to verify the flypaper effect, but does not consider left, right and center parties, as done by Nascimento (2010) and Sakurai & Menezes-Filho (2008), since there is evidence that Brazilian political parties are ideologically inconsistent, they do not clearly represent different public administration profiles (Ames, 1995; Sakurai & Menezes Filho, 2011; Mainwaring & Scully, 1995) and there are 35 parties in Brazil, which is too spready. The alignment variable explained in the methodology considers only if president, governors, or mayors are aligned by the same party or coalition, which reduces problems concerning so many parties.

Vegh and Vuletin (2015) provides many possible reasons for the emergence of the flypaper effect, but they also provide an additional explanation for the flypaper effect based on precautionary savings. An increase in grants raises the variance of total income by less than an increase in private income. Then, the amount of additional precautionary savings on the part of local governments is lower in response to the increase in grants and the increase in public spending is correspondingly higher.

2.3 Methodology

2.3.1 Data

The sample consists in a panel of 476 municipalities with more than 50,000 inhabitants from 2005 to 2012. The number of municipalities and the period were based on the availability of the control variables, as not all the Brazilian municipalities have continuous data available to build a consistent panel data. The selection excluded those municipalities that did not declare information to the National Treasury Secretariat (STN) or that didn't have basic informations as current expenditure, income, population, GDP and grants. In addition, the DF was excluded because it represents a hybrid entity accumulating state and municipality functions and would certainly be considered as an outlier. Current expenditure and grants data were obtained from Finbra's Finance System, while GDP and population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE) database.

The timeline is not more than 10 and therefore it was not possible to use the traditional GMM estimator. Otherwise, robust inference and clusters were used for the 5 Brazilian regions according to the IBGE (North, Northeast, Central-West, South and Southeast), allowing heteroscedasticity and error correlations over time for municipalities.

The municipalities above 50 thousand inhabitants were used because the data of the municipalities below this size are not reliable and can bias the results. Moreover, the National Treasury uses municipality samples of more than 100 thousand inhabitants to analyse the scenarios and also the score of the payment ability of municipalities.

2.3.2 Variables Expenditure and Income

Many authors consider expenditure as dependent variable in the econometric model (Cossio, 2002; Cossio & Carvalho, 2001; Costa, 2013; Mendes, 2002, 2005; Ribeiro, 2015; Rios & Costa, 2005; Severo Filho, 2012). For this reason and based on the concept of flypaper effect, the dependent variable considered in the present study was current expenditure, since it is the best representation of expenditure for the present study's purpose. However, there are studies that used other spending variables, such as Wyckoff (1988), who used capital expenditure, and Brollo & Nannicini (2012), who used capital transfers. It is true that not all expenditures serve to capture electoral strategy (Drazen & Eslava, 2005). True is this assertion that Strumpf (1998) used the residual of an equation as a proxy for wasteful expenditure. For the income variable, the GDP of the municipalities was used as a proxy.

2.3.3 Grant Variable

The nonmatching and unconditional (lump sum) grants considered were the state grants FPM, IOF and ITR; and the state grants ICMS, IPVA and IPIexp. Flypaper effect studies in Brazil consider different types of grants, such as others current transfers (Costa, 2013) and capital transfers (Brollo & Nannicini, 2012; Sakurai & Menezes-Filho, 2008, 2011). The authors who used grant proxies similar to the present study are Cossio (2002) and Mendes (2005). In general, the studies consider only FPM, IOF, ICMS and IPVA (Cossio, 2002). The present study is therefore a pioneer in using ITR and IPIexp grants in the econometric model, and also the grant created by LC 87/96, which is not constitutional, but legal because it comes from infraconstitutional legislation and was tested separately to the main model.

Although the topic 2.2 explains the three individual participation coefficients to calculate the FPM (Capital, Reserve and Interior), the sample of 476 municipalities is composed by municipalities based on all of the kinds of coefficients. The amount of 25 capitals is based on equation (2), while 142 reserve municipalities are based on equation (3) and 451 interior municipalities are based on equation (4).

The grants FPM, IOF, ICMS and IPVA are clearly unconditional and nonmatching (lump sum) grants. The IPI exportation grant was also considered lump sum, since 25% of the total received from these grants by the states are redistributed to the municipalities according to the CF without any conditions or matching. The same rules do not apply to CIDE fuels grants, because they are classified as conditional.

The ITR tax was also considered in the present study, in convergence with previous studies (Costa, 2013). Transfers to the Fundeb (called Fundef until 2006), SUS, FNAS and FNDE are not considered lump sum because they are clearly linked to a specific activity, health or education services in these cases. For this reason, they were deducted from the grants, except IOF, because it is not basis for Fundeb deduction.

Finally, the present study does not consider "non-fiscal" transfers derived from the exploitation of petroleum as nonmatching and unconditional (lump sum) grants, because they are considered as exploratory nature grants, different from tax grants (Mendes, Miranda & Cossio, 2008).

2.3.4 Alingment Variable

Elections in Brazil are held every 4 years and the mayor elections in municipalities do not coincide with the the president federal elections.

Table 5: Election Years and Presidents

Scope	Year	Candidates	President	Party
Brazil	2002	President, State Governors, Senators and Federal Deputies	Luiz Inácio Lula da Silva	PT
Brazil	2004	Mayors and City Councilmen		
Brazil	2006	President, State Governors, Senators and Federal Deputies	Luiz Inácio Lula da Silva	PT
Brazil	2008	Mayors and City Councilmen		
Brazil	2010	President, State Governors, Senators and Federal Deputies	Dilma Rousseff	PT
Brazil	2012	Mayors and City Councilmen		
Brazil	2014	President, State Governors, Senators and Federal Deputies	Dilma Rousseff	PT
Brazil	2016	Mayors and City Councilmen		
Brazil	2016	Dilma's impeachment (31/8/2016)	Michel Temer	MDB[9]
Brazil	2018	President, State Governors, Senators and Federal Deputies	Jair Bolsonaro	PSL

Source: authors and Superior Electoral Court (TSE). PT: Worker's Party. MDB: Brazilian Democratic Movement. PSL: Liberal Social Party.

According to some previous studies (Brollo & Nannicini, 2012; Grossman, 1994; Laband, 1986), there is a predisposition for greater resource allocation in municipal election

[9] Called before as PMDB: Brazilian Democratic Movement Party.

years, since it is the last year of the mayor's tenure. Brollo & Nannicini (2012) found that in preelection years municipalities in which the mayor is affiliated with the coalition (and especially with the political party) of the Brazilian president receive approximately one-third larger discretionary grants for infrastructures. Although this paper considers the spam team from 2005 to 2012, Table 5 allows to expand future research in this area.

Grossman (1994) and Laband (1986) developed models that political variables significantly explain the volume of federal grants *per capita* to states, such as alignment between parties in federal and state power, (Mendes, 2004). Arulampalam *et al.* (2009) verified the Indian central government favors areas with greater political support through grants. For Rogoff (1990), the attempt to maintain political power generates expenditures towards economic growth that is meaningful close to election dates in order to gain more votes (Schneider, 2012). Rios & Costa (2013) also use alignment variables in Portuguese municipalities and identify statistical significance of them.

Thereupon, the present study used alignment of the party and the coalition of the president with the mayor, as well as the alignment of the party and the coalition of the governor with the major. In this way, the alignment and the election year were used as the instrumental variables, as some other studies (Brollo & Nannicini 2012; Sakurai & Menezes-Filho, 2008, 2011; Simão & Orellano, 2015).

2.3.5 Control Variables

Several authors use some variables to control population size, social characteristics such as wealth, literacy, years of schooling, garbage collection service, demographic variables, age of population, education level. However, for the timeline of the sample selected in the present study there are not many social data feasible. Therefore, the following variables were used as control variables: the proportions of woman (gender), over 60 years old (elderly) and under 14 years old (youth), and also a score attributed to each municipality according to its characteristics from the perspective of the employment and income, called Firjan Municipal Development Index (IFDM), and the demographic density.

The paper contributes to the current state-of-the-art of flypaper effect because it is pioneer in some aspects, although the database is from 2005 to 2012. 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. In addition, the grant variables were deducted from the amount that does not fit the concept of lump sum grants, as Fundeb. Then, there were analysis and incorporation of alignment variable as instrument in the econometric model and also inclusion of control variables that were not approached in previous studies, such as IFDM.

The defense for using database from 2005 to 2012 is because the control variables are available only until 2012, which turns it infeasible to work with a balanced panel since 2013. In addition, the IFDM data are only available from 2005 to 2013 (Appendix 1). The data were only until 2012 to allow the use of control variables (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 indeed discontinued and there is no prospect of further updates. Another limitation refers to municipal GDP data, which are available only two years after the end of the year it refers to (IBGE 2018).

Even though there are more current state data available, it is more appropriate to conduct municipality level studies because local governments are closer to the local population and have more accurate information about local preferences, by this way making probably better decisions (Hayek, 1945). Greater knowledge of local preferences may increase the demand for municipal government supply and this increase in local spending is likely to occur

simultaneously to the drop of federal government spending (Guedes & Gasparini, 2007). Moreover, citizens have more control over public decisions at local level than at state or federal levels and, consequently, would seek for more government accountability. Therefore, the local level tends to be as larger as more decentralized is the decision-making (Guedes & Gasparini, 2007; Wallis & Oates, 1988).

2.4 Econometric Model

The model to identify the flypaper effect is:

$$\mathrm{EXP_{it}} = \beta_0 + \beta_1 \mathrm{GDP_{it}} + \beta_2 \mathrm{GRANT_{it}} + \beta_3 \mathrm{CONTROLS_{it}} + \epsilon_{it} \quad (5)$$

EXP_{it} is the current expenditure of the municipality *I* in the year *t*. GDP_{it} is the Gross Domestic Product of the municipality *I* in the year *t*. $GRANT_{it}$ is the sum of the nonmatching and unconditional (*lump sum)* transfers of the municipality *I* in the year *t*, which in the present study are the federal transfers FPM, ITR and IOF; and the state transfers ICMS, IPVA and IPIexp, considering they are constitutional and clearly exogenous according to Cossio (2002) & Mendes *et al.* (2008). *CONTROLS* are percentages of woman, youth and elderly people above 60 years, as well as populational density and the employment and income Municipal Development Firjan Index (IFDM), and ϵit represents the residuos; (*I* = 476 municipalities and *t* = 2005 to 2012).

All the variables and the expected results according to previous literature are following presented:

Table 6: Variables

Variable	Previous Literature	Expected Results
EXP	(Bae & Feiock, 2004; Cardoso *et al.*, 2012; Fisher, 1982; Gamkhar & Oates, 1996; Gramlich, 1977; Heyndels, 2001; Hines & Thaler, 1995; Inman, 1979; Lago-Penãs, 2008; Levaggi & Zanola, 2003; Mendes & Sousa, 2006; Saruc & Sagbas, 2008; Strumpf, 1998; Wyckoff, 1988).	Dependent Variable
GDP	(Courant *et al.*, 1979; Gramlich, 1977; Heyndels, 2001; Inman, 1979; Saruc & Sagbas, 2008).	+ < GRANT coefficient
GRANT	(Brollo & Nannicini, 2012; Courant *et al.*, 1979; Costa, 2013; Gramlich, 1977; Heyndels, 2001; Inman, 1979; Islam, 1990; Marconi, Arvate, Moura Neto & Palombo, 2009; Saruc & Sagbas, 2008).	+ > GDP coefficient
ALIG	(Arulampalam *et al.*, 2009; Bracco *et al.*, 2015; Brollo & Nannicini, 2012; Dollery & Worthington, 1996; Drazen & Eslava, 2010; Grossman, 1994; Knight, 2002; Laband, 1986; Lago-Penãs, 2008; Mendes & Sousa, 2006; Rios & Costa, 2005; Rogoff, 1990; Schneider, 2012; Simão & Orellano, 2015; Soares & Neiva, 2011; Veiga & Veiga, 2007).	+
Controls	(Cruz & Mereb, 2018; Hamilton, 1983; Heyndels, 2001; Nascimento, 2010).	Not aplicable

Source: authors.

The monetary variables (*EXP*, *GDP* and *GRANT*) were considered as *per capita*, with neperian logarithm (ln) and also deflated by the General Market Price Index – Internal Availability (IGP-DI), an index which is composed by the arithmetic weighted average of the Broad Producer Price Index (IPA), the Consumer Price Index (IPC) and the National Construction Cost Index (INCC). The variables levels were checked in function of the possible specification errors highlighted by Oates (1972), and also to disclosure the possible analyzing differences arisen by these errors. The logarithmic form was applied to enhance the analysis specification and fairness (Bailey & Connoly, 1998; Becker, 1996; Dollery & Worthington, 1999). There is a limitation concerned to the population to calculate the *per capita* level because it is extrapoled considering the number of people checked each 10 years by the census.

These procedures were adopted considering the flypaper effect's sensibility and the different results relying on the equation functional form (Bailey & Connoly, 1998), as it was

identified by Parmagnani & Rocha (2013). In addition, diminishing the errors specification risks is necessary (Hines & Thaler, 1995; Moffitt, 1984), as well it is necessary to avoid the other error especifications considered by the previous literature (Hines & Thaler, 1995; Chernick, 1979; Fisher, 1982; Megdal, 1987; Moffitt, 1984).

There are also evidences of improper functional form (Becker, 1996, Dollery & Worthington, 1999), influence of local expenditures on the grants (Islam, 1998; Islam & Choudhury, 1990; Marshall, 1991; Oulasvirta, 1997) and risks of interdependency between the variables (Bailey & Connolly, 1998).

As stated by the vast flypaper literature, authors found evidences on international level and on Brazilian level, as with relevant statistic evidence (Ladd, 1993) and non relevants (Marshall, 1991). Thus, flypaper is found not only in the public sector, but also in the private one (Blanchard, Lopez-de-Silanes & Shleifer, 1994). Anyway, cautious is encouraged concerned to the specification errors. Contributions by the present paper are the deep analysis of lump sum grants in Brazil and differ from others by approaching alignment variable as instrument to identify and confirm flypaper effect through grants, as already done in Portuguese municipalities by Rios & Costa (2005).

2.4.1 Unit Root Test

Unit root tests are necessary because the model contains municipal variables. Accordingly, the following tests were catched on:

Table 7: Unit Root Tests

Tests	LLC	IPS	ADF Fisher	PP-Fisher	Pesaran CD test	Hadri Lagrang
H_0	Presence of unit root	Presence of unit root	Presence of unit root	Presence of unit root	Cross-section independence CD ~ N(0,1)	All panels are stationary
H_1	Absence of unit root	At least 1 unit cross section without unit root	At least 1 unit cross section without unit root	At least 1 unit cross section without unit root	No Cross-section independence CD ~ N(0,1)	At least one panel is not stationary

Source: Baltagi (2013) and Gadelha *et al.* (2017).

The tests described above are the Levin, Lin & Chu (2002), which is a generalized test of the unit root ADF test for panels with correlated errors serially heterogenic, fixed effects and individual deterministic trend. The IPS, ADF Fisher and PP-Fisher are the traditional tests to test unit roots in the data. Pesaran (2004) and Pesaran (2015) tests are an investigation of the mean correlation between panel units and consider a transformation of the sum of pairwise correlations between panel units is standard normally distributed. Finally, the last test is the Hadri (2000) Lagrange multiplier (LM) tests, which check if the panels are trend stationary.

2.4.2 Fixed or Random Effects

According to the data disposal and also with the economic theory of the flypaper effect, what is intended with the present study is justified by the heterogeneity existing between each of the 476 Brazilian municipalities during the period from 2005 to 2012. Thus, it was preferred application of fixed effect instead of pooled. In addition, no random effects were used because the sample was selected based on municipalities with more than 50 thousand inhabitants, and it was directed in this aspect and duly justified by the Brazilian National Treasury itself. In any case, the necessary tests were carried out for the panel types:

Table 8: Fixed or Random Effects – Panel tests

Test	Chow test (generalized)	Breusch-Pagan LM	Hausman
H_0	Use Pools	Use Pools	Use Random effects

H_1	Use Fixed Effects	Use Random effects	Use Fixed Effects

Source: authors.

2.4.3 Instrumental Variables Tests and Remedies

To verify if the validity of instrumental variables the following tests were used:

Table 9: Instrumental Variables Tests

Test	Null Hyphothesis	Description
Sanderson-Windmeijer	Endogenous 33 fficient 33 is unidentified	The Sanderson-Windmeijer (SW) first-stage chi-squared and F statistics are tests of under identification and weak identification (Sanderson & Windmeijer, 2016) Ideal: p-value of test F close to **zero** to reject H_0
Kleibergen-Paap rk LM	Matrix of reduced form coefficients has rank=K1-1 (underidentified) Ha: matrix has rank=K1 (identified)	Underidentification test Ideal: p-value of ch-sq close to **zero** to reject H_0
Cragg-Donald Kleibergen-Paap Stock-Yogo	Equation is weakly identified	Weak identification arises when the excluded instruments are correlated with the endogenous regressors, but only weakly (Stock, Wright & Yogo, 2005; Stock & Yogo, 2005). Ideal: Cragg-Donald > Stock & Yogo
Anderson-Rubin	B1=0 and orthogonality conditions are valid	Test checks if the coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and, in addition, that the overidentifying restrictions are valid. Both tests are robust to the presence of weak instruments. Ideal: p-value being **high** to **not** reject H_0
Underidentification test (Anderson canon. Corr. LM statistic):	The model is not identified.	Ideal: p-value of ch-sq close to **zero** to reject H_0
Hansen J statistic	The instruments are valid.	Overidentification test of all instruments (Hayashi, 2000).

Source: authors.

To test the validity of the instruments, the F test of Sanderson & Windmeijer (2016) verifies if the model is valid with the used instruments. Sargan's statistic is consistent if the disturbance is homoscedastic and (for AC-consistent estimation) if it is also autocorrelated. With cluster option, Hansen's J statistic allows observations to be correlated within groups (Hayashi, 2000).

Concerning exogeneity, however, previous literature has identified that grants are not exogenous (weak, strong, and super) with respect to local expenditure and there is also simultaneity among them (Islam & Choudhury, 1990). Deriving and testing a model of fiscal response to endogenously determined grants on a sample of 49 upper-tier municipalities in Ontario, Islam & Choudhury (1990) identified simultaneity between grants and expenditures, because the Ols and 2SLs estimates of reduced-form coefficients differed significantly. Deriving and testing a model of fiscal response to endogenously determined grants on a pooled time-series and cross-section sample of 49 upper-tier municipalities in Ontario, Islam & Choudhury (1990) identified simultaneity between grants and expenditures, because the Ols and 2SLs estimates of reduced-form coefficients differed significantly. In addition, the Cragg-Donald and Anderson-Rubin tests were also used to verify exogeneity.

In Brazil, endogenously problem may be even more evident because grant's formula is directly proportional to the size of the population and inversely proportional to the *per capita*

income (represented by the GDP). Another problem could be the population estimation, which is calculated by interpolation, considering the census is done only every 10 years.

Ultimate, to check over and under identification the Hansen J statistic and Kleibergen-Paap statistic tests were done. The null hypothesis of the Hansen J statistic is if the instruments are valid instruments. The test also indicates the instruments are uncorrelated with the error term and the excluded instruments are correctly excluded from the estimated equation. Under the null, the test statistic is distributed as chi-squared in the number of (L-K) overidentifying restrictions. For the 2SLS estimator, the test statistic is Sargan's statistic, typically calculated as N*R-squared from a regression of the IV residuals on the full set of instruments.

The political alignment can indeed be an instrument, and this is one of the innovations of present the study, because if the municipality has social security debts, it cannot receive FPM. In addition, there are several juridical discussions to suspend the penalties established by the Fiscal Responsibility Law and also the courts setting fixed percentages for municipalities that have decreased population, which means mainly political decisions. The security of the method must exist, and it does not be distorted by the judicial protection; otherwise, the method is not valid. Moreover, the present study considers the exact financial cash flow transferred to the municipality and not only the amount calculated, because it is more consistent to consider the exactly amount given to the municipality.

2.4.4 Econometric assumptions

Using the alignment variable as instrument influencing GRANT and consequently the dependent variable EXP does not allow checking other tests, since it is not possible to perform such tests by the form xtivreg2 in Stata, but only if they are treated as a panel or traditional pooled. The data have a large cross-section (476 municipalities), but limited time series of 8 years. According to the literature (Baltagi, 2013; Baum, 2006), the tests make sense only for large and extensive panels and problems as cointegration, normality (Williams, Allison & Moral-Benito, 2018), serial correlation (Bhargava, Franzini & Narendranathan, 1982) and multicollinearity (Goldberger, 1991) are not serious problems in short panels.

Specifically regarding to collinearity, Cossio & Carvalho (2001) warned that ICMS state grants of ICMS in their model may have generated collinearity, since the collection of ICMS is determined by municipal GDP. However, the authors argued that the importance of this type of transference is low in relation to the total grants, a causation that can also be applied to the present study. Another problem is the high correlation between EXP, GDP and GRANT variables. Future studies can deepen the theme and verify the interrelationship between these variables. Finally, with regard to 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.

2.5 Empirical Results

The descriptive statistic of the variables used in the model is presented below. Also, the mean difference statistics between the municipalities (mayors) that are aligned and unaligned to the president's coalition or party, respectively, are showed following.

Table 10: Descriptive Statistics

	Coalition				Party			
Variable	**Aligned**	**Unaligned**	***t***	***p* Value**	**Aligned**	**Unaligned**	***t***	***p* Value**
Model I								
EXP	6.771	6.715	-3.796	0.000	6.786	6.724	-3.278	0.001
GDP	9.376	9.266	-4.930	0.000	9.466	9.273	-6.663	0.000
GRANT	5.870	5.826	-2.930	0.003	5.900	5.829	-3.641	0.000
Gender	0.510	0.509	-3.323	0.000	0.511	0.509	-4.777	0.000
Youth	0.259	0.260	0.849	0.395	0.253	0.261	4.035	0.000

Elderly	0.093	0.096	2.357	0.018	0.094	0.095	0.962	0.336
Dens	0.004	0.003	-5.924	0.000	0.005	0.003	-6.219	0.000
IFDM	0.672	0.661	-2.792	0.005	0.688	0.660	-5.171	0.000
Obs	1,306	2,502	-	-	608	3,200	-	-

Source: authors. Variables *per capita*, with neperian logarithm (ln) and also deflated by the General Market Price Index – Internal Availability (IGP-DI).

In the total of 3,808 municipalities, 1,306 (34%) of them are aligned to the same coalition of the president, while 2,502 (66%) are not. Concerned to parties alignment, from the total of 3,808 municipalities, 3,200 (84%) are aligned, whilst 608 (16%) are not. In both types of alignment, only the variables elderly (party) and youth (coalition) do not have means differences statistically significant. All the other variables have means differences statistically significant between parties and coalition alignments, disclosing there is difference being aligned or unaligned to the same coalition or party of the republic president, in the same sense of previous literature (Brollo & Nannicini, 2012).

The mean of GRANT received by aligned and unaligned municipalities concerning the coalition of the president are respectively 5.870 and 5.826, whilst the alignment/unalignment by parties is 5.900 and 5.829. Both cases show the means of aligned municipalities are greater than the unaligned, what means it matters being aligned and the municipalities alignment receives in mean more lump sum grants than the unaligned ones.

A correlation matrix was also calculated and a potential reason for a high correlation between the variables EXP and GDP (0.748), EXP and GRANT (0.782) and GDP and GRANT (0.780) is that the share of GRANT in Brazil is calculated directly proportional to the population and inversely to the income *per capita*, as formula showed in methodology chapter. Consequently, it also should have engendered correlation and also multicollinearity of the independent variables. Other reason is that municipalities with high GDP receives more GRANT and have more expenditures.

2.5.1 Unit Root Test Results

Concerning the existence of spurious regressions, the results of the unit root tests do not indicate first order unit root, neither second order, which allows using of the variables without any need of taking the first diference of the variables to correct this problem.

Table 11: Unit Root Tests Results

Tests	**LLC**	**IPS**	**ADF Fisher**	**PP-Fisher**	**Pesaran CD test**	**Hadri Lagrang**
H_0	Presence of unit root	Presence of unit root	Presence of unit root	Presence of unit root	Cross-section independence CD ~ N(0,1)	All panels are stationary
EXP	-0.733	-1.895	-15.129	-9.210	818.72	49.194
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP	-0.631	-1.639	-13.383	-8.145	671.00	66.024
p-value	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
GRANT	-0.893	-2.111	-21.771	-7.904	572.62	32.488
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: authors, adapted from Levin, Lin & Chu (2002).

2.5.2 Fixed or Random Effects

Following, it was analyzed the best panel model to be used and the results indicated fixed effects, as shown in the table below:

Table 12: Random x Fixed Effect Tests

Tests	**Chow test (generalized)**	**Breusch-Pagan LM**	**Hausman**
H_0	Use Pooled	Use Pooled	Use Random effects

H_1	Use Fixed Effects	Use Random effects	Use Fixed Effects
Results	F(4, 2372) = 58.54 p value = 0.0000	chibar2(01) = 1593.27 p value = 0.000	$\chi^2(10) = 66.47$ p value = 0.0000

Source: authors. Breusch & Pagan (1980); Chow (1960); Baltagi (2013).

The Hausman test ($\chi^2 = 66.47$; prob = 0,000) disclosed the fixed effect panel should be used because the parameters on the test were nulls. The Lagrange test ($x^2 = 6{,}331.95$; prob = 0,000) restate this conclusion. The fixed effect model solves possible omission of variables in the model (Baum, 2006; Baltagi, 2013). In addition, the present study considers the fixed effect model is the best fitted because the panel has short time series (8 years) and length cross-section (476 municipalities). Thereupon, by fixed effect is possible to pick up the heterogeneity among the various municipalities during the years.

2.5.3 Instrumental Variables Tests Results

Following, some tests were performed to verify the alignment (ALIG) instrumental variables of the president with the mayor (FM), the governor with the mayor (SM), and all of them, the president with the governor and with the mayor (FMSM). Both the alignment of the coalitions and the alignment of the parties of each of politicians were tested. In this same analysis, the alignment effect was evaluated whether an election year influence the amount of grants transferred to the municipalities, by the interaction of the alignment variable with the electoral year (ALIG2).

Table 13: Identified flypaper effect constitutional grants (robust) with all kinds of alignment

	Coalition				Party			
GRANT	**Coef.**	**St**	**t**	**P>t**	**Coef.**	**St**	**t**	**P>t**
GRANT_1	0.037	0.025	1.500	0.133	0.039	0.025	1.570	0.117
GRANT_2	-0.061	0.015	-4.140	0.000	-0.060	0.015	-4.100	0.000
ALIG_FM	-0.019	0.007	-2.560	0.011	0.000	0.016	0.000	0.998
ALIG2FM	0.008	0.011	0.730	0.463	0.010	0.012	0.800	0.426
ALIG_SM	-0.011	0.008	-1.330	0.183	-0.018	0.013	-1.450	0.148
ALIG2SM	0.006	0.011	0.580	0.561	-0.002	0.012	-0.180	0.856
ALIGFSM	0.014	0.012	1.190	0.234	-0.025	0.020	-1.230	0.220
ALIG2FMSM	-0.012	0.019	-0.640	0.520	0.017	0.026	0.640	0.523
GDP	0.160	0.024	6.810	0.000	0.157	0.023	6.750	0.000
Gender	1.729	1.220	1.420	0.157	1.726	1.223	1.410	0.158
Youth	-0.119	0.345	-0.340	0.730	-0.058	0.343	-0.170	0.866
Elderly	-0.060	0.497	-0.120	0.904	0.037	0.494	0.070	0.941
IFDM	-0.033	0.042	-0.780	0.434	-0.025	0.042	-0.600	0.546
year2	0.064	0.010	6.680	0.000	0.064	0.010	6.710	0.000
year3	0.062	0.021	3.030	0.002	0.069	0.021	3.250	0.001
year4	0.127	0.017	7.460	0.000	0.135	0.017	7.950	0.000
year5	0.112	0.018	6.280	0.000	0.118	0.018	6.560	0.000
year6	0.120	0.024	5.040	0.000	0.127	0.024	5.280	0.000
year7	0.207	0.024	8.510	0.000	0.209	0.024	8.580	0.000
year8	0.182	0.026	7.010	0.000	0.186	0.025	7.430	0.000

Source: authors.

Considering that only the president-mayor alignment was significant, a new regression was rerun only with these variables in the model and the other kinds of alignment were disconsidered.

Table 14: 1st stage -Identified flypaper effect constitutional grants (robust) of only president and mayor alignment

	Coalition				Party			
GRANT	**Coef.**	**St**	**t**	**P>t**	**Coef.**	**St**	**t**	**P>t**
GRANT_1	0.037	0.025	1.500	0.134	0.038	0.025	1.530	0.125

GRANT_2	-0.062	0.015	-4.140	0.000	-0.062	0.015	-4.120	0.000
ALIG_FM	-0.014	0.007	-2.090	0.037	0.000	0.016	0.000	0.998
ALIG2FM	0.004	0.009	0.430	0.666	0.011	0.011	0.980	0.326
GDP	0.159	0.023	6.800	0.000	0.158	0.023	6.760	0.000
Gender	1.737	1.225	1.420	0.156	1.728	1.228	1.410	0.159
Youth	-0.107	0.345	-0.310	0.756	-0.090	0.345	-0.260	0.795
Elderly	-0.108	0.497	-0.220	0.828	-0.067	0.495	-0.140	0.892
IFDM	-0.031	0.042	-0.730	0.465	-0.029	0.042	-0.680	0.497
year2	0.064	0.010	6.680	0.000	0.064	0.010	6.680	0.000
year3	0.064	0.021	3.120	0.002	0.068	0.021	3.290	0.001
year4	0.132	0.016	8.250	0.000	0.134	0.016	8.240	0.000
year5	0.115	0.017	6.560	0.000	0.118	0.018	6.660	0.000
year6	0.123	0.023	5.260	0.000	0.127	0.024	5.360	0.000
year7	0.210	0.024	8.640	0.000	0.208	0.024	8.680	0.000
year8	0.188	0.025	7.430	0.000	0.186	0.025	7.590	0.000

Source: authors. The dependent variable is real GRANT *per capita*. Fixed municipality and year effects are included. The overidentification test is $x^2(2)$. Standard errors are in parentheses. *N* = from 2005 to 2012.

The validation test of the instrument variables indicated regressions not unidentified, strong and valid instruments, as results shown below:

Table 15: Instrumental Variables tests on president-mayor alignment variable and lags of Grant variable

Only President-Mayor	**H_0**	**GRANT**	
		Coalition	**Party**
Sanderson-Windmeijer F test (4, 3313)	Endogenous 37fficient37is unidentified	6.14 (0.000)	4.95 (0.000)
Kleibergen-Paap rk LM – Chi-sq(4)	Matrix of reduced form coefficients has rank= K1-1 (underidentified)	20.988 (0.000)	16.64 (0.002)
Cragg-Donald		11.47	10.66
Stock-Yogo K1=1 and L1=6:			
10% maximal IV size	Equation is weakly identified	24.58	
15% maximal IV size		13.96	
20% maximal IV size		10.26	
25% maximal IV size		8.31	
Anderson-Rubin Wald F test (4,3314)		2.39 (0.049)	2.34 (0.053)
Anderson-Rubin Wald test	B1=0 and orthogonality conditions are valid	9.59 (0.048)	9.40 (0.052)
Stock-Wright LM S statistic		16.91 (0.002)	16.04 (0.003)
Hansen J statistic Chi-sq(1)	Instruments are valid	7.38 (0.060)	3.76 (0.288)

Source: authors.

With the alignment variable, its election year influence on the amount of grants transferred to the municipalities and also 2 lags of GRANT variable (instrumentalized variable), the Sanderson-Windmeijer F test rejected the null that endogenous regressor is unidentified. The Cragg-Donald test rejected the null that the equation is weakly identified at 20% maximal IV size of Stock-Yogo test, while the Anderson-Rubin did not reject the null the orthogonality conditions are valid. In conclusion, the Hansen J test did not reject the null the instruments are valid at 1% and 5% concerning coalition alignment and at more than 25% in the party alignment (p value 0.287).

Bracco *et al.* (2015) used alignment as an instrument to estimate the flypaper effect considering it is necessary to identify truly exogenous changes in intergovernmental grants as in Dahlberg *et al.* (2008). Based on the instrument variables tests results, the instruments are valid in the model. Finally, the second stage of the final regression with the valid instrumental variables generated the following results:

Table 16: 2nd stage – Identified flypaper effect constitutional grants (robust) of only president-mayor alignment

2 stage	Coalition				Party			
EXPCUR	**Coef.**	**St**	**z**	**P>z**	**Coef.**	**St**	**z**	**P>z**
GRANT	0.669	0.214	3.120	0.002	0.762	0.225	3.390	0.001
GDP	0.085	0.042	2.030	0.042	0.070	0.043	1.600	0.109
Gender	2.835	1.243	2.280	0.023	2.663	1.268	2.100	0.036
Youth	-0.786	0.440	-1.790	0.074	-0.780	0.446	-1.750	0.080
Elderly	-1.734	0.486	-3.570	0.000	-1.732	0.501	-3.460	0.001
IFDM	0.000	0.078	0.000	0.999	0.003	0.079	0.040	0.968
year2	0.054	0.013	4.220	0.000	0.049	0.013	3.670	0.000
year3	0.083	0.024	3.480	0.001	0.076	0.025	3.090	0.002
year4	0.100	0.033	2.980	0.003	0.086	0.035	2.470	0.014
year5	0.214	0.031	6.910	0.000	0.203	0.032	6.240	0.000
year6	0.229	0.037	6.110	0.000	0.217	0.039	5.570	0.000
year7	0.242	0.049	4.880	0.000	0.222	0.052	4.290	0.000
year8	0.290	0.047	6.200	0.000	0.272	0.049	5.550	0.000

Source: authors. The dependent variable is real current expenditure *per capita*. Fixed municipality and year effects are included. The overidentification test is $x^2(2)$. Standard errors are in parentheses. *N* = from 2005 to 2012.

The GRANT variable is statistically significant at 1% and the coefficient is 0.668, while the GDP variable is significant at 5% and the coefficient is 0.086, which means the impact of GRANT increase on the expenditure is 8.5 times greater than the increase of GDP, evidence of a strong flypaper effect in the case of alignment of the same coalition. Concerned to party alignment, GRANT is statistically significant at 1% and the coefficient is 0.763, while GDP is not significant at 10% and coefficient is 0.070. According to the literature (Saruc & Sagbas, 2008, Courant et at. 1979), these results indicate flypaper effect ($\beta2 > \beta1$) and substitution effect or GRANT displacement effect ($\beta2 < 1$). The results allow concluding that the flypaper effect exists in Brazilian municipalities and is intensified or justified by the alignment of the representatives in the same way of theoretical literature (Hamilton, 1983; Inman, 2008) and previous empirical studies in Brazil (Rios & Costa, 2013).

Finally, considering the same analysis of the previous tables, but considering not only constitutional grants (FPM, ITR, IOF, ICMS, IPVA and IPIexp), but also the legal grants resulted from the Complementary Law 87/96. Therefore, the results were similar.

One of the reasons of the huge flypaper effect observed is the fact that mandatory constitutional grants are well tied to the tax share formula that is directly proportional to the population and inversely proportional to income *per capita*. The present study analyzed the mandatory lump sum grants, which are already previously defined in the shared calculations. Some studies identified the flypaper effect by analyzing discretionary grants as a dependent variable, which are actually more volatile and susceptible to variations over the year (Brollo & Nannicini, 2012). If these transfers were analyzed in the present model, the results could be even stronger.

Another reason is that municipalities maybe do not have margin to manage tax's matters, because they have already reached the limit of the tax constraint and cannot expand tax base or tax rate of their taxes (ISS, IPTU and ITBI). Although the municipalities have tax autonomy of some taxes, the Union establishes maximum and minimum rates and other rules, which tight municipalities' hands to expand taxation. In conclusion, everything they receive of lump sum grants is simply spent, without any possibility of tax reduction as stated by the theory, and that is why flypaper is so representative.

The main contribution of the study was the use of the alignment variables as instruments to identify and measure flypaper effect. Evaluating the reasons of so huge flypaper effect is also an innovation, as there is a need for fundamental restructuring of Brazilian taxation and its sharing. This fact is much discussed in Brazil, especially in the various attempts at tax reform

in the Chamber of Deputies and in the Federal Senate (PEC 293/04). However, it is noticed that fundamental aspects are not being discussed in depth, as they are by papers as Mendes *et al.* (2008). Therefore, reform is necessary, but it must be carried out deeply since the basis of taxation theory.

Possible alternatives may adopt other forms of distribution rather than being simply directly proportional to population and inversely proportional to GDP. An efficiency tax index could be created and drive the distribution proportionally to it, or also an autonomy tax index which measure the effort of municipalities' taxation, in a sense that stimulates those municipalities that they can act more autonomously according to the tax base they have available. Finally, it is possible to allocate resources in proportion to a social efficiency index, if it is possible to establish reliable indexes for this purpose.

Unfortunately, Brazil cannot answer whether resources are being transferred to the places that admittedly need them or optimize their application. What happens is a mere sharing of resources and a simple mathematical logic, without considering clear economic or social purposes. Is it true that the most populated municipalities do need more grants? Do those who generate less income (GDP) need fewer grants? It is a generalized calculation, without considering deeper economic and social aspects in detail.

In this way, is accountability really happening? There are many problems, as the data availability, why the sample had to be restricted due to the lack of reliability of the data provided by the National Treasury. Although significant advances have occurred since the implementation of the Integrated System of the Federal Government Financial Administration (Siafi) in 1987, like Finbra and Accounting and Tax Information System of the Brazilian Public Sector (Siconfi), there is a lack of data available and mainly lack of analyses of how the grants are being spread and what exactly the outcomes they are causing.

2.6 Conclusions

Fiscal federalism is the decentralization of competencies to subnational entities which have the tax jurisdiction of certain taxes and also competencies to provide goods and services to local communities with autonomy and non-sovereignty. Recent studies on analytic fiscal illusion (Baekgaard *et al.*, 2016) examined their influence on the government expenditure cycle (Abbott & Jones, 2016), their relationship with budget (Gérard & Ngangué, 2015), transparency (Afonso 2014) and a possibility of raising fees or taxes due to illusion (Ross & Yan, 2013). Furthermore, the flypaper effect concept is based on empirical evidence that grants transferred from one government level to another tend to "stick" with the recipient being used for service provision and is not passed on to taxpayers in the form of lower taxes (Ahmad & Craig, 1997). Consequently, the grant leads to a higher level of service provision than would be the case if the payment was made directly to individuals.

In Brazil, this process was consolidated with the Federal Constitution of 1988. However, this type of state organization can create two phenomena: fiscal illusion and flypaper effect. Considering there are many unconditional and nonmatching grants (lump sum) in Brazil, the research problem of the present study was if unconditional and nonmatching (lump sum) grants, structured according to constitutional fiscal decentralization, cause fiscal illusion and flypaper effect in Brazil.

To answer the proposed problem, the main objective of the research was to verify if grants derived from fiscal decentralization in public resource cause fiscal illusion and flypaper effect in the Brazilian municipalities and to verify whether federal financial statements and systems exercise an important role in decision-making on resource allocations.

Based on the data and analyzes carried out, the GRANT variable is statistically significant at 1% and the coefficient is 0.668, while the GDP variable is significant at 5% and the coefficient is 0.086, what means the impact of Grant increase on the expenditure is 8.5 times

greater than the increase of GDP, evidence of a strong flypaper effect in the case of alignment of the same coalition. Concerned to party alignment, Grant is statistically significant at 1% and the coefficient is 0.763, while GDP is not significant at 10% and coefficient is 0.070. According to the literature (Saruc & Sagbas, 2008; Courant *et al.*, 1979), these results indicate flypaper effect ($\beta 2 > \beta 1$) and substitution effect or Grant displacement effect ($\beta 2 < 1$). The results allow concluding the flypaper effect exists in Brazilian municipalities and is intensified or justified by the alignment of the representatives in the same way of theoretical literature (Hamilton, 1983; Inman, 2008) and previous empirical studies in Brazil (Rios & Costa, 2013).

In this sense, the high flypaper (more than 8 times: 0.668 / 0.08) is an economic problem that has relation to the financial decision making. The money sticks where it hits because municipalities do not have margin to expand taxes. Therefore, the theory that lump sum grants should represent a reduction in the tax collection of citizens is not applicable, since municipalities are already constrained and at the limit of tax expansion.

The current criteria for transfer distribution generate a group of overfunded municipalities (Mendes, 2002), which is confirmed by Firjan (2018) survey against the increase of the number of municipalities in Brazil. In addition, the flypaper effect can lead to a trend of excessive spending, deteriorating more the fiscal situation of municipalities (Giuberti, 2005; Macedo & Corbari, 2009).

The main contribution of the study is to show that political alignment continues to be an important characteristic in the Brazilian fiscal federalism, even with strict formulas to distribute grants from the federal level to the local levels. Furthermore, the dependency level of the municipalities on the grants sent by the Federal and State levels continues to be high and present in Brazilian municipalities.

It is necessary to rethink the grant distribution system in Brazil, which was detailed done by Mendes *et al.* (2008). According to the authors, the first thing is to reduce the total amount transferred by the FPM grant, because unconditional transfers, even under the best distribution criteria, induce the flypaper effect and adversely impact accountability, fiscal responsibility, and efficient management. An alternative could be the piggyback in state and federal taxes, added to discounting payment agreements of state and federal taxes of an amount of what was already paid to the municipality. This cooperative action would stimulate consumers to claim receipts, creating an automatic inspection, increasing local revenue, and reducing the need for unconditional and nonmatching grants.

The lack of continuous data over time of socioeconomic characteristics of society, such as private income, education level, employment, family economic stability and propensity to spend on public goods can be a substantial cause of the flypaper effect (Parmagnani & Rocha, 2013). Future studies may try to address this issue, deepen the IBGE and Institute for Applied Economic Research (IPEA) databases and enable balanced panel analysis. Another thing that may have to be done with this aspect is the debt of the municipalities, as it continuously increases every day.

Future studies may consider public security spending as a proxy for the most violent municipalities, given that some authors use the municipality level of violence as a control variable because the most violent ones must spend more on public safety. In addition, other control variables can be considered, as high spending municipalities (Hines & Thaler, 1995; Megdal, 1987), socioeconomic characteristics of society, such as private income, education level, employment, family stability (Hamilton, 1983) and dummy if there was a cut in the grants for the period previous or not (Heyndels, 2001). Finally, the Brazilian states one can be analyzed, because if they have more tax margin to act (ICMS, IPVA and ITCMD), it means more autonomy and consequently the flypaper effect should be smaller than in the municipalities, considering they do not depend so much on Federal grants.

3. THE MARGINAL COST OF PUBLIC FUNDS AND THE FLYPAPER EFFECT: EVIDENCE FROM BRAZILIAN MUNICIPALITIES

Abstract

The flypaper effect is the empirical anomaly that intergovernmental grants are transformed by recipient authorities into public expenditures at a significantly higher rate than the local private resources. The objective of this research is to detect the existence and investigate the causes of the flypaper effect in the Brazilian federation. Panel data evidence of 5,568 Brazilian municipalities from 2006 to 2013 indicates the presence of a substantial flypaper effect, with an estimated impact of federal grants on municipal public expenditures that is far greater than the impact of private resources. Using the elasticity of the tax base with respect to the municipalities' tax rates as a proxy of the marginal cost of public funds (MCF), we find evidence in support to the Dahlby (2011) hypothesis of a role of the distortionary nature of local taxation in the emergence of the flypaper effect.

Keywords*:* Brazilian municipalities; grants; flypaper effect; marginal cost of public funds.

JEL: C33; H77; H72.

3.1 Introduction

The flypaper effect is the empirical phenomenon by which the receipt of unconditional lump-sum grants results in a stronger response of local public expenditure than an equivalent increase in personal income would provoke (Hines & Thaler, 1995). In a sense, grants stick with the recipient government and fuel service provider instead of being passed on to taxpayers in the form of lower taxes (Ahmad & Craig, 1997). Consequently, grant increases lead to a higher level of service provision than would be the case if the payment was made directly to taxpayers through lower federal income taxes.

This paper first investigates whether there is evidence of a flypaper effect in the Brazilian federation. To do so, we study the impact on municipal expenditures of several unconditional and nonmatching grants that should, in principle, be perceived as analogous to private income increases and compare their impact to changes in private resources proxied by Gross Domestic Product (GDP). Indeed, we are not the first to study the flypaper effect in the Brazilian context. However, in spite of a large literature on this topic (Mattos, Cardim & Politi, 2018; Mattos, Rocha & Arvate, 2011; Mendes, 2005; Parmagnani & Rocha, 2013; Sakurai & Menezes-Filho, 2011), there is still no conclusive evidence on the size of the flypaper effect in Brazil, and especially on its causes.

This paper aims to add to that literature and shed light on the issue by exploring the possible causes of the high response of municipal spending to grants. Addressing those issues is of high policy relevance, considering that Brazilian fiscal federalism is facing increasing difficulties in the twenty-first century. Due to the instability experienced by Brazil as a result of the economic recession, the fall in tax revenues, and frequent political crises, this research aims to contribute to the design of fiscal federalism reforms that can mitigate those problems.

In particular, we first test the hypothesis that the flypaper effect is due to grant endogeneity, and, following the existing literature, we build instrumental variables for grants based on the Firjan index and the lag of the grants received by the municipalities (Hayashi & Boadway, 2001; Avelino, Bressan & Cunha, 2013; Postali, 2015; Caetano, Avila & Tavares, 2017; Mendes *et al.*, 2018).

Next, after ruling out that grant endogeneity is the cause of the flypaper effect, we test the hypothesis that lump-sum grants generate in reality a price effect in addition to the income

effect when recipient governments use distortionary taxation to fund local public spending – an early intuition by Hamilton (1986) that has recently been formally deepened by Dahlby (2011). The underlying mechanism is that a lump-sum transfer to a subnational government allows it in principle to reduce the tax rates on the own distortionary sources of revenues and keep on providing the same level of services as it did before the transfer. This implies that, at the new equilibrium with lower own tax rates, and as long as those revenue sources are indeed distortionary, the marginal cost of public funds (MCF) is lower and so is the effective price of providing public services, so that even lump-sum grants will generate a substitution effect by changing the price of public services. In addition, the substitution effect of a lump-sum grant will be larger when the grant-recipient government's MCF is higher. Empirically, we use the elasticity of the tax base as a proxy of a municipality's MCF and find support to the hypothesis that the distortionary nature of local taxation contributes to explaining the flypaper effect.

The rest of this work is structured as follows. Section two discusses the existing evidence on the flypaper effect. Section three presents Brazil's institutional and fiscal structure. Section four develops the econometric model, Section five reports and discusses the estimation results, and Section six concludes.

3.2 Grants, Local Expenditures, and the Flypaper Effect

The flypaper effect arises when a dollar of exogenous grant-in-aid leads to significantly higher public spending than an equivalent dollar of citizen income, going against the theory that establishes that nonmatching grants should "have an effect on local spending similar to that of any other change in private income in the community" (Courant *et al.*, 1979). Hence, "there is a significantly higher propensity for recipients to increase public expenditure in response to lump-sum grants than in response to equivalent increases in private income" (Oates, 1988).

Considering the following baseline model in equation (6), where local expenditure (*Exp*) is the dependent variable and *Grant* and *GDP* are the independent variables (possibly along with a set of exogenous controls), the coefficient of lump-sum grants (β_2) should be of the same size as the coefficient on private resources, measured by *GDP* or disposable income (β_1):

$$Exp = \beta_0 + \beta_1 GDP + \beta_2 Grant + x_{it}'\delta + \mu \quad (6)$$

where *Exp* is current expenditures, *GDP* is Gross Domestic Product, *Grant* is nonmatching and unconditional (lump-sum) transfers received, x_{it} is a vector of control variables discussed below, and μ is the random disturbance term. If the two estimated coefficients turn out to be different, and in particular if $\beta_2 > \beta_1$, grants have an excess expansionary effect on local public expenditure than own resources (Courant *et al.*, 1979). In particular, the evidence from the estimation of equation (6) can be conveniently summarized in the following way (Sagbas & Saruc, 2004) according to Table 1.

Several explanations have been offered for the emergence of the flypaper effect. Courant *et al.* (1979) argue that "bureaucrats and politicians find it easier to avoid cutting taxes when the government receives revenue-sharing monies than they do to raise taxes when some exogenous event raises the income of the community." In addition, the flypaper effect may occur due to inadequate econometric procedures in measuring elasticities (Hines and Thaler 1995), or it could be the case that governors do not respond to the median voter (rejection of the hypothesis that governors respond to the median voter).

Vegh and Vuletin (2015) summarize the numerous possible reasons for the emergence of the flypaper effect into five groups. First, non-fungible conditional transfers are often misclassified as unconditional ones. Second, omitted variables in a model (for example, equation 6) could create the flypaper effect (Hamilton, 1983). Third, the citizen confuses the income effect generated by unconditional transfers with a price effect that reduces the average

effective cost of public spending (Courant *et al.*, 1979), since he is not fully informed and fails to see the public budget (Filimon, Romer & Rosenthal, 1982) or he might not behave completely rationally (Hines & Thaler, 1995). Fourth, some authors have pointed to the role that inefficient political institutions have in revealing citizens' preferences (Chernick, 1979; Knight, 2002; Roemer & Silvestre, 2002) or, as we discuss extensively in section four, to the deadweight loss from distortionary taxation (Hamilton, 1986; Dahlby, 2011).

Besides these five reasons, Vegh and Vuletin (2015) provided an additional explanation for the flypaper effect based on precautionary savings. They argue that an increase in grants raises the variance of total income by less than an increase in private income. Consequently, the amount of additional precautionary savings on local governments is lower in response to the increase in grants, and the increase in public spending is correspondingly higher. Based on data from Argentinean provinces, Vegh and Vuletin (2015) found evidence that the flypaper effect was a decreasing function of the correlation between fiscal transfers and private income, and this relationship should become stronger the higher is the volatility of transfers and private income.

Empirically, many studies on a diverse set of countries found that nonmatching grants stimulate local spending per dollar more than does income going to private citizens within the community (Gramlich & Galper, 1973; Gramlich, 1977; Wyckoff, 1991; Strumpf, 1998). As far as Brazil is concerned, the evidence on the size of the flypaper effect, and especially on its causes, is far from conclusive (Mattos, Rocha & Arvate 2011; Mendes 2005; Parmagnani & Rocha, 2013). Amongst the most recent studies, Vegh and Vuletin (2016) find the size of the flypaper effect to be larger, the lower is the elasticity of substitution between private and public spending. In contrast, Mattos, Rocha and Arvate (2011) find that higher transfers from the federal government induce less efficiency in local tax collection as compared to increases in private income. Finally, Mattos, Cardim and Politi (2018) test the hypothesis that lump-sum intergovernmental grants have both an income effect and a price effect that arises from the fact that grants reduce the MCF. Using data on Brazilian municipalities from 2006 to 2012, they find only limited evidence that grants push down the MCF in a significant way, with the effect being more substantial in larger cities where the distortionary impact of taxation is higher.

3.3 Fiscal Federalism in Brazil

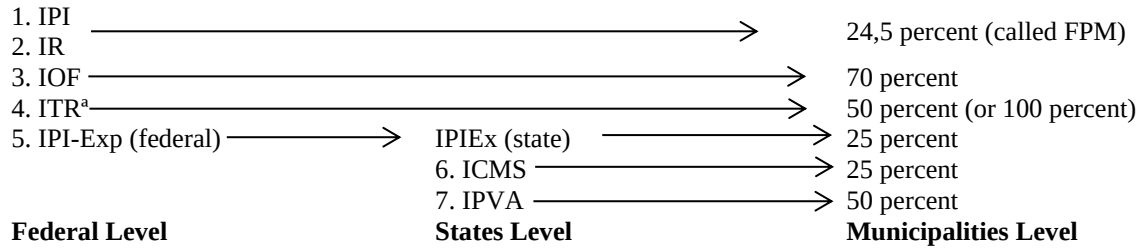
The Federal level collects most of the taxes, while the states and municipalities collect the taxes of their tax jurisdiction. From the total net revenue of Income Tax (IR) and Federal Value-Added Tax or Excise Tax on Manufactured Goods (IPI) taxes, the federal level transfers 23.5 percent to the 5,568 municipalities constituting the Municipal Participation Fund (FPM). The FPM's calculation is directly proportional to the population of the municipality and inversely proportional to its income *per capita*, according to the following equation:

$$FPM_{it} = f(\mathrm{POP}_{i(t-1)}, \frac{1}{Income\ per\ capita_{i(t-2)}}) \quad (7)$$

where *POP* is the population of the municipality *I* in the prior year *(t*-1*)* and income *per capita* is the income of the state of the municipality *I* two years before *(t*-2*)* because of the availability of data (IBGE 2018). Shah (1994) highlights the principal merit of the *FPM* is its consistent design with objectives of transparency, predictability and local autonomy. Although it addresses some fiscal equalization objectives, it also has design flaws. Therefore income *per capita* is an imperfect guide to the government's ability in raising taxes, considering that a significant proportion of income can be related to nonresident owners of factors of production.

The other nonmatching and unconditional (lump-sum) transfers and the percentages to municipalities are shown in Figure 2.

Figure 2: Federal and State Grants to States and Municipalities in Brazil



Source: Authors. Federal Value-Added Tax or Excise Tax on Manufactured Goods (IPI), Income Tax (IR), Financial Transactions Tax (IOF), Rural Property Tax (ITR), Federal Value-Added Tax or Excise Tax on Manufactured Goods destined to exportation (IPI-Exp), Tax on Circulation of Goods and Services (ICMS), Motor Vehicle Tax (IPVA), Municipal Participation Fund (FPM). [a] Municipalities that help tax collection and supervision receive 100 percent of the ITR collection.

While there are six main lump-sum grants that municipalities receive from federal (FPM, IOF and ITR) and state (IPIEx, ICMS and IPVA) levels, FPM is the main one and represents the greatest part of total grants, almost sixty three percent of the total (Appendix 2), and is the most widely employed in the literature (Sakurai, 2013; Vegh & Vuletin, 2016; Araujo & Siqueira, 2016; Mattos, Cardim & Politi, 2018).

3.3.1 MCF

It is important to analyze the MCF in the context of the flypaper because its isolated study can lead to erroneous conclusions. Several authors did this analysis by robust studies (Akai & Sakata, 2002; Dahlby & Ferede, 2016; Habibi *et al.*, 2003; Martinez-Vazquez & Timofeev, 2009; Oates, 1972). Some author's explanations of the flypaper effect are directly or indirectly based on the MCF (Aragón, 2013; Dahlby, 2011; Hamilton, 1986).

Initially, the concept of marginal cost of fund (MCF) is broadly described by Dahlby (2008). In summary, it measures the loss incurred by society in raising additional revenues to finance government spending. The flypaper effect can be obtained when the MCF is greater than one and non-decreasing in the tax rate (Sepúlveda, 2017).

There are many ways to calculate MCF (Dahlby, 2008). However, many estimates are not comparable, because there are many definitions of the same concept (Auriol & Warlters, 2012) and those who review theoretically the works show the diversity of estimates (Ballard & Fullerton, 1992; Dahlby, 2008). Some MCF's works are shown below:

Table 17: Previous Studies

Author	MCF Proxy
Hamilton (1986)	Intergovernmental transfers can stimulate public expenditures more than income increases because they normally lead to a greater reduction in the marginal cost of public funds (MCF).
Dahlby (2011)	Grants can reduce the cost of taxation for local governments through a change in the MCF. Lump-sum grants allow the recipient government to reduce its tax rate, which in turn, decreases the MCF in order to keep the same level of public service.
Auriol and Warlters (2012)	MCF = $-\Delta W/\Delta R$, where ΔW is a monetary measure of the change in social welfare and ΔR is the change in tax revenue arising from a marginal change in a tax instrument. The estimated MCF in Africa is 1.21.
Aragón (2013)	The flypaper effect is obtained when the marginal (administrative) cost of tax collections increases with the tax rate.
Végh and Vuletin (2016)	For Argentinean provinces and Brazilian states, there is a positive association between the size of the flypaper effect and the level of the tax rate. Moreover, the flypaper effect should be larger the lower the elasticity of substitution between private and public spending and, in fact, should vanish for very high degrees of substitution.
Dahlby and Ferede (2016)	$MCF_{it} = S_{it}/(S_{it}+\tau_{it}.\eta)$, where Sit is the share of total tax revenue from personal income tax base for province *I* in year *t*, τ_{it} is the personal income tax rate for province *I* in year *t* and η is the uniquely estimated semi-elasticity of the personal income tax base with respect to

	personal income tax rate.
Sepúlveda (2017)	Fypaper effect can be explained as an optimal decision of a benevolent and 45fficient government constrained by taxpayers' responses to taxation. The MCF does not need to change with transfers to produce the flypaper effect. It can be constant but needs to be greater than one. The simple underlying explanation for the flypaper effect is that public expenditures are cheaper when financed with transfers than when financed with income.
Mattos, Cardim and Politi (2018)	For Local Governments in Brazil, an increase in R$ 1.00 in *per capita* unconditional transfers reduces the local price effect (MCF) around 0.07%.

Source: authors. According to Dahlby (2011), benevolent local governments financing its expenditures with a distortionary tax predict flypaper effects, because lump-sum intergovernmental transfer has a "price effect" and an "income effect. Thus, these grants allow recipient governments to reduce its tax rate, which lowers its marginal cost of public funds, while can provide the same level of public service. "The reduction in the effective price of providing the public service helps to explain the flypaper effect" (Dahlby, 2011).

Sepúlveda (2017) support the flypaper effect can be obtained when the MCF is greater than one and non-decreasing in the tax rate. The reason is because an amount of income is lost before being made available to the government, while the same amount of transfers is readily available without costs. Hence, the flypaper effect does not require the MCF to be increasing in the tax rate (Dahlby, 2011; Dahlby & Ferede, 2016; Hamilton, 1986). Besides, the flypaper effect can be obtained with a constant greater than one MCF.

Dahlby and Ferede (2016) tested the hypothesis that the stimulative effects of intergovernmental grants increase with the marginal cost of public funds of the recipient government in Canadian provinces. The results indicate that the stimulative effects of lump-sum grants on spending increase with the provincial government's marginal cost of public funds (MCF). Mattos, Cardim and Politi (2018) document empirical evidence on price-effect caused by lump sum grants for Brazilian municipalities from 2006 to 2010 and found that an increase in R$ 1.00 in *per capita* unconditional transfers reduces the local price effect (marginal cost of fund – MCF) around 0.07%.

Considering the MCF is often calculated by the tax rate, in Brazil is very difficult to take a single tax rate or the median of them, because there are many types of taxes and many tax rates. To exemplify, Ferreira, Serrano and Revelli (2019b) show the States Participation Fund (FPE), which is a percentage of 48% of the total of two Federal taxes: Income tax (IR) and Federal value added tax or excise tax on manufactured goods (IPI). Moreover, the states receive four more grants from Federal level: Residual taxes, Financial Transactions tax (IOF), Contribution of Intervention in the Economic Domain on fuels (CIDE) and Federal value-added tax or excise tax on manufactured goods on exportation (IPI-Exp).

Each of these taxes has different tax rates, considering the particular situations, the taxpayer conditions and particular exceptions (Lanzer, 2011). For example, companies can pay 15% or 25% of Income tax (IR), depending on how much is the year earnings. The employees can pay four tax rates (7,5%; 15%; 22,5%; and 27,5%), depending on the tax base of each employee. Thereupon, it's hard to stablish a tax rate to a Brazilian state, for example.

3.4 Empirical Work

3.4.1 Data

We use panel data of 5,568 municipalities from 2006 to 2013. The dataset does not include those municipalities that did not declare information to the National Treasury or lack basic information about current expenditure, population, *GDP* or grants. Current expenditure and grant data were obtained from Finbra's Finance System. *GDP* and population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE) database (IBGE 2018) and the Firjan Index of Municipal Development (IFDM) from the Federation of Industries of the State of Rio de Janeiro (Firjan System). Unlike paper 1 (Chapter 2), this paper deals with

all Brazilian municipalities because data are available and there were not control variables limitations.

3.4.2 Variables

We use current expenditure as the dependent variable, and municipal *GDP* as a proxy for private disposable income. The *Grant* variable includes only the federal grant *FPM*, as discussed in section three. All monetary variables (*Exp*, *GDP* and *Grant*) are expressed in *per capita* terms, and are deflated by the General Market Price Index – Internal Availability (IGP-DI), an index which is made of the arithmetic weighted average of the Broad Producer Price Index (IPA), the Consumer Price Index (IPC) and the National Construction Cost Index (INCC). The descriptive statistics of the variables used in the analysis are shown in Table 18.

Table 18: Descriptive Statistics

Variable	Description	Source	Obs	Mean	Std.Dev.	Min	Max
Exp	Current expenditure	Finbra dataset	44,560	664.396	483.078	0	66,463.38
GDP	Gross Domestic Product	IBGE	44,560	5,437.665	6,508.541	0.000	299,501.300
Grant	Fund Municipality Fund	National Treasury	44,560	262.229	190.622	0.000	2,415.940
IFDM	Firjan Index of Municipal Development	The Federation of Industries of the State of Rio de Janeiro (Firjan System)	44,057	0.482	0.137	0.080	0.900
Autonomous Index	Autonomous Index calculated as: (ISS+IPTU+ITBI Revenues) ÷ Total Revenues	Authors	43,242	0.045	0.052	0.080	0.900
ISS revenue	Revenue of municipal tax on general services (ISS)	Finbra dataset	43,529	5,423,100	111mi	-	10,1bi
Payroll costs for firms in the service sector	Total payroll costs for firms in the service sector	Cadastro Central de Empresas	44,514	159mi	2.76bi	2,000	239 bi
Firms	Number of firms in the service sector	Cadastro Central de Empresas	44,524	876	8,089	1	578,990
Tax rate	Tax rate (ISS revenue/ payroll costs)	Authors, based on (Mattos, Cardim and Politi 2018)	43,522	0	0	-	41
MCF	Marginal Cost of Public Fund	Authors	44,560	1.739	2.186	-6.290	12.837

Source: authors. Exp: Current Expenditure. GDP: Gross Domestic Product. Grant: federal grant Municipal Participation Fund. IFDM: Firjan Index of Municipal Development. ISS is the municipal tax on general services, called Tax on Services (ISS). IPTU is the municipal tax on urban properties, called Urban Property Tax (IPTU). ITBI is the municipality tax transfer of real estate "inter vivos". MCF is the marginal cost of public funds. All monetary variables are *per capita*, with neperian logarithm (ln) and deflated to 2005 by the General Market Price Index – Internal Availability (IGP-DI). Mi: millions in reais (R$). Bi: billions in reais (R$).

The *IFDM* index is available only up to the year 2013, so the final panel dataset is from 2006 to 2013. The expected results on the signs of the variable's coefficients, according to the existing literature, are illustrated in Table 19.

Table 19: Variables

Variable	Previous Literature	Expected Results
Exp	(Gramlich, 1977; Hamilton, 1983; Wyckoff, 1988; Hines & Thaler, 1995; Gamkhar & Oates, 1996; Strumpf, 1998; Heyndels, 2001; Levaggi & Zanola 2003; Bae & Feiock, 2004; Sagbas & Saruc, 2004; Mendes, 2005; Mendes & Sousa, 2006; Lago-Peñas, 2008; Inman, 2008; Parmagnani & Rocha, 2013; Vegh & Vuletin, 2016).	Dependent Variable
Grant	(Gramlich, 1977; Courant *et al.*, 1979; Islam & Choudhury, 1990; Heyndels, 2001; Sagbas & Saruc, 2004; Inman, 2008; Marconi *et al.*, 2009; Mattos, Rocha & Arvate, 2011; Brollo & Nannicini, 2012; Vegh & Vuletin, 2016).	+ > GDP coefficient
GDP	(Gramlich, 1977; Courant *et al.*, 1979; Heyndels, 2001; Sagbas & Saruc, 2004).	+ < Grant coefficient
IFDM	(Avelino, Bressan & Cunha, 2013; Cruz & Mereb, 2018; Mattos, Cardim & Politi, 2018)	+

Source: authors. Exp: Current Expenditure. GDP: Gross Domestic Product. Grant: federal grant Municipal Participation Fund. IFDM: Firjan Index of Municipal Development.

3.4.3 Instrumental Variables

To investigate the response of local expenditures to internal and external revenue sources specified in equation (6), we allow Grant to be an endogenous regressor on the panel dataset of Brazilian municipalities. For this reason, equation (8) provides the first-stage regression for an instrumental variable (IV) approach using the Firjan Index of Municipal Development and lags of grants as instruments:

$$Grant_{it} = \gamma_0 + \gamma_1 IFDM_{it} + \gamma_2 Grant_{i(t-1)} + \gamma_3 Grant_{i(t-2)} + x'_{it}\theta + \epsilon_{it} \qquad (8)$$

where $Grant_{it}$ is nonmatching and unconditional (lump-sum) transfers to municipality *I* in year *t* (*FPM* federal transfers). *IFDM* is the Firjan Index of Municipal Development of the municipality *I* in year *t*, and ranges from zero to one. It is attributed to each municipality according to its characteristics in terms of employment, income, health, and education. The Federation of Industries of the State of Rio de Janeiro (Firjan System) created the *IFDM* based on a qualitative evaluation of structural municipal dimensions that can be considered exogenous with respect to local governments' fiscal policies (Appendix 3).

As one should expect, the *IFDM* index is negatively correlated with grants and positively correlated with GDP (Appendix 4). However, the index has substantial cross-sectional variation, and some municipalities have low *GDP per capita* and receive relatively few grants, but are well ranked in the index, as seen by the top 10 best and worst *IFDM* in 2013 (Appendix 5). The way it is constructed, and its sample distribution make the index a potentially valid and powerful instrument for grants. As shown in equation (3), we use one-year and two-years lags of grants along with the *IFDM* index as instruments for current grants and test their joint performance as instrumental variables in the next section.

3.4.4 MCF Specification

If evidence of $\beta_1 < \beta_2$ from equation (6) might be compatible with several explanations, we test the hypothesis that lump-sum grants generate in reality a price effect in addition to the income effect when recipient governments use distortionary taxation to fund local public spending – an early intuition by Hamilton (1986) that has been later formalized by Dahlby (2011).

The underlying mechanism is that a lump-sum transfer to a subnational government allows it in principle to reduce the tax rates on the own distortionary sources of revenues and keep on providing the same level of services as it did before the transfer. At the new equilibrium with lower own tax rates, and as long as those revenue sources are indeed distortionary (for example, the elasticity of the tax base concerning tax rate is not equal to zero), the MCF is lower and so is the valid price of providing public services.

Dahlby (2011) shows that the substitution effect of a lump-sum grant will be larger when the grant-recipient government's MCF is higher. Numerical simulations based on plausible values of the key model parameters (marginal utility of income, MCF, share of subnational taxes on residents' income, tax base elasticity) suggest that the effect of a lump-sum grant on spending would be up to five times larger than the effect of a local private income increase.

To test the hypothesis that the stimulative effect of lump-sum grants on spending increases with the provincial government's MCF, we use as a proxy the elasticity of the tax base to the tax rate. Based on Dahlby (2011) and Mattos, Cardim and Politi (2018), we assume that the tax base B_{it} depends only on the local tax rate τ_{it}. Consequently, the MCF can be proxied by:

$$MCF_{it} = \frac{1}{1+\tau_{it}\frac{\partial lnB_{it}}{\partial ln\tau_{it}}} \quad (9)$$

Unfortunately, and similar to earlier studies (Hokonsen 1998), no data are available for the tax bases of each municipality from the period that we analyze. However, several proxies can be calculated for the MCF (Dahlby, 2008). In particular, we use the natural logarithm of the number of service sector firms as a proxy for the tax base (*B*) and the ratio between local tax revenues on services (*ISS*) and annual firms' labor costs (payroll expenses) as a proxy for the tax rate (Hayashi & Boadway, 2001; Mattos, Cardim & Politi, 2018).

Then, to test that hypothesis that the MCF has an impact on the effect of grants on expenditures (Dahlby & Ferede, 2016), we estimate equation (10):

$$Exp_{it} = \beta_1 Grant_{it} + \beta_2 GDP_{it} + \beta_3 MCF_{it} + \beta_4 (MCF * Grant_{it}) + \boldsymbol{x}_{it}'\boldsymbol{\delta} + \epsilon_{it} \quad (10)$$

where MCF_{it} is the marginal cost of public funds of municipality *I* in year *t*. If the *MCF* in a locality has an impact on the effect of grants on expenditures, we should expect the estimated coefficient β_3 to be different from zero. In particular, $\beta_3 > 0$ shows that a higher *MCF* makes local public expenditures more responsive to grants.

3.5 Estimation Results

3.5.1 Instrumental variables estimation results

Table 20 reports the results of estimation of equations (6) and (8), where grants are instrumented by *IFDM* and lags of grants. The F tests do not reveal a problem of weak instruments. The results show that *Grant* is statistically significant at 1 percent level both in the pooled (column 1) and in the fixed effects specification (column 2), and with a coefficient that is greater than 1, while the *GDP* variable is close to zero, pointing to a far larger impact on local expenditures of a change in grants than of an increase in local resources.

Table 20: Flypaper effect estimates from 2006 to 2013. Dependent variable: Current expenditure (Exp)

Variable			1st Stage	2nd Stage			
	Pooled (1)	FE (2)	All	All	Pop<3k	Pop<50k	Pop>50k
GDP	0.023***	0.009***		0.009***	0.003	0.009***	0.010***
	(0.001)	(0.001)		(0.001)	(0.005)	(0.529)	(0.002)
Grant	1.180***	1.201***		1.017**	1.256	0.992*	9.129*

	(0.010)	(0.077)		(0.512)	(0.850)	(0.529)	(4.188)
Dummies years	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instruments							
IFDM	227.10***	61.631**	14.693***				
	(27.920)	(28.214)	(2.608)				
$Grant_{t-1}$	-0.062***	-0.064	0.078***				
	(0.007)	(0.060)	(0.007)				
$Grant_{t-2}$	-0.057***	-0.039	0.073***				
	(0.006)	(0.062)	(0.008)				
Mun. FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors	Robust	Robust	Robust	Robust	Robust	Robust	Robust
Obs	44,057	44,057	44,056	44,056	3,579	38,817	5,239
Mun	-	5,564	5563	5563	452	4,908	655
R^2	0.336	0.550	-	0.050	0.102	0.045	0.178
F(12,44044)	2832.07***						
F(12,5563)		820.09***					
F(3,38482)			85.80***				
F(9,38484)				597.65***			
F(9,3118)					110.19***		
F(9,33900)						472.96***	
F(9,4575)							294.53***
J-test	-	-	-	4.812*	0.350	4.129	0.029

Source: authors. Robust standard errors are in parentheses. Mun: Municipalities. FE: Fixed Effects. OLS: ordinary least squares. GDP: Gross Domestic Product. Grant: federal grant Municipal Participation Fund. IFDM: Firjan Index of Municipal Development. *N* = from 2006 to 2013. ****p*< .01; ***p*< .05; **p*< .1. As IFDM is available only up to the year 2013, the reason why the data is up to this year. The OLS coefficient is similar to the results found in the relevant literature in Brazil. Sakurai (2013) found a Grant coefficient of 0.61*** and an income coefficient of 0.01*** considering the same dependent variable of US – current expenditure. Parmagnani and Rocha (2013) found similar coefficients for only the FPM grant and also to other kinds of grants. Araújo and Siqueira (2016) also found grant coefficients of 0.7387 *** for municipalities with up to 50 thousand inhabitants and 0.5255 *** for municipalities with more than 50 thousand inhabitants. Gonçalves (2013) identified 0.5360* for grants lump-sum and 0.2637* for conditional grants. Vegh and Vuletin (2016) found grant coefficients from 0.872*** to 1,018*** depending on the control variables used. Around the world, these coefficients are not a surprise (Acosta, 2010; Gennari & Messina, 2014; Gramlich, 1977; Inman, 2008).

Importantly, the evidence of a strong flypaper effect persists when grants are instrumented by the *IFDM* and lags of *Grants*, in line with the evidence from previous studies (Hayashi & Boadway, 2001; Avelino, Bressan & Cunha, 2013; Postali, 2015; Caetano, Avila & Tavares, 2017; Mendes *et al.*; 2018). The coefficient on *Grants* is estimated to be around 1, while the *GDP* coefficient is again close to zero, indicating the presence of a flypaper effect ($\beta_2 > \beta_1$). The tests reported in table 20 (Hansen J test) suggest that the instruments are valid.

The analysis was subsequently performed through smaller samples according to the size of the municipalities. The results do not show flypaper effect in municipalities under 3,000 inhabitants (*Grant* was not significant), while the flypaper turns out to be considerable in the largest municipalities over 50,000 inhabitants. One possible reason why there is no evidence of the flypaper effect in smaller municipalities is the tax collection method known as *Simples Nacional* (Mattos, Cardim & Politi, 2018), which can interfere in the data and, consequently, affect the reliability of the information provided. Another reason may be the anomalies that emerge in the smaller municipalities, as there is evidence that there is no local tax on properties (IPTU) collection in election years, which can distort results (Sakurai, 2013). Finally, the informality in these smallest municipalities (Mattos, Cardim & Politi, 2018) and the quality of their data can influence the results, because there is no checking of the data itself, auditing or enforcement by the National Treasury, as it is responsible for consolidating the information. Larger municipalities are inevitably more supervised, both by private and public auditors and international organizations, in the case of international loans with conditional fiscal clauses.

3.5.2 Marginal Cost of Funds

We turn to the estimation of equation (10) testing the MCF hypothesis. The results are reported in Table 21.

Table 21: MCF tests. Dependent variable: Current expenditure (Exp) (2006 to 2013)

Variable	(1)	(2)	(3)	Pop<3k	Pop<50k	Pop>50k
GDP	0.009***	0.009***	0.009***	0.003	0.009***	0.011***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Grant	1.213***	1.245***	1.227***	1.425***	1.272***	0.952**
	(0.077)	(0.076)	(0.074)	(0.081)	(0.081)	(0.159)
MCF			-4.067	-2.625	-4.729	-0.468
			(3.413)	(8.600)	(4,304)	(1.840)
MCF*Grant			0.012***	0.008	0.012**	0.028*
			(0.004)	(0.009)	(0.006)	(0.017)
Controls	No	Yes	No	No	No	No
Dummy Years	Yes	Yes	Yes	Yes	Yes	Yes
Mun. FE	Yes	Yes	Yes	Yes	Yes	No
Year FE	No	No	No	No	No	Yes
Robust	Yes	Yes	Yes	Yes	Yes	Yes
Obs	44,544	43,242	44,544	3,624	39,320	5,240
n. Mun	5,568	5,561	5,568	453	4,915	655
R^2	0.540	0.585	0.537	0.517	0.557	0.656
F(9,5569)	1049.36***					
F(10,5560)		1798.33***				
F(11,5569)			885.51***			
F(11,452)				176.41***		222.93***
F(11,4914)					759,70***	

Source: authors. Robust standard errors are in parentheses. Mun: Municipalities. FE: Fixed Effects. OLS: ordinary least squares. Pop: population in 2015. GDP: Gross Domestic Product. Grant: federal grant Municipal Participation Fund. IFDM: Firjan Index of Municipal Development. MCF is the marginal cost of public funds. *N* = from 2006 to 2013. ****p*< .01; ***p*< .05; **p*< .1.

The results show that the interaction term, coefficient β_4 from equation (10), is positive and statistically significant in all models, as predicted by the MCF hypothesis. This suggests that the expansionary effect of grants on expenditures grows with the proxy of the elasticity of the tax base that we have employed. The above results are compatible with the hypothesis that the stimulative effect of grants on public spending increases with the MCF. Consequently, and while not excluding that other forces might be at work at the same time, we find evidence that the employment of distortionary sources of revenue plays an important role in explaining the phenomenon of the flypaper effect in the Brazilian municipalities. These results are similar to the ones obtained for the Canadian provinces by Dahlby and Ferede (2016).

3.6 Conclusions

The objective of the present research was to test the existence of the flypaper effect in the Brazilian municipalities and to investigate its causes, based on a panel of 5,568 municipalities from 2006 to 2013. Estimation of an expenditure determination equation reveals that the grant variable has a large and statistically significant impact on local expenditures (an estimated coefficient of over one). In contrast, the GDP variable has a small and insignificant impact (coefficients close to zero), thus providing evidence of a strong flypaper effect.

Using the IFDM index and lags of the grant variable as instruments, we have been able to rule out grant endogeneity as a possible cause of the flypaper effect. On the other hand, using indicators of elasticity of the tax base concerning the tax rate as a proxy to the MCF, we get strong support to the Dahlby's (2011) hypothesis that the distortionary nature of local taxation is responsible for the flypaper effect.

The results of the present study point out that the tax structure and the assignment of revenue sources across levels of government can have significant consequences on local

decision-making processes in fiscal matters, regarding the high sensitivity of local public spending to grants known as the flypaper effect, and that any proposal of fiscal decentralization reform should carefully consider the distortionary nature of the revenue sources to be assigned to local governments.

Overall, while being conditional on the length (until year 2013), frequency (some variables available from the Census only), and quality (especially for small municipalities) of the data, the evidence we have provided seems largely compatible with an explanation of the flypaper effect based on the cost of collecting public revenues in Brazilian municipalities. Admittedly, though, other competing interpretations of the flypaper effect cannot be entirely ruled out. It would be valuable, in future research, to evaluate the robustness of the tests we have performed here against empirical models that explicitly include in the picture the political economy of grant distribution, the role and quality of local bureaucratic institutions, and the possibility of behavioural responses of grant recipients that cannot be fully understood within a stylized neoclassical model. Moreover, it would be extremely useful if future contributions could complement the evidence that we have presented here with what emerges from explicitly dynamic models, more recent data, and further proxies of the MCF than the ones we have employed here.

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

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 FPM to reduce regional inequalities is not being achieved in some municipalities.

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

JEL: C33; H77; H72.

4.1 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 tranfers withing 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. About this last one, Dahlby and Ferede (2016) did a similar analysis of the Canadian

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.

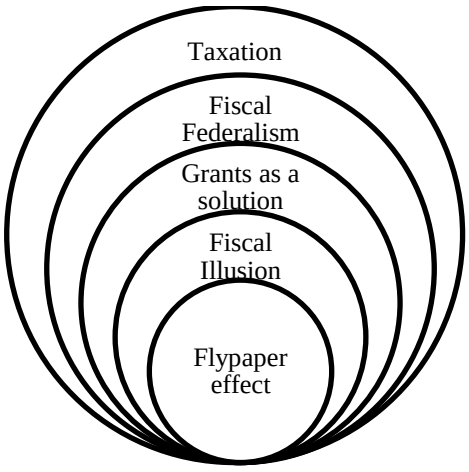
The purpose of this chapter was to carry out an aggregated analysis at the state and municipal levels through the most updated data available considering the research period of the thesis, from 2017 to 2021. Even in 2021, GDP data at the municipal level is only available until 2018, because IBGE publishes this information with a lag of 3 years, as shown in topic 4.3.6.

This chapter is structured as follows. Section 4.2 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 4.3 describes the methodology, while Section 4.4 reports and discusses the estimation results, and Section 4.5 concludes.

4.2 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 3: 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 & Ferede, 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; Panao, 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 e 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 affect, 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 22: 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.

4.3 Methodology

4.3.1 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 6.

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 from 2000 to 2018 because all the complete data were available, which is more reliable and stable considering the deflated applied to the data.

This is the largest panel in the Brazilian literature presented in the Appendix 7 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 4.3.5 Data Limitations.

4.3.2 Variables

Several previous works have studied the determinants of local public expenditures (Dahlby & Ferede, 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 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.

4.3.3 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 23, 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 or 2021 due to budgetary issues added to the limitations imposed by the Covid-19 pandemic crisis[10].

4.3.4 State Econometric Model

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

[1010] According to IBGE, the Census did not happen in 2020 and maybe cannot happen in 2021. More details are presented in the topic 4.3.6 Data Limitations. Source: https://www.ibge.gov.br

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

$$Exp_{it} = \beta_0 + \beta_1 Grant_{it} + \beta_2 GDP_{it} + \beta_2 Controls_{it} + \epsilon_{it} \quad (11)$$

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 & Ferede, 2016; Habibi *et al.*, 2003; Martinez-Vazquez & Timofeev, 2009; Psycharis, Zoi & Iliopoulou, 2016). This index is represented below:

$$MCF_{it} = \frac{\text{Proper Tax Revenue}_{it}}{\text{Total Revenue}_{it}} \quad (12)$$

Where $\text{Proper Tax Revenue}_{it}$ 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. $\text{Total Revenue}_{it}$ is the sum of Current Revenues and Investment Revenues.

After calculating the index, equation (13) was estimated, which includes interactions of MCF and Grants:

$$Exp_{it} = \beta_0 + \beta_1 Grant_{it} + \beta_2 MCF_{it} + \beta_3 (MCF_{it} \times Grant_{it}) + \beta_4 GDP_{it} + \beta_4 Controls_{it} + \epsilon_{it} \quad (13)$$

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 & Ferede, 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 to 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:

$$MCF\_d_{it} = \frac{\partial\,(\text{Proper Tax Revenue}_{it})}{\partial\,(\text{Total Revenue}_{it})} \tag{14}$$

Which is similar to the equation (12), 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*:

$$Proper\ Tax\ Revenue_{it} = \beta_1 + \beta_1 Total\ Revenue\_d_{it} + \epsilon_{it} \tag{15}$$

After calculating the *MCF_d*, equation (16) was estimated, which includes interactions of *MCF_d* and *Grants*, similar to equation (13):

$$Exp_{it} = \beta_0 + \beta_1 Grant_{it} + \beta_2 MCF\_d_{it} + \beta_3 MCF\_d_{it} \times Grant_{it} + \beta_4 GDP_{it} + \beta_4 Controls_{it} + \epsilon_{it} \tag{16}$$

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

4.3.5 Municipality Econometric Model

Initially, the econometric model described in equation (13) 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:

$$Exp_t = \beta_0 + \beta_1 Grant_t + \beta_2 GDP_t + \epsilon_{it} \tag{17}$$

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_{it} 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.

$$Flypaper\ Index_i = \frac{\frac{\partial \text{Grant}_t}{\partial \text{Exp}_t}}{\frac{\partial \text{GDP}_t}{\partial \text{Exp}_t}} = \frac{\partial \text{Grant}_t}{\partial \text{Exp}_t} x \frac{\partial \text{Exp}_t}{\partial \text{Grant}_t} = \frac{\partial \text{Grant}_t}{\partial \text{GDP}_t} = \frac{\beta_1}{\beta_2} \quad (18)$$

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:

$$Normal\ Flpaper\ Index_i = \frac{\text{Flypaper Index}_i - min\ (\text{Flypaper Index})}{(max(\text{Flypaper Index}) - min\ (\text{Flypaper Index}))} \quad (19)$$

where $Flypaper\ Index_t$ is the result of equation 18 of the municipality *I, max* is the maximum flypaper index value, and *min* is the minimum flypaper index value.

4.3.6 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 8). In addition, the last census happened in 2010 and did not happen again in 2020 budgetary reasons and maybe will not happen in 2021. 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. The query performed is available in Appendix 9.

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, Jutaí – 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.

4.4 Empirical Results

Descriptive statistics of the variables used in the model are shown in Appendix 10. 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 (11), (13), (16) and (17) 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 23: Statistic Tests of flypaper effect constitutional grants

Variable/ Model	States								Municipalities					
	Without Federal District				With Federal District				(9)	(10)	(11)	(12)	(13)	(14)
	(1) Pool	(2)	(3)	(4)	(5) Pool	(6)	(7)	(8)	Pool	Pool	Pop<3k	Pop<50k	Pop>50k	Panel
GDP	0.092***	0.045***	0.125***	0.060***	0.109***	0.092***	0.111***		0.029***	0.026***	0.030	0.027***	0.036***	0.014***
	(0.003)	(0.008)	(0.006)	(0.008)	(0.008)	(0.007)	(0.005)		(0.000)	(0.000)	(0.002)	(0.001)	(0.000)	(0.001)
Grant	0.836***	0.447***	0.126*	0.153	0.860***	0.552***	0.176*	0.153	1.310***	1.207***	1.441***	1.418***	2.101**	1.116***
	(0.028)	(0.038)	(0.071)	(0.066)	(0.469)	(0.059)	(0.103)	(0.104)	(0.026)	(0.033)	(0.058)	(0.011)	(0.069)	(0.127)
MCF			-0.731***	-0.736***			-1.521***	-1.582***						
			(0.128)	(0.120)			(0.188)	(0.185)						
MCF*Grant			1.096***	1.159***			1.485***	1.354***						
			(0.275)	(0.274)			(0.413)	(0.439)						
Capital										177.180***				
										(14.672)				
Gini		2.306***		1.746**		2.834**		0.969						
		(0.696)		(0.766)		(1.152)		(1.254)						
Theil		-0.922***		-0.726***		-1.346***		-0.779*						
		(0.272)		(0.277)		(0.459)		(0.463)						
Citizen's		0.001***		0.000***		0.000		0.000						
Income		(0.000)		(0.000)		(0.000)		(0.000)						
Water		-0.263		-0.510***		-0.296		-0.287						
bodies		(0.180)		(0.195)		(0.281)		(0.301)						
Illiteracy		-1.663***		-2.012***		-1.361**		-1.651**						
		(0.432)		(0.443)		(0.683)		(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 17. (2): Wald $\chi^2(7)$ and equation 11. (3): Wald $\chi^2(4)$ and equation 13. (4): Wald $\chi^2(9)$ and equation 13. (5): Pool, F(2, 695) and equation 17. (6): Wald $\chi^2(7)$ and equation 11. (7): Wald $\chi^2(4)$ and equation 13. (8): Wald $\chi^2(9)$ and equation 13. (8): equation 17. (14): Panel data – fixed effects and equation 11. Robust standard errors are in parentheses. N States = from 1985 to 2010. N Municipalities = from 2000 to 2018. ***p< .01; **p< .05; *p< .1.

4.4.1 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 (16), to verify another way of estimating the MCF, the results are presented below:

Table 24: Identified flypaper effect constitutional grants (robust) with *MCF_d*

	Without Federal District		**With Federal District**	
Variables/Models	**(7)**	**(8)**	**(9)**	**(10)**
Grant	0.816	0.726	0.831	0.845
	(0.079)***	(0.087)***	(0.121)***	(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	0.046	0.099	0.096
	(0.007)***	(0.008)***	(0.005)***	(0.007)***
Gini		2.803		3.307
		(0.708)***		(1.195)***
Theil		-0.937		-1.366
		(0.269)***		(0.463)***
Citizen's Income		0.000		-0.000
		(0.000)***		(0.000)
Water bodies		-0.434		-0.308
		(0.196)**		(0.301)
Illiteracy		-1.876		-1.463
		(0.442)***		(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 12) 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 14) 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.

4.4.2 Municipality Results

The results show evidence of the flypaper effect in Brazilian municipalities (see Table

23, models 9 to 14), validating previous studies (Araújo & Siqueira, 2016; Cruz & Silva, 2020; Diniz *et al*., 2017; Ferreira, Serrano & Revelli, 2019b; Freitas, Pereira, Lúcio & Gomes, 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 Sofware 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 25: Larger and Lesser Municipalities Index

nº	Municipality	Flypaper Index	nº	Municipality	Flypaper Index
1º	São Paulo – SP	1.00	5,554º	Amapá – AP	0.01
2º	Duque de Caxias – RJ	0.90	5,555º	Alto do Rodrigues – RN	0.01
3º	Araporã – MG	0.75	5,556º	Santo Antônio do Leverger – MT	0.01
4º	Porto Real – RJ	0.52	5,557º	Santa Helena – PR	0.01
5º	Betim – MG	0.45	5,558º	Campina Grande – PB	0.01
6º	São Gonçalo do Rio Abaixo – MG	0.31	5,559º	Cascavel – PR	0.00
7º	Osasco – SP	0.29	5,560º	Gurupi – TO	0.00
8º	Cairu – BA	0.27	5,561º	Ananindeua – PA	0.00
9º	Itatiaiuçu – MG	0.26	5,562º	Serranópolis – GO	0.00
10º	São José da Barra – MG	0.23	5,563º	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 26: 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
		Sergipe	0.16
Central-West	0.66	Federal District	0.00
		Goiás	0.14
		Mato Grosso	0.38
		Mato Grosso do Sul	0.34
Southeast	1.00	Espírito Santo	0.22
		Minas Gerais	0.27
		Rio de Janeiro	1.00
		São Paulo	0.34
South	0.61	Paraná	0.20
		Santa Catarina	0.25
		Rio Grande do Sul	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 4.3.6). 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 7). 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, 2020; 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.

4.5 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 Ferede (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.

5. FINAL CONSIDERATIONS

The present thesis proposes to verify the existence of the flypaper effect in Brazilian municipalities and its reasons. Thus, research was divided into 3 studies with the general objective of verifying the flypaper effect in subnational entities in Brazil, in order to identify the reasons that cause this phenomenon.

The first study verified the flypaper effect in 476 Brazilian municipalities with more than 50 thousand inhabitants from 2005 to 2012, considering new variables as transfer instruments. Political alignment, party alignment and coalitions between the mayor and the president of the republic and the state governor were considered instruments for the transfers. The results allow for the conclusion that the flypaper effect exists in Brazilian municipalities and is intensified or justified by the alignment of the representatives in the same way of theoretical literature (Hamilton, 1983; Inman, 2008) and previous empirical studies in Brazil (Rios & Costa, 2013).

The main contribution of the study is to show that political alignment continues to be an important characteristic in the Brazilian fiscal federalism, even with strict formulas to distribute grants from the federal level to the local levels. Furthermore, the dependency level of the municipalities on the grants sent by the Federal and State levels continues to be high and present in Brazilian municipalities.

This initial study is relevant because it brought up a current, complex scenario of fiscal federalism in Brazil, involving several transfers from the Union and states to municipalities. Therefore, there were no previous studies that presented the Brazilian reality with an extensive database and identified the effect at the level of local entities with such a long timeline and with instruments to the grant variable. The analysis through electoral alignment is relevant as it demonstrates that there may be an impact on transfers due to the alignment between the heads of government spheres (President, Governor, Mayor).

It could be questioned how electoral alignment can act as an instrument if FPM and FPE coefficients and other transfers are objective and defined in legislation with precise formulae, instead of voluntary transfers. Initially, voluntary transfers were not considered in the subject because they are not considered unconditional and nonmatching transfers (lump sum). Then, the coefficients are established by law and annually calculated by the Federal Court of Accounts. However, as the calculation is based on the estimated population and income *per*

capita calculated by the IBGE, several municipalities managed to maintain in court their current population count in order to avoid a range fall and consequent decrease in the coefficients, reducing the amount of transfers[11].

The current criteria for transfer distribution also generate a group of overfunded municipalities (Mendes 2002), which is confirmed by Firjan (2018) survey against the increase in the number of municipalities in Brazil. In addition, the flypaper effect can lead to a trend of excessive spending, deteriorating more the fiscal situation of municipalities (Giuberti, 2005; Macedo & Corbari, 2009). Thus, as much as objective aspects are defined, there is a discretion margin in these transfers, which justifies considering political alignment as a proxy of grants.

The second study verified the flypaper effect in 5,568 Brazilian municipalities from 2006 to 2013, using the elasticity of the tax base with respect to the municipalities' tax rates as a proxy of the marginal cost of public funds (MCF). Using the IFDM index and the transfer variable intervals as instruments, we have been able to rule out transfer endogeneity as a possible cause of the flypaper effect. On the other hand, using indicators of elasticity of the tax base concerning the tax rate as a proxy to the MCF, the results support the Dahlby's (2011) hypothesis that the distortionary nature of local taxation is responsible for the flypaper effect.

The results point out that the tax structure and the assignment of revenue sources across levels of government can have significant consequences on local decision-making processes in fiscal matters, regarding the high sensitivity of local public spending to grants (flypaper effect), and that any proposal of fiscal decentralization reform should carefully consider the distortionary nature of the revenue sources to be assigned to local governments.

The MCF was used by some researchers (Dahlby, 2011; Dahlby & Ferede, 2016; Hokonsen, 1998; Mattos, Cardim & Politi, 2018), but not from the perspective of flypaper nor with grants as an instrumental variable, which demonstrates the pioneering nature of this thesis. The results point out that the tax structure and the assignment of revenue sources across levels of government can have significant consequences on local decision-making processes in fiscal matters, regarding the high sensitivity of local public spending to grants known as the flypaper effect, and that any proposal of fiscal decentralization reform should carefully consider the distortionary nature of the revenue sources to be assigned to local governments.

Finally, the third one verified the flypaper effect in 27 Brazilian states from 1985 to 2010 and 5,568 Brazilian municipalities from 2000 to 2018, considering two different ways to calculate the MCF. The first proxy was an autonomous index as a proxy of the 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 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.

An extensive and long database allowed us to conclude 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 when compared to smaller municipalities. The flypaper index showed the municipalities in the Southeast region have the greatest flypaper effect incidence, followed by Center-west and South regions. At the

[11] Euclides da Cunha – BA (Action nº 1000719-43.2018.4.01.3306 - Vara Federal da Subseção Judiciária de Paulo Afonso – BA; Jutaí – AM (Action nº s/nº); Uarini – AM (Action nº s/nº); Barreiros – PE (Action nº 0800382-56.2013.4.05.8300, 3ª Vara Federal da Seção Judiciária de Pernambuco); Santo Antônio do Içá – AM (Action nº 0017396-03.2015.4.01.3200, 3ª Vara Federal da Seção Judiciária do Estado do Amazonas); Santa Isabel do Rio Negro – AM (Action nº 1000064-98.2018.4.01.3200, 1ª Vara Federal Cível da Seção Judiciária do Estado do Amazonas); Teresina – PI (Action Suspensão de Liminar 461/DF, Supremo Tribunal Federal); Boa Vista – RR (Action nº 0028811-48.2013.4.01.0000/RR – SLAT, Tribunal Regional Federal da 1ª Região).

same time, there is evidence that the constitutional function of the FPM to reduce regional inequalities was not achieved in some municipalities.

The three studies are connected because they have in common the analysis of the flypaper phenomenon, the first two being at the municipal level and the third at the state and municipal level. The thesis sought an innovative treatment, trying to identify the occurrence of the flypaper effect in Brazilian states and municipalities, considering some analyzed municipalities were created in the last 5 years and, therefore, were not previously studied by other authors.

The political alignment continues to be an important characteristic in Brazilian fiscal federalism, even with strict formulas to distribute grants from the federal level to the local levels. This evidence is intensified because the dependency level of the municipalities on the grants sent by the Federal and State levels continues to be high and present in Brazilian municipalities.

Another aspect observed is related to tax autonomy, since evidence of higher flypaper effect in municipalities with low tax autonomy were found. This result can help the legislator to establish tax guidelines, because being aware of its reality, tax autonomy and other factors can become criteria for sharing transfers. Finally, it was also observed the perception that the MCF acts as a flypaper effect booster both in the municipalities (second study) and in the states (third study), according to the two proxies tested.

Thus, the general objective of this study was to identify the reasons leading to the flypaper effect. Additionally, it was verified whether the effects were properly fulfilled and reduced the gap of the object of study through empirical tests and discussion based on the specialized literature. In conclusion, the flypaper effect, which is considered a type of fiscal illusion, was empirically confirmed in the three chapters, demonstrating the impacts of intergovernmental transfers in Brazil and their main causes and consequences.

It is necessary to rethink the grant distribution system in Brazil, which was detailed done by Mendes *et al.* (2008). According to the authors, the first thing is to reduce the total amount transferred by the FPM grant, because unconditional transfers, even under the best distribution criteria, induce the flypaper effect and adversely impact accountability, fiscal responsibility and efficient management. An alternative could be piggybacking in state and federal taxes, along with discount agreements for state and federal taxes of amounts already paid to the municipality. This cooperative action would stimulate consumers to claim receipts, creating an automatic inspection, increasing local revenue and reducing the need for unconditional and non-matching grants.

The results shed light on the indispensability of 5,568 municipalities, followed by mandatory expenditures necessary to maintain the city hall and city council. The anomaly may not only be found in the formula to distributing grants, but also in the federative structure and the huge number of municipalities, which has grown exponentially since the 1990s (Fernandes & Araújo 2015; Gomes & Mac Dowell, 2000; Tomio, 2002). Future studies can verify, for example, whether it is necessary 2,446 municipalities with up to 10,000 inhabitants (IBGE, 2020), considering the advantages and disadvantages of merging municipalities (Blesse & Baskaran, 2013; Egger, Kothenburger & Loumeau, 2017; Suzuki & Ha, 2018).

The calculation methodology needs attention, currently based on the population and income *per capita* of the municipalities (which is the income *per capita* of the state in which the municipality is located). There are scientific studies on the subject (Ferreira, Serrano & Souza Neto, 2019; Vieira *et al.*, 2019; Monasterio, 2014; Gasparini & Miranda, 2006; Payeras & Hoffmann, 2009; Hoffmann, Silveira & Payeras, 2006; Gasparini & Melo, 2003; Payeras & Cunha, 2004), but changing requires a legislative proposal to alter the Federal Constitution of 1988 and the laws which establish these distribution criteria, such as Complementary Law

62/1989. These kinds of laws are the most difficult to alter, because the because of their legislative rites and the necessary special quorums required by the hierarchy of norms.

One of the weaknesses of the study is their data sources, as they are not frequently updated. Although the thesis was finished in 2021, the most current data from the municipalities are from before 2018, due to the data availability. The IBGE publishes outdated data at the municipal level due to the cost of generating such information and the difficulties to treat them. Some variables are calculated only in the census years, which is carried out every 10 years. The population and income *per capita* calculations performed by IBGE are estimates through the National Houshold Sample Survey (PNAD). In consequence, these limitations make balanced panel data research unfeasible.

Another shortcoming refers to the quality of data, especially for small municipalities. The Finbra and Siconfi systems are not audited and present several conflicting information that need improvement. Thus, these research limitations did not compromise this study, but need to be addressed to improve data quality and statistical analysis. A research agenda can help to certify the quality of the data, and later to deepen statistical techniques, to test new variables, to investigate the existence of endogeneity, to explore the use of instrumental variables and to compare the conclusions with other countries and also within Brazilian regions and states.

Future research can analyze cases of discrepancy between municipalities, considering the transfer distribution criteria are based only on population and income *per capita*. The amount distributed cannot fully fulfill its function of reducing regional inequalities established in the Federal Constitution of 1988. In this way, researchers on the subject may consider more recent data from other sources of information, as well as social variables related to the flypaper effect, such as the Gini Index and the Human Development Index. Model tests by region can enrich the analysis and lead to more detailed conclusions of the phenomenon.

Finally, it is also possible to perform tests on other systems and databases in the public sector and expand the analysis of them. The Siafi can also be the object of scientific research, considering it is responsible for most of the federal public sector transactions and has not yet been thoroughly analyzed in the academic sphere. Finally, audits by courts of accounts can be assessed with the required international auditing standards.

REFERENCES

Abbott, A., & Jones, P. (2016). Fiscal illusion and cyclical government expenditure: state government expenditure in the United States. **Scottish Journal of Political Economy**, 63(2), 177-193.

Acar, Y. (2019). Does flypaper effect exist? New evidence from turkish municipalities. **Sosyoekonomi**, 27(39), 55-68.

Acosta, P. (2010). The "flypaper effect" in presence of spatial interdependence: Evidence from Argentinean municipalities. **The Annals of Regional Science**, 44, 453-466.

Affonso, R. B. A. (2003). **O Federalismo e As Teorias Hegemônicas da Economia do Setor Público na Segunda Metade do Século XX: um balanço crítico**. Master's Thesis in Economics, Universidade Estadual de Campinas, Campinas, SP, Brazil.

Afonso, W. B. (2014). Fiscal illusion in state and local finances a hindrance to transparency. **State and Local Government Review**, 46(3), 219-228.

Aghón, G. (1993). **Descentralizacion Fiscal: Marco Conceptual**. Serie Política Fiscal 44. Proyecto Regional de Descentralizacion Fiscal (CEPAL-GTZ).

Ahmad, E., & Craig, J. (1997). Intergovernmental transfers. In T. Ter-Minassian (Eds.). **Fiscal Federalism in Theory and Practice** (73-107). Washington: International Monetary Fund.

Ahmad, E., Hewitt, D., & Ruggiero, E. (1997). Assigning expenditure responsibilities. In T. Ter-Minassian (Eds.). **Fiscal Federalism in Theory and Practice** (25-48). Washington: International Monetary Fund.

Akai, N., & Sakata, M. (2002). Fiscal decentralization contributes to economic growth: evidence from state-level cross-section data for the United States. **Journal of Urban Economics**, 52, 93-108.

Ames, B. (1995). Electoral Strategy under Open-List Proportional Representation. **American Journal of Political Science,** 39, 406-33.

Amusa, H., Mabunda, R., & Mabugu, R. (2008). Fiscal illusion at the local sphere: an empirical test of the flypaper effect using south african municipal data. **Afr. J. Econ.,** 76(3), 443-465.

Aragón, F. M. (2013). **Local Spending, Transfers and Costly Tax Collection**. National Tax Journal, 66(2), 343-370.

Araújo, J. M., & Siqueira, R. B. (2016). Demanda por gastos públicos locais: evidências dos efeitos de ilusão fiscal no Brasil. **Estudos Econômicos,** 46(1), 189-219.

Arulampalam, W., Dasgupta, S., Dhillon, A., & Dutta, B. (2009). Electoral Goals and Center-state Transfers: A Theoretical Model and Empirical Evidence from India. **Journal of Development Economics**, 88, 103-19.

Auriol, E., & Warlters, M. (2012). The marginal cost of public funds and tax reform in Africa. **Journal of Development Economics**, 97(1), 58-72.

Avelino, B. C., Bressan, V. G. F., & Cunha, J. V. A. (2013). A Study on the Accounting Factors Influencing the FIRJAN Municipal Development Index (IFDM) in Brazilian Capitals. **Journal of Education and Research in Accounting,** 7, 263-278.

Bae, S., & Feiock, R. C. (2004). The Flypaper Effect Revisited: Intergovernmental Grants and Local Governance. **International Journal of Public Administration**, 27(8-9), 577-596.

Baekgaard, M., & Kjaergaard, M. (2016). Intergovernmental grants and public expenditures: evidence from a survey experiment. **Local Gov. Stud.**, 42(2), 189-207.

Baekgaard, M., Serritzlew, S., & Blom-Hansen, J. (2016). Causes of Fiscal Illusion: Lack of Information or Lack of Attention? **Public Financial Publications**, 34(2), Summer, 26-44.

Bailey, S. J., & Connolly, S. (1998). The Flypaper Effect: Identifying Areas for Further Research. **Public Choice,** 95(3/4), 335-361.

Baker, M., Payne, A., & Smart, M. (1999). An empirical study of matching grants: The 'CAP on the CAP'. **Journal of Public Economics**, 72, 269-288.

Ballard, C. L., & Fullerton, D. (1992). Distortionary Taxes and the Provision of Public Goods. **Journal of Economic Perspectives**, 6(3), 117-131.

Baltagi, B. H. (2013). **Econometric analysis of panel data**.

Baskaran, T. (2016). Intergovernmental transfers, local fiscal policy, and the flypaper effect: evidence from a German state. **FinanzArchiv: Public Finance Analysis**, 72(1), 1-40.

Bastida F., Benito B., & Guillamón, M. (2009). An empirical assessment of the municipal financial situation in Spain. **International Public Management Journal**, 12(4), 484-499.

Baum, C. (2006). **An Introduction to Modern Econometrics using Stata**, StataCorp LP. Available on: https://econpapers.repec.org/bookchap/tsjspbook/imeus.htm. Accessed on: Aug. 6, 2021.

Becker, E. (1996). The illusion of fiscal illusion: Unsticking the flypaper effect. **Public Choice,** 86, 85-102.

Bhanot S. P., Han J., & Jang C. (2018). Workfare, wellbeing and consumption: evidence from a field experiment with Kenya's urban poor. **Journal of Economic Behavior & Organization**, 149, 372-388.

Bhargava, A., Franzini, L., & Narendranathan, W. (1982). Serial correlation and fixed effects model. **Review of Economic Studies**, 49, 533-549.

Blanchard, O. J., Lopez-de-Silanes, F., & Shleifer, A. (1994). What Do Firms Do with Cash Windfalls? **Journal of Financial Economics**, 36(3), 337-360.

Blesse, S., & Baskaran, T. (2013). **Do municipal mergers reduce costs? Evidence from a German federal state**. Discussion Paper n. 176, Center for European, Governance and Economic Development Research (CEGE), Gottingen/DE, December.

Bracco, E., Lockwood, B., Porcelli, F., & Redoano, M. (2015). Intergovernmental grants as signals and the alignment effect: Theory and evidence. **Journal of Public Economics**, 123, 78-91.

Bradford, D. F., & Oates, W. E. (1971). The Analysis of Revenue Sharing in a New Approach to Collective Fiscal Decisions. **The Quarterly Journal of Economics**, 85(3), 416-439.

Brasil. (1988). **Constitution of the Federative Republic of Brazil: constitutional text of October 5**, 1988.

Brasil. Secretaria do Tesouro Nacional. (2017). **Boletim de Finanças dos Entes Subnacionais**.

Breusch, T. S., & Pagan, A. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. **Review of Economic Studies**, 47(1), 239-253.

Brollo, F., & Nannicini, T. (2012). Tying Your Enemy's Hands in Close Races: The Politics of Federal Transfers in Brazil. **American Political Science Review**, 106(4), 742-761.

Buchanan, J. M. (1967). **Public finance in democratic process: fiscal institutions and individual choice.** Chapel Hill: University of North Carolina Press.

Buchanan, J. M. (1995). Federalism and Individual Sovereignty. Cato Journal, 15(2), 259-68.

Buchanan, J. M., & Tullock, G. (1962). **The calculus of consent: the logical foundations of constitutional democracy.** Michigan: The University of Michigan Press.

Buchanan, J. M., & Wagner, R. (1977). **Democracy in deficit: the political legacy of Lord Keynes.** Indianapolis: Liberty Fund, 2000. The Collected Works of James M. Buchanan, v. 8.

Caetano, C. C. R., Avila, L. A. C. D., & Tavares, M. (2017). A relação entre as transferências governamentais, a arrecadação tributária própria e o índice de educação dos municípios do estado de Minas Gerais. **Revista de Administração Pública**, 51, 897-916.

Cantarero, D., & Perez, P. (2012). Decentralization and regional government size in Spain. **Portuguese Econ. J.**, 11(3), 211-237.

Cárdenas, O. J., & Sharma, A. (2011). Mexican Municipalities and the Flypaper Effect. **Public Budgeting & Finance**, 31, 73-93.

Cardoso, B. F., Nascimento, J. S., & Paixão, A. N. (2012), Efeitos das transferências fiscais sobre as despesas dos estados brasileiros. **Revista de Economia**, 38(2), 149-167.

Castro M., & Mattos E. (2021). Measuring Fiscal Spillovers in Brazilian Municipalities. **Public Finance Review,** 49(2), 221-261.

Chernick, H.. (1979). An Economic Model of the Distribution of Project Grants. In P. Mieszkowski & W. Oakland (Eds.). **Fiscal Federalism and Grants-in-Aid (**81-103). Washington, DC: Urban Institute Press.

Choi, J. J.; Laibson, D., & Madrian, B. C., (2009). Mental Accounting in Portfolio Choice: Evidence from a Flypaper Effect. **American Economic Review**, 99(5), 2085-2095.

Chow, G. (1960). Tests of Equality Between Sets of Coefficients in Two Linear Regressions. **Econometrica**, 28(3), 591-605.

Clark, B Y, & Whitford A B. (2011). Does more federal environmental funding increase or decrease states' efforts? **J. Policy anal. Manage.,** 30(1), 136-152.

Cohen, J. P. (2001). Reciprocal state and local airport spending spillovers and symmetric responses to cuts and increases in federal airport grants. **Public Financ. Rev**., 30(1), 41-55.

Colburn, C. B. (1992). The changing composition of income transfer programmes: a public choice analysis. **Appl. Econ.**, 24(2), 161-168.

Correia, J. G. A.; Diniz, G. I., & Costa, R. F. R. (2014). Analisando o comportamento dos gastos públicos nos municípios cearenses. **Revista de Políticas Públicas**, 18(1), p.85-96.

Cossio, F. A. B. (1998). **Disparidades econômicas inter-regionais, capacidade de obtenção de recursos tributários, esforço fiscal e gasto público no federalismo brasileiro**. Master's Thesis in Economics, Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro.

Cossio, F. A. B. (2002). Ensaios sobre federalismo fiscal no Brasil. Doctoral Thesis in Economics, Pontifícia Universidade Católica do Rio de Janeiro. Rio de Janeiro.

Cossio, F. A. B. (2006). **Os Efeitos das Transferências Intergovernamentais: O Flypaper Effect nas Finanças Municipais Brasileiras**. Doctoral Thesis in Economics (Chap. 3), Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro, RJ, Brazil.

Cossio, F. A. B., & Carvalho, L. M. (2001). Os efeitos expansivos das transferências intergovernamentais e transbordamentos espaciais de despesas públicas: evidências para os municípios brasileiros. **Pesquisa e Planejamento Econômico**, 31(1), 75-124.

Costa, R. F. R. (2013). **O Impacto das Transferências Constitucionais sobre o Comportamento Fiscal dos Municípios Brasileiros**. Prêmio Tesouro, Secretaria do Tesouro Nacional, Brasília.

Costa, R. F. R., & Castelar, L. I. M. (2015). O Impacto das Transferências Constitucionais. **Análise Econômica**, 33(64), 171-189.

Courant, P. N., Gramlich, E. M., & Rubinfeld D. L. (1979). The stimulative effect of intergovernmental grants: or why money sticks where it hits, 5-21 In P. Mieszkowski & W. H. Oakland (Eds.). **Fiscal Federalism and Grants-in-Aid**. Washington, DC: Urban Institute.

Cruz, T., & Mereb, T. (2018). **Minimum Spending in Education and the Flypaper Effect**. Working paper.

Cruz, T., & Silva, T. (2020). Minimum Spending in Education and the Flypaper Effect. **Economics of Education Review**, 77, 102012.

Dahlberg, M., Mörk, E., Rattso, J. & Hanna, A. (2008). Using a discontinuous grant rule to identify the effect of grants on local taxes and spending. **Journal of Public Economics**, 92, 2320-2335.

Dahlby, B. (2008). **The marginal cost of public funds:** Theory and applications. Cambridge, MA: MIT Press.

Dahlby, B. (2011). The marginal cost of public funds and the flypaper effect. **International Tax and Public Finance**, 18, 304-321.

Dahlby, B., & Ferede, E. (2016). The stimulative effects of intergovernmental grants and the marginal cost of public funds. **International Tax Public Finance**, 23, 114-139.

De Widt D. (2016). Top-down and bottom-up: institutional effects on debt and grants at the English and German local level. **Public Administration**, 94(3), 664-684.

Deller, S. C.; & Maher, C. S. (2005). Categorical municipal expenditures with a focus on the flypaper effect. **Public Budgeting & Finance**. 25(3), 73-90.

Deller, S. C.; & Maher, C. S. (2006). A model of asymmetries in the flypaper effect. **Publius**, 36(2), 213-229.

Denzau, A; & Grier, K. (1984). Determinants of local school spending: some consistent estimates. **Public Choice**, 44(2), 375-383.

Dewortor, W. K., & Chui, C. M. (2019). Aid fungibility and government spending in Africa: evidence from instrumental variable panel quantile regression. **Applied Economics Letters**, 27(14), 1188-1193.

Dickey, D. A., & W. A. Fuller. (1979). Distribution of the estimators for autoregressive time series with a unit root. **Journal of the American Statistical Association**, 74, 427-431.

Dickson, V., & Yu, W. (2000). Revenue structures, the perceived price of government output, and public expenditures. **Public Financ. Rev.**, 28(1), 48-65.

Diniz, J. A., Lima, R.H., & Martins, V. G. (2017). O Efeito Flypaper no Financiamento da Educação Fundamental dos Municípios Paraibanos. **Administração Pública e Gestão Social**, 9(2), 95-104.

Dollery, B. E, & Worthington, A. C. (1995a). Federal expenditure and fiscal illusion: a test of the flypaper hypothesis in Australia. **Publius**, 25(1), 23-34.

Dollery, B. E., & Worthington, A. C. (1995b). State expenditure and fiscal illusion in Australia: a test of the revenue complexity, revenue elasticity and flypaper hypotheses. **Econ. Anal. Policy**, 25(2), 125-140.

Dollery, B. E., & Worthington, A. C. (1996). The empirical analysis of fiscal illusion. **Journal of Economic Surveys**, 10(3), 261-297.

Dollery, B. E., & Worthington, A. C. (1999). Fiscal illusion at the local level: an empirical test using Australian municipal data. **The economic record**, 75, 37-48.

Downes, T. A. (2000). Does fiscal dependency matter? Aid elasticities for dependent and independent school districts. **Econ. Educ. Rev.**, 19(4), 417-429.

Downs, T. A. (1957). An economic theory of political action in a democracy. **Journal of political economy**, 65, 135-150.

Drazen, A., & Eslava, M. (2005). **Electoral manipulation via expenditure composition: theory and evidence**. NBER Working Paper Series 11085.

Drazen, A., & Eslava, M. (2010). Electoral manipulation via expenditure composition: theory and evidence. **Journal of Development Economics**, 92, 39-52.

Egger, P. H., Kothenburger, M., & Loumeau, G. (2017). Municipal merger and local activity: evidence from Germany. 73rd. **Annual Congress of the International Institute of Public Finance (IIPF)**, Tokyo, Japan, August.

Ferede E., & Islam, S. (2015). Block grants and education expenditure: evidence from canadian provinces. **Public Financ. Rev.**, 44(5), 635-659.

Fernandes, A. S. A., & Araújo, S. M. V. G. (2015). A criação de municípios e a formalização de regiões metropolitanas: os desafios da coordenação federativa. **Revista Brasileira de Gestão Urbana**, 7(3), 295-309.

Ferreira, L. O. G., Serrano, A. L. M., & Revelli, F. (2019a). Faithfulness Representation and Verifiability of Brazilian Accounting Databases. **EGPA Spring Workshop PSC XII Public Sector Financial Management**, Cluj-Napoca, Romania, 9-10 May 2019.

Ferreira, L. O. G., Serrano, A. L. M., & Revelli, F. (2019b). The Effects of Federal Constitutional Grants in Brazilian Municipalities. **Review Urban & Regional Devel.**, 31(3), 203-233.

Ferreira, L. O. G., Serrano, A. L. M., & Souza Neto, M. L. (2019). Por uma verdadeira mudança no fundo de participação dos estados brasileiros. **Revista Observatorio de la Economía Latinoamericana**, mayo.

Filimon, R., Romer, T., & Rosenthal, H. (1982). Asymmetric information and agenda control: The bases of monopoly power in public spending. **Journal of Public Economics**, 17(1), 51-70.

Fisher, R. C. (1982). Income and Grants Effects on Local Expenditure: the Flypaper Effect and other difficulties. **Journal of Public Economics**, 17, 51-70.

Freitas, T. de A., Pereira, R. A. de C., Lúcio, F. G. C., & Gomes, J. W. F. (2019). Uma análise do efeito flypaper e ilusão fiscal para os municípios do nordeste brasileiro. **R. Bras. Eco. de Emp.**, 19(1), 47-60.

Gadelha, S. R. B., Oliveira, E., Botelho, R., & Teixeira, A. F. (2017). Austeridade da Política Fiscal, Sustentabilidade da Dívida Pública e Efeito Flypaper: Evidências para os Governos Subnacionais usando Econometria de Dados em Painel. **Economics and Politics Research Group**.

Gamkhar, S., & Oates, W. E. (1996). Asymmetries in the Response to Increases and Decreases in Intergovernmental Grants: Some Empirical Findings. **National Tax Journal**, 49(4), 501-512.

Gasparini, C. E., & Melo, C. S. L. (2003). **Equidade e eficiência municipal: uma avaliação do Fundo de Participação dos Municípios - FPM.** Monografia premiada em 1º lugar no VIII Prêmio Tesouro Nacional, Brasília: ESAF.

Gasparini, C. E., & Miranda, R. B. (2006). **Evolução dos aspectos legais e dos montantes de transferências realizadas pelo Fundo de Participação dos Municípios**. Brasília: Instituto de Pesquisa Econômica Aplicada, 1243.

Gennari, E., & Messina, G. (2014). How sticky are local expenditures in Italy? Assessing the relevance of the flypaper effect through municipal data. **International Tax and Public Finance,** 21(2), 324-344.

Gérard, T., & Ngangué, N. (2015). Does fiscal illusion impact budget policy?: a panel data analysis. **International Journal of Economics and Financial Issues,** 5(1), 240-248.

Giuberti, A. C. (2005). **Efeitos da lei de responsabilidade fiscal sobre os gastos dos municípios brasileiros.** Master's Thesis in Economics, Universidade de São Paulo, São Paulo, SP, Brazil.

Goldberger, A. S. (1991). **A course in econometrics**. Cambridge, Mass. London: Harvard University press XVII, 405.

Gomes, G. M., & Mac Dowell, M. C. (2000). **Descentralização política, federalismo fiscal e criação de municípios: o que é mau para o econômico nem sempre é bom para o social**. Texto para Discussão n. 706, Brasília: IPEA.

Gonçalves, A. L. (2013). Os efeitos das transferências fiscais sobre as despesas públicas e arrecadação tributária dos municípios brasileiros. **Revista de Desenvolvimento Econômico**, XV(28), 17-27.

Gordon, R. (1983). An Optimal Taxation Approach to Fiscal Federalism. **The Quarterly Journal of Economics**, 98(4), 567-586.

Gramlich, E. M. (1977). Intergovernmental Grants: a review of the empirical literature. In W. E. Oates (Eds.). **The political economy of fiscal federalism** (219-239). Lexington: Lexington Books.

Gramlich, E. M. (1993). A Policymarker's Guide to Fiscal Decentralization. **National Tax Journal**, XLVI(3), 229-235.

Gramlich, E. M., & Galper. H. (1973), State and local behavior and federal grant policy. **Brookings Papers on Economic Activity**, 4(1), 15-65.

Grossman, P. J. (1994). A political theory of intergovernmental grants. **Public Choice**, 78, 295-303.

Guedes, K. P., & Gasparini, C. E. (2007). Descentralização fiscal e tamanho do governo no Brasil. **Economia Aplicada**, 11(2), 303-323.

Gujarati, D.N. (2009). **Basic Econometrics**. Tata McGraw-Hill Education, New Delhi.

Habibi, N.; Huang, C.; Miranda, D.; Murillo, V.; Ranis, G.; Sarkar, M. & Stewart, F. (2003). Decentralization and Human Development in Argentina. **Journal of Human Development and Capabilities**, 4, 73-101.

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. **Econometrics Journal**, 3(2), 148-161.

Hamilton, B. W. (1983). The flypaper effect and other anomalies. **Journal of Public Economics**, 22(3), 347-361.

Hamilton, J. H. (1986). The flypaper effect and the deadweight loss from taxation. **Journal of Urban Economics**, 19 (2), 148-155.

Hayashi, F. (2000). **Econometrics**. Princeton University Press, Princeton.

Hayashi, M., & Boadway, R. (2001). An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada. **The Canadian Journal of Economics**, 34 (2), 481-503.

Hayek, A. (1945). The Use of Knowledge in Society F. **The American Economic Review**, 35(4), 519-530.

Heller, P. S. (1975). A Model of Public Fiscal Behavior in Developing Countries: Aid, Investment, and Taxation. **American Economic Review,** 65(3), 429-445.

Hemming, R., & Spahn, P. B. (1997). European Integration and The Theory of Fiscal Federalism. In T. Ter-Minassian, & M. Blejer. (Eds.). **Macroeconomic Dimension of Public Finance: Essays in Honor of Vito Tanzi**. Washington D. C.: International Monetary Fund.

Heyndels, B. (2001). Asymmetries in the flypaper effect: empirical evidence for the Flemish municipalities. **Applied Economics**, 33 (10), 1329-1334.

Hines, J. R., & Thaler R. H. (1995). The Flypaper Effect. **Journal of Economic Perspectives**, 9(4), 217-226.

Hoffmann, R., Silveira, F. G., & Payeras, J. A. (2006). **Progressividade e sacrifício equitativo na tributação: o caso do Brasil**. Rio de Janeiro: Instituto de Pesquisa Econômica Aplicada, 1188.

Hokonsen, L. (1998). An Investigation into Alternative Representations of the Marginal Cost of Public Funds. **International Tax and Public Finance**, 5, 329-343.

Hortas-Rico, M., Rios, V., & Pascual, P. (2020). **What shapes the flypaper effect? The role of the political environment in the budget process**. GEN Working Paper B 2020-1.

IBGE – Instituto Brasileiro de Geografia e Estatística. (2019). **Estimativas de população enviadas ao TCU.**

IBGE – Instituto Brasileiro de Geografia e Estatística. (2020). **Estimativas de população enviadas ao TCU.**

IBGE – Instituto Brasileiro de Geografia e Estatística. (2017). **Produto Interno Bruto Brasileiro**.

IBGE – Instituto Brasileiro de Geografia e Estatística (2018). **Produto Interno Bruto dos Municípios.**

Ingberman, D. E., & Inman, R. P. (1987). **The Political Economy of Fiscal Policy**. Working Paper 2405.

Inman, R. P. (1979). The Fiscal Performance of Local Governments: An Interpretive Review. In P. Mieszkowski & M. Straszheim (Eds.). **Current Issues in Urban Economics** (270-321). Baltimore: Johns Hopkins Press.

Inman, R. P. (2008). **The Flypaper Effect**. National Bureau of Economic Research Working Paper 14579, Cambridge, MA.

Inman, R. P., & Rubinfeld, D. L. (1996). Designing Tax Policies in Federalist Economies: An Overview. **Journal of Public Economics**, 60, 307-334.

Inman, R. P., & Rubinfeld, D. L. (1997). Rethinking Federalism. **Journal of Economic Perspectives**, (11), 43-64.

Iqbal Z. (1997). Foreign aid and the public sector: a model of fiscal behaviour in Pakistan. **Pakistan Development Review**, 36(2), 115-129.

Islam, M. (1998). Fiscal Illusion, Intergovernmental Grants and Local Spending. **Regional Studies**, 32(1), 63-71.

Islam, M. N., & Choudhury, S. A. (1990). Testing the Exogeneity of Grants to Local Governments. **Canadian Journal of Economics**, 23(3), 676-692.

Karnik, A., & Lalvani, M. (2008). Flypaper effect incorporating spatial interdependence. **Review of Urban & Regional Development Studies**, 20(2), 86-102.

Khan, H. A., & Hoshino, E. (1992). Impact of foreign aid on the fiscal behavior of LDC governments. **World Development**, 20(10), 1481-1488.

Kneebone, R., & McKenzie, K. (2001). Electoral and partisan cycles in fiscal policy: An examination of canadian provinces. **International Tax and Public Finance**, 8, 753–774.

Knight, B. (2002). Endogenous Federal Grants and Crowd-out of State Government Spending: Theory and Evidence from the Federal Highway Aid Program. **American Economic Review**, 92(1), 71-92.

Laband, D. N. (1986). The private interest in public redistribution: a public choice view of the geographic distribution of federal funds. **Public Choice**, 49, 117-125.

Ladd, H. F. (1993). State responses to the TRA86 revenue windfalls: A new test of the flypaper effect. **Journal of Policy Analysis and Management**, 12(1), 82-103.

Lago-Peñas, S. (2008). Local Governments' Asymmetric Reactions to Grants: Causes and Consequences. **Public Finance Review**, 36(2), 219-242.

Lanzer, B. N. (2011). **Ensaios sobre o Custo Marginal do Financiamento Público no Brasil**. Master's Thesis in Economics, UFRGS, Porto Alegre.

Levaggi, R., & Zanola, R. (2003). Flypaper Effect and Sluggishness: Evidence from Regional Health Expenditure in Italy. **International Tax and Public Finance**, 10(5), 535-547.

Levin, A., Lin, C., & Chu, C. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. **Journal of Econometrics**, 108(1), 1-24.

Lim, S., Lee, S., & Kim, P. (2017). Asymmetry in the fly-paper effect of the national subsidy in Korea. **Journal of the Asia Pacific Economy**, 22(4), 560-574.

Linhares, F. C., Simonassi, A. G., Nojosa, G. M. (2012). A Dinâmica do Equilíbrio Financeiro Municipal e a Lei de Responsabilidade Fiscal. **Revista EconomiA**, Setembro/Dezembro.

Litschig, S., & Morrison, K. (2013). The Impact of Intergovernmental Transfers on Education Outcomes and Poverty Reduction. **American Economic Journal: Applied Economics**, 5(4), 206-240.

Lloyd-Sherlock, P. (2006). Simple Transfers, Complex Outcomes: The Impacts of Pensions on Poor Households in Brazil. **Development and Change**, 37, 969-995.

Macedo, J. J., & Corbari, E. C. (2009). Efeitos da Lei de Responsabilidade Fiscal no endividamento dos Municípios Brasileiros: uma análise de dados em painéis. **Revista Contabilidade & Finanças**, 20(51), 44-60.

Mainwaring, S., & Scully, T. R. (1995). Introduction: Party Systems in Latin America. In **Building Democratic Institutions: Party Systems in Latin America** (Eds.). S. Mainwaring & T. R. (1-34). Scully, Stanford: Stanford University Press.

Marconi, N., Arvate, P. R., Moura Neto, J. S., & Palombo, P. E. M. (2009). Vertical transfers and the appropriation of resources by the bureaucracy: the case of Brazilian state governments. **Public Choice**, 141(1), 65-85.

Marshall, L. (1991). New Evidence on Fiscal Illusion: The 1986 Tax 'Windfalls'. **American Economic Review**, 81, 1336-44.

Martinez-Vazquez J., & Timofeev, A. (2009). A fiscal perspective of state rescaling. **Cambridge Journal of Regions, Economy and Society**, 2(1), 85-105.

Masiero, G., & Santarossa, M. (2019). Earthquakes, grants and public expenditure: how municipalities respond to natural disasters. **Journal of Regional Science**, 60(3), 481-516.

Mattos E., Politi R., & Yamaguchi, A. (2017). Grants and dispersion of local education spending in Brazil. **Regional Studies**, 52(2), 239-249.

Mattos, E., Cardim, R., Politi, R. (2018). Grants and Marginal Cost of Public Funding: Empirical Evidence for Local Governments in Brazil. **Revista Brasileira de Economia**, 72(4), 479-496.

Mattos, E., Rocha, F., & Arvate, P. R. (2011). Flypaper effect revisited: evidence for tax collection efficiency in Brazilian municipalities. **Estudos Econômicos**, 41(2), 239-267.

Megdal, S. R. (1987). The Flypaper Effect Revisited: An Econometric Explanation. **The Review of Economics and Statistics**, 69(2), 347-351.

Mendes, C. C., & Sousa, M. C. S. (2006). Demand for locally provided public services within the median voter's framework: the case of the Brazilian municipalities. **Applied Economics**, 38(3), 239-251.

Mendes, M. J. (2002). **Descentralização fiscal baseada em transferências e captura de recursos públicos nos municípios brasileiros**. Doctoral Thesis in Economics. Universidade de São Paulo, São Paulo, SP, Brazil.

Mendes, M. J. (2005). Capture of fiscal transfers: a study of Brazilian local governments. **Economia Aplicada**, 9(3), 427-444.

Mendes, M. J., Miranda, R. B., & Cossio, F. (2008). **Transferências intergovernamentais no Brasil: diagnóstico e proposta de reforma**. Consultoria Legislativa do Senado Federal, Texto para Discussão 40, abr.

Mendes, Marcos. (2011). **Fundo de Participação dos Estados: sugestão de novos critérios de partilha que atendam determinação do STF**. Núcleo de Estudos e Pesquisas do Senado, 96.

Mendes, W. D. A., Ferreira, M. A. M., Abrantes, L. A., & Faria, E. R. D. (2018). A influência da capacidade econômica e da formação de receitas públicas no desenvolvimento humano. **Revista de Administração Pública**, 52(5), 918-934.

Moffitt, R. A. (1984) The effects of grants-in-aid on state and local expenditures - The case of AFDC. **Journal of Public Economics**, 23, 279-305.

Monasterio, L. M. (2014). A estranha distribuição da população dos pequenos municípios brasileiros. **Revista Econômica do Nordeste**, 45(4), 111-119.

Nascimento, J. S. (2010). **Efeitos das transferências sobre os gastos e a arrecadação dos municípios brasileiros**. Doctoral Thesis in Economics, Universidade de Viçosa, Viçosa, MG, Brazil.

Niskanen, W.A. (1971). **Bureaucracy and representative government**. Chicago: Aldine-Atherton.

Oates, W. E. (1972). **Fiscal federalism**. New York: Harcourt Brace.

Oates, W. E. (1988). On the nature and measurement of fiscal illusion: a survey. In Brennan *et al.* (Eds.). **Taxation and Fiscal Fereralism: Essays in Honor of Russel Mathews** (65-82). Camberra.

Olson, M. (1965). **The logic of collective action. Public goods and the theory of groups**. Massachusetts, Harvard University Press.

Oulasvirta, L. (1997). Real and perceived effects of changing the grant system from specific to general grants. **Public Choice,** 91, 397-416.

Panao, R. A. L. (2020). Beyond Flypaper: Unconditional Transfers and Local Revenue Generation in the Philippines, 1992–2016. **International Journal of Public Administration**, 1-14.

Pansani, D. A. (2018). **Cálculo de índice de ilusão fiscal a partir de evidências do efeito flypaper e da ilusão causada pela complexidade da estrutura tributária de estados e municípios**. Master's Thesis in Accounting, Universidade de Brasília, Brasília, DF, Brazil.

Pansani, D. A., Serrano, A. L. M., & Ferreira, L. O. G. (2020). Análise de Evidências e Causas do Efeito Flypaper e da Ilusão Fiscal nos Estados e Municípios Brasileiros. **Administração Pública e Gestão Social**, 12(3).

Parmagnani, F. J. A., & Rocha, F. (2013). **Evaluating the impact of SUS transfers on municipalities' health expenditures**. FEA-USP Working Paper, University of São Paulo, São Paulo, revised 15 Jan 2014.

Payeras, J. A., & Cunha, M. S. (2004). O princípio do sacrifício equitativo no sistema tributário brasileiro. **Revista Economia**, 5(2), 297-339.

Payeras, J. A., & Hoffmann, R. (2009). O sacrifício equitativo na tributação brasileira. **Revista Economia**, 10(4), 766- 788.

Pesaran, M. H. (2004). **General diagnostic tests for cross section dependence in panels**. University of Cambridge, Faculty of Economics, Cambridge Working Papers in Economics 0435.

Pesaran, M. H. (2015). Testing Weak Cross-Sectional Dependence in Large Panels. **Econometric Reviews**, 34(6-10), 1089-1117.

Postali, F. A. S. (2015). Tax effort and oil royalties in the Brazilian municipalities. **EconomiA,** 16(3), 395-405.

Prud'homme, R. (1995). The dangers of decentralization. **The World Bank Research Observer**, 10(2), 201-220.

Psycharis, Y., Zoi, M., & Iliopoulou, S. (2016). Decentralization and local government fiscal autonomy: evidence from the Greek municipalities. **Environment and Planning C: Government and Policy**, 34(2), 262-280.

Puviani, A. (1903). **Teoria dell'illusione finanziaria**. Milan: Remo Sandon.

Ribeiro, E. C. B. A. (2015). **Ensaios sobre os gastos públicos dos municípios brasileiros: Análises dos fenômenos efeito flypaper, corrida para o fundo e migração de bem-estar**. Doctoral Thesis in Economics. Universidade Federal de Juiz de Fora, RJ, Brazil.

Ribeiro, E. P. (2005). Capacidade e Esforço Tributário no Rio Grande do Sul: O caso dos municípios. **Perspectiva Econômica**, 1(1), 21- 49.

Ribeiro, E. P., & Shikida, C. (2000). Existe trade-off entre receitas próprias e transferências? O caso dos municípios mineiros. In de J. A. Paula & E. Alli (Eds.). **Anais do IX Seminário sobre a Economia Mineira 1** (441-462), Cedeplar, Universidade Federal de Minas Gerais, MG, Brazil.

Ribeiro, E.P., & Schwengber, S. B. (2000). **O Impacto do Fundo de Participação (FPE) no Esforço Tributário dos Estados: uma estimativa do potencial de arrecadação do ICMS**. IV Prêmio STN de Monografias, Brasília: ESAF.

Rios, M. E., & Costa, J. S. (2005). O Efeito Flypaper nas Transferências para os Municípios Portugueses. **Revista Portuguesa de Estudos Regionais**, 8, 85-108.

Rocha, C. A. A. (2011). **Rateio do FPE: Avaliação de Impacto e de Viabilidade Legislativa das Propostas Aventadas**. Núcleo de Estudos e Pesquisas do Senado, 102.

Rodríguez-Pose, A., & Gill, N. (2004). Reassessing Relations between the Centre and the States: The Challenge for the Brazilian Administration. **Regional Studies**, 38(7), 833-844.

Roemer, J., & Silvestre, J. (2002). The "Flypaper Effect" Is Not an Anomaly. **Journal of Public Economic Theory**, 4 (1), 1-17.

Rogoff, K. (1990). **Political Budget Cycles**. American Economic Review 80, 1-16.

Ross, J. M., & Yan, W. (2013). Fiscal illusion from property reassessment?: an empirical test of the residual view. **National Tax Journal**, Forthcoming 66(1), 7-32.

Sagbas, S., & Saruc, N. T. (2004). Intergovernmental Transfers and the Flypaper Effect in Turkey. **Turkish Studies**, 5(2), 79-92.

Sakurai, S. N. (2013). Efeitos assimétricos das transferências governamentais sobre os gastos públicos locais: evidências em painel para os municípios brasileiros. **Pesquisa e Planejamento Econômico (PPE),** 43 (2), 309-332.

Sakurai, S. N., & Menezes-Filho, N. (2008). Fiscal policy and reelection in Brazilian municipalities. **Public Choice**, 137(1), 301-314.

Sakurai, S. N., & Menezes-Filho, N. (2011). Opportunistic and partisan election cycles in Brazil: new evidence at the municipal level. **Public Choice**, 148, 233-247.

Salomão Neto, B. A. (2020). Problemas fiscais, efeito Flypaper e hipótese do Leviatã em Uberlândia: diagnóstico e proposição de soluções. **Revista de Desenvolvimento e Políticas Públicas**, 4(1), 21-39.

Sanderson, E., & Windmeijer, F. (2016). A Weak-Instrument F-test in Linear IV Models with Multiple Endogenous Variables. **Journal of Econometrics**, 190(2), 212-221.

Saruc, N. T., & Sagbas, I. (2008). The Surge Impact of the Flypaper, Substıtutıon and Stımulatıon Effects on Local Tax Effort in Turkey. **International Research Journal of Finance and Economics**, 13, 42-49.

Schettini, B. P. (2012). Análises da dinâmica orçamentária dos municípios brasileiros: uma aplicação da metodologia VAR com dados empilhados. **Economia Aplicada**, 16(2), 291-310.

Schneider, R. A. (2012). **Motivação política nas transferências voluntárias federais nos Estados Unidos**. Master's Thesis in Economics. Universidade de Brasília, Brasília, DF, Brasil.

Sepúlveda, C. F. (2017). Taxpayers' Behavior and the Flypaper Effect. **Review of Public Economics**, 222, 91-108.

Severo Filho, F. A. A. (2012). **Análise do flypaper effect e sua variabilidade nos municípios cearenses**. Master's Thesis in Economics. Universidade Federal do Ceará, Fortaleza, CE, Brazil.

Shah, A. (1994). **The reform of intergovernmental fiscal relations in developing and emerging market economies**. Washington, D.C.: World Bank.

Silva I, & Sumarto S. (2015). How do educational transfers affect child labour supply and expenditures? Evidence from indonesia of impact and flypaper effectsoxf. **Dev. Stud.**, 43(4), 483-507.

Simão, J. B., & Orellano, V. I. F. (2015). Um estudo sobre a distribuição das transferências para o setor de saúde no Brasil. **Estud. Econ.**, 45(1), 33-63.

Smith, A. (2003). **The Wealth of Nations**. Fifth Edition, Bentham Bell, New York.

Soares, M. M., & Neiva, P. R. P. (2011). Federalism and Public Resources in Brazil: Federal Discretionary Transfers to States. **Brazilian Political Science Review**, 5(2).

Souza, M. C. S. (2003). Technical Efficiency of the Brazilian Municipalities: correcting non-parametric frontier measurements for outliers. **Programa de Seminários Acadêmicos**, Universidade de Brasília, Brasília, DF, Brazil.

Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression, In D. W. K. Andrews, & J. H. Stock (Eds.). **Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg** (5, 80-108).

Stock, J. H., Wright, J. H., & Yogo, M. (2002). A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments. **Journal of Business and Economic Statistics**, 20, 518-529.

Strumpf, K. S. (1998). A predictive index for the flypaper effect. **Journal of Public Economics**, 69, 389-412.

Suzuki, K. & Ha, H. (2018). Municipal Merger and Local Democracy: An Assessment of the Merger of Japanese Municipalities. **Lex localis - Journal of Local Self-Government**, 16(4), 759-784.

Tanzi, V. (1996). Fiscal federalism and decentralisation: a review of some efficiency and macroeconomic aspects. In **Annual world bank conference on development economics** (1995, 295-315). Annual World Bank Conference on Development Economics, Washington D.C.

Tiebout, C.M. (1956). A Pure Theory of Local Expenditures. **Journal of Political Economy**, 64, 416-424.

Tomio, F. R. L. (2002). A criação de municípios após a Constituição de 1988A Criação de municípios após a Constituição de 1988. **Revista Brasileira de Ciências Sociais**, 17(48), 61-89.

Vallés-Giménez, J., & Zárate-Marco, A. (2017). Tax Effort of Local Governments and its Determinants: The Spanish Case. **Annals of Economics and Finance**, 18(2), 323-348.

Vegh, C. A., & G. Vuletin. (2016). Unsticking the flypaper effect using distortionary taxation. **Económica**, 62, 185-237.

Végh, C. A., & Vuletin, G. (2010). **Unsticking the flypaper effect using distortionary taxation**, working paper, University of Maryland.

Vegh, C. A., & Vuletin, G. (2015). Unsticking the flypaper effect in an uncertain world. **Journal of Public Economics**, 131(C), 142-155.

Veiga, L. G., & Veiga, J. (2007). Political business cycles at municipal level. **Public Choice**, 131, 45-64.

Veloso, J. F. A. (2008). **As transferências intergovernamentais e o esforço tributário municipal: uma análise do fundo de participação dos municípios (FPM)**. Master's Thesis in Economics, Universidade Católica de Brasília, Brasília.

Vieira, M., Abrantes, L., Almeida, F., & Anjos, D. (2019). Implicações do Fundo de Participação dos Estados (FPE) na Redução das Desigualdades Regionais. **Journal of Accounting, Management and Governance**, 22(1), 136-152.

Wallis, J. J., & Oates, W. E. (1988). Decentralization in the Public Sector: An Empirical Study of State and Local Government. In. Rosen, Harvey S. **Fiscal Federalism: Quantitative Studies**, University of Chicago Press, p. 5-32.

Wheare, K. C. (1946). **Federal government**. London, Oxford University.

White, H. (1994). Foreign Aid, Taxes and Public Investment: A Further Comment. **Journal of Development Economics**, 45(1), 155-63.

Wilde, J. A. (1971). Grants-in-aid: The Analytics of Design and Response. **National Tax Journal**, 24, 143-156.

Williams, R., Allison, P. D., & Moral-Benito, E. (2018). Linear Dynamic Panel-data Estimation Using Maximum Likelihood and Structural Equation Modeling. **The Stata Journal**, 18(2), 293-326.

Wyckoff, P. G. (1988). A bureaucratic theory of flypaper effects. **Journal of Urban Economics**, 23(1), 115-129.

Wyckoff, P. G. (1991). The elusive flypaper effect. **Journal of Urban Economics**, 30(3), 310-328.

Zhang, H., & Hu, W. (2009), Impact of fiscal transfer of fiscal effort of Chinese provincial government. **Front. Econ.**, 4(3), 406-424.

APPENDIXES

Appendix 1: Municipalities without IFDM index at least one year (unbalanced panel)

n	IBGE	Mun.	UF	n	IBGE	Mun.	UF
1	1101104	Itapuã do Oeste	RO	153	2203230	Currais	PI
2	1101476	Primavera de Rondônia	RO	154	2203354	Dirceu Arcoverde	PI
3	1200013	Acrelândia	AC	155	2203750	Fartura do Piauí	PI
4	1200054	Assis Brasil	AC	156	2204550	Guaribas	PI
5	1200328	Jordão	AC	157	2205250	Jardim do Mulato	PI
6	1200393	Porto Walter	AC	158	2205300	Jerumenha	PI
7	1200435	Santa Rosa do Purus	AC	159	2205581	Lagoa do Piauí	PI
8	1200609	Tarauacá	AC	160	2205904	Manoel Emídio	PI
9	1200807	Porto Acre	AC	161	2206308	Miguel Leão	PI
10	1300029	Alvarães	AM	162	2206720	Nazária	PI
11	1300086	Anamã	AM	163	2206803	Nossa Senhora dos Remédios	PI
12	1300631	Beruri	AM	164	2206951	Novo Santo Antônio	PI
13	1300904	Canutama	AM	165	2207553	Paquetá	PI
14	1301605	Fonte Boa	AM	166	2207777	Patos do Piauí	PI
15	1302108	Japurá	AM	167	2207934	Pedro Laurentino	PI
16	1302306	Jutaí	AM	168	2208106	Pimenteiras	PI
17	1303700	Santo Antônio do Içá	AM	169	2208908	Ribeiro Gonçalves	PI
18	1303908	São Paulo de Olivença	AM	170	2209104	Santa Cruz do Piauí	PI
19	1304005	Silves	AM	171	2209203	Santa Filomena	PI
20	1304260	Uarini	AM	172	2209450	Santo Antônio dos Milagres	PI
21	1400027	Amajari	RR	173	2209708	São Francisco do Piauí	PI
22	1400175	Cantá	RR	174	2209955	São João da Varjota	PI
23	1400209	Caracaraí	RR	175	2209971	São João do Arraial	PI
24	1400233	Caroebe	RR	176	2210359	São Lourenço do Piauí	PI
25	1400282	Iracema	RR	177	2210391	São Miguel do Fidalgo	PI
26	1400308	Mucajaí	RR	178	2210623	Sebastião Barros	PI
27	1400407	Normandia	RR	179	2210904	Socorro do Piauí	PI
28	1400456	Pacaraima	RR	180	2211209	Uruçuí	PI
29	1400472	Rorainópolis	RR	181	2211357	Várzea Branca	PI
30	1400506	São João da Baliza	RR	182	2404309	Governador Dix-Sept Rosado	RN
31	1400605	São Luiz	RR	183	2410009	Pilões	RN
32	1400704	Uiramutã	RR	184	2411056	Tibau	RN
33	1500701	Anajás	PA	185	2412559	São Miguel do gostoso	RN
34	1500909	Augusto Corrêa	PA	186	2501302	Aroeiras	PB
35	1501253	Bannach	PA	187	2509404	Mogeiro	PB
36	1501451	Belterra	PA	188	2510006	Nazarezinho	PB
37	1501907	Bujaru	PA	189	2510600	Ouro Velho	PB
38	1501956	Cachoeira do Piriá	PA	190	2513000	Salgadinho	PB
39	1502772	Curionópolis	PA	191	2513505	Santana de Mangueira	PB
40	1502806	Curralinho	PA	192	2514602	São José do Bonfim	PB
41	1503200	Igarapé-Açu	PA	193	2515203	São Sebastião do Umbuzeiro	PB
42	1504604	Mocajuba	PA	194	2516805	Triunfo	PB
43	1504752	Mojuí dos Campos	PA	195	2603926	Carnaubeira da Penha	PE
44	1504950	Nova Esperança do Piriá	PA	196	2614402	Solidão	PE
45	1505403	Ourém	PA	197	2701506	Campo Grande	AL
46	1505494	Palestina do Pará	PA	198	2701605	Canapi	AL
47	1505650	Placas	PA	199	2703304	Inhapi	AL
48	1505908	Porto de Moz	PA	200	2703601	Japaratinga	AL
49	1506401	Santa Cruz do Arari	PA	201	2704104	Lagoa da Canoa	AL
50	1507466	São João da Ponta	PA	202	2705309	Minador do Negrão	AL
51	1507508	São João do Araguaia	PA	203	2705408	Monteirópolis	AL

52	1507706	São Sebastião da Boa Vista	PA	204	2706802	Piaçabuçu	AL
53	1508357	Vitória do Xingu	PA	205	2708204	São Brás	AL
54	1600055	Serra do Navio	AP	206	2709202	Traipu	AL
55	1600154	Pedra Branca do Amaparí	AP	207	2802601	Gracho Cardoso	SE
56	1600238	Ferreira Gomes	AP	208	2804201	Monte Alegre de Sergipe	SE
57	1600253	Itaubal	AP	209	2900207	Abaré	BA
58	1600808	Vitória do Jari	AP	210	2901502	Anguera	BA
59	1703073	Barra do Ouro	TO	211	2901809	Antônio Gonçalves	BA
60	1703826	Cachoeirinha	TO	212	2903706	Boa Nova	BA
61	1704600	Chapada de Areia	TO	213	2905305	Cafarnaum	BA
62	1709807	Ipueiras	TO	214	2906899	Caraíbas	BA
63	1710706	Itaguatins	TO	215	2908705	Condeúba	BA
64	1712157	Lavandeira	TO	216	2909208	Coronel João Sá	BA
65	1715705	Palmeirante	TO	217	2910776	Feira da Mata	BA
66	1716703	Colméia	TO	218	2912509	Ibipitanga	BA
67	1717206	Piraquê	TO	219	2913408	Igaporã	BA
68	1718451	Pugmil	TO	220	2915353	Itaguaçu da Bahia	BA
69	1718709	Rio dos Bois	TO	221	2917003	Itiúba	BA
70	2100105	Afonso Cunha	MA	222	2918506	Jussara	BA
71	2100154	Água Doce do Maranhão	MA	223	2920304	Malhada de Pedras	BA
72	2100402	Altamira do Maranhão	MA	224	2922854	Nova Redenção	BA
73	2100477	Alto Alegre do Pindaré	MA	225	2924207	Pedro Alexandre	BA
74	2100501	Alto Parnaíba	MA	226	2924504	Pindaí	BA
75	2100600	Amarante do Maranhão	MA	227	2924702	Piripá	BA
76	2100808	Anapurus	MA	228	2925600	Presidente Dutra	BA
77	2100873	Araguanã	MA	229	2926509	Ribeira do Amparo	BA
78	2101301	Bacuri	MA	230	2930758	Sítio do Mato	BA
79	2101350	Bacurituba	MA	231	2932457	Umburanas	BA
80	2101731	Belágua	MA	232	2933455	Wanderley	BA
81	2101772	Bela Vista do Maranhão	MA	233	3106408	Belo Vale	MG
82	2101905	Bequimão	MA	234	3117009	Comercinho	MG
83	2102002	Bom Jardim	MA	235	3118700	Coqueiral	MG
84	2102150	Brejo de Areia	MA	236	3120409	Cristiano Otoni	MG
85	2102309	Buriti Bravo	MA	237	3123304	Dores do Turvo	MG
86	2102374	Cachoeira Grande	MA	238	3124906	Eugenópolis	MG
87	2102408	Cajapió	MA	239	3125309	Faria Lemos	MG
88	2102507	Cajari	MA	240	3127305	Galiléia	MG
89	2103109	Cedral	MA	241	3128709	Guaxupé	MG
90	2103125	Central do Maranhão	MA	242	3130556	Imbé de Minas	MG
91	2103158	Centro do Guilherme	MA	243	3139300	Manga	MG
92	2103257	Cidelândia	MA	244	3145802	Onça de Pitangui	MG
93	2103752	Davinópolis	MA	245	3157278	Santa Bárbara do Monte Verde	MG
94	2103802	Dom Pedro	MA	246	3158953	Santana do Paraíso	MG
95	2104099	Formosa da Serra Negra	MA	247	3164209	São Romão	MG
96	2104206	Fortuna	MA	248	3170305	Umburatiba	MG
97	2104503	Governador Archer	MA	249	3170529	Urucuia	MG
98	2104628	Governador Luiz Rocha	MA	250	3171105	Veríssimo	MG
99	2104651	Governador Newton Bello	MA	251	3171709	Virgínia	MG
100	2104677	Governador Nunes Freire	MA	252	3505609	Barrinha	SP
101	2104701	Graça Aranha	MA	253	3508306	Cabrália Paulista	SP
102	2105005	Humberto de Campos	MA	254	3525805	Júlio Mesquita	SP
103	2105153	Igarapé do Meio	MA	255	3533205	Nova Independência	SP
104	2105203	Igarapé Grande	MA	256	3553302	Tambaú	SP
105	2105609	Joselândia	MA	257	3557204	Chavantes	SP
106	2105658	Junco do Maranhão	MA	258	4100905	Amaporã	PR
107	2105807	Lago do Junco	MA	259	4101309	Antônio Olinto	PR

108	2105906	Lago Verde	MA	260	4108452	Foz do Jordão	PR
109	2105963	Lagoa Grande do Maranhão	MA	261	4109500	Guaraqueçaba	PR
110	2106201	Luís Domingues	MA	262	4119103	Piên	PR
111	2106326	Maracaçumé	MA	263	4126009	São Sebastião da Amoreira	PR
112	2106631	Matões do Norte	MA	264	4126272	Saudade do Iguaçu	PR
113	2106706	Mirador	MA	265	4200754	Alto Bela Vista	SC
114	2106904	Monção	MA	266	4203105	Caibi	SC
115	2107100	Morros	MA	267	4205506	Fraiburgo	SC
116	2107308	Nova Iorque	MA	268	4210050	Macieira	SC
117	2107357	Nova Olinda do Maranhão	MA	269	4211652	Novo Horizonte	SC
118	2108058	Paulino Neves	MA	270	4212650	Pescaria Brava	SC
119	2108108	Paulo Ramos	MA	271	4220000	Rincão	SC
120	2108256	Pedro do Rosário	MA	272	4301057	Arroio do Sal	RS
121	2108405	Peri Mirim	MA	273	4304622	Capão Bonito do Sul	RS
122	2108801	Pirapemas	MA	274	4304655	Capão do Cipó	RS
123	2109270	Presidente Sarney	MA	275	4304697	Capitão	RS
124	2109403	Primeira Cruz	MA	276	4308300	Fontoura Xavier	RS
125	2109759	Santa Filomena do Maranhão	MA	277	4312609	Muçum	RS
126	2110039	Santa Luzia do Paruá	MA	278	4314175	Pedras Altas	RS
127	2110203	Santa Rita	MA	279	4314548	Pinto Bandeira	RS
128	2110401	São Benedito do Rio Preto	MA	280	4316303	Roque Gonzales	RS
129	2110807	São Félix de Balsas	MA	281	4317251	Santa Tereza	RS
130	2111003	São João Batista	MA	282	4318200	São Francisco de Paula	RS
131	2111029	São João do Carú	MA	283	4319505	São Sebastião do Caí	RS
132	2111052	São João do Paraíso	MA	284	4320354	Sentinela do Sul	RS
133	2111532	São Pedro da Água Branca	MA	285	4322152	Tunas	RS
134	2111631	São Raimundo do Doca Bezerra	MA	286	4322558	Vanini	RS
135	2111672	São Roberto	MA	287	5006275	Paraíso das Águas	MS
136	2111706	São Vicente Ferrer	MA	288	5105176	Juruena	MT
137	2111789	Serrano do Maranhão	MA	289	5106000	Nortelândia	MT
138	2111904	Sucupira do Norte	MA	290	5106851	Porto Estrela	MT
139	2112001	Tasso Fragoso	MA	291	5107578	Rondolândia	MT
140	2112100	Timbiras	MA	292	5108352	Vale de São Domingos	MT
141	2112274	Tufilândia	MA	293	5200159	Adelândia	GO
142	2112308	Tuntum	MA	294	5201454	Aparecida do Rio Doce	GO
143	2112605	Urbano Santos	MA	295	5201603	Araçu	GO
144	2201150	Baixa Grande do Ribeiro	PI	296	5204201	Cachoeira de Goiás	GO
145	2201309	Barreiras do Piauí	PI	297	5209457	Guarinos	GO
146	2201705	Bertolínia	PI	298	5212303	Leopoldo de Bulhões	GO
147	2201929	Bonfim do Piauí	PI	299	5219506	Santa Rosa de Goiás	GO
148	2201945	Boqueirão do Piauí	PI	300	5220280	São Patrício	GO
149	2202174	Campo Largo do Piauí	PI	301	5220702	Sítio d'Abadia	GO
150	2202455	Capitão Gervásio Oliveira	PI	302	5221080	Teresina de Goiás	GO
151	2202851	Coronel José Dias	PI	303	5221452	Trombas	GO
152	2203008	Cristalândia do Piauí	PI				

Source: authors. ID: It is an identification number defined by the IBGE. UF: Unit Federation or States, which are 27 (AC: Acre, AL: Alagoas, AM: Amazonas, AP: Amapá, BA: Bahia, CE: Ceará, DF: Federal District, ES: Espírito Santo, GO: Goiás, MA: Maranhão, MG: Minas Gerais, MS: Mato Grosso do Sul, MT: Mato Grosso, PA: Pará, PB: Paraíba, PE: Pernambuco, PI: Piauí, PR: Paraná, RJ: Rio de Janeiro, RN: Rio Grande do Norte, RO: Rondônia, RR: Roraima, RS: Rio Grande do Sul, SC: Santa Catarina, SE: Sergipe, SP: São Paulo, TO: Tocantins).

Appendix 2: Percentage of each kind of Grant from 2006 to 2013

Variable	Obs	Mean	Std.Dev.	Min	Max
FPM percent	44,560	0.627	0.201	0.000	1.000
ITR percent	44,560	0.004	0.010	0.000	0.512
IOF percent	44,560	0.000	0.006	0.000	0.511
ICMS percent	44,560	0.331	0.177	0.000	0.965
IPVA percent	44,560	0.030	0.035	0.000	0.423
IPIEx percent	44,560	0.005	0.005	0.000	0.340

Source: authors. Considering the lack of data available, it is an unbalanced panel because some municipalities did not present data in some years. The municipalities that do not have data of FPM are presented in Appendix 5. Obs: observations. Std.Dev.: Standard deviation. Min: minimum. Max: maximum. Available on: https://www.tesourotransparente.gov.br/consultas/transferencias-constitucionais-realizadas.

Appendix 3: IFDM Components

Employment/Income	Education	Health
Formal jobs generation	Primary school enrollment	Proportion of prenatal consultation
Formalization rate	Primary school leaver	Death due to not defined cause
Income generation	Age-series distortion on primary school	Child mortality
Real aggregate wages on formal jobs	Undergraduate teachers in primary school	Hospitalizations (ISAB)
Gini index	Average daily hour-class in primary school	
	IDEB index result	

Source: authors. IDEB: Basic Education Development Index (Índice de Desenvolvimento da Educação Básica - IDEB, in portuguese). ISAB: Internments suitable for Primary Healthcare.

Appendix 4: Pearson correlation instrument variable IFDM from 2006 to 2013

	Exp	GDP	Grant	IFDM
Exp	1			
GDP	0.350	1		
Grant	0.449	-0.004	1	
IFDM	0.109	0.430	-0.201	1

Source: authors

Appendix 5: Municipalities with the 10 worst and best IFDM index in 2013

id	Mun.	State	IFDM	Pop	Exp	GDP	Grant
1304237	Tonantins	AM	0.10	18162	660.857	2003.59	180.778
1501105	Bagre	PA	0.12	26666	0	1935.83	134.487
5200852	Americano do Brasil	GO	0.14	5813	725.828	4409.46	300.967
2614303	Moreilândia	PE	0.14	11246	853.748	2209.39	235.316
2913002	Ibitiara	BA	0.14	16647	1735.88	1658.57	200.43
1505809	Portel	PA	0.14	56094	616.055	2974.01	100.465
2404309	Governador Dix-Sept Rosado	RN	0.15	12934	716.951	7533.7	196.863
2203271	Curral Novo do Piauí	PI	0.15	5027	693.488	1630.32	306.787
2612109	Salgadinho	PE	0.16	10076	475.131	1594.22	196.98
2211704	Wall Ferraz	PI	0.16	4355	673.316	1807.62	354.126
---	---	---	---	---	---	---	---
4108403	Francisco Beltrão	PR	0.85	84437	532.751	8949.39	103.057
2312908	Sobral	CE	0.85	197663	753.783	6318.09	109.828
2304285	Eusébio	CE	0.85	49455	1039.13	15301.18	131.941
5107925	Sorriso	MT	0.86	75104	746.594	17903.38	81.5299

1502152	Canaã dos Carajás	PA	0.86	31062	1761.93	40961.66	115.454
5107909	Sinop	MT	0.87	123634	598.732	10627.09	70.1632
3140001	Mariana	MG	0.87	57639	1550.03	41907.08	120.939
4211306	Navegantes	SC	0.89	68337	721.939	14491.98	95.2235
3131901	Itabirito	MG	0.90	48614	1257.6	30252.04	130.355
5008305	Três Lagoas	MS	0.90	109633	931.631	21636.68	93.5315

Source: authors

Appendix 6: 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 7: Flypaper Effect researches in Brazil

n	Author	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 & 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.	Municipalitie's 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 & Gasparini (2007)	26 brazilian states agrouped by their	It was verified the presence of fiscal illusion and flypaper effect, although the main objective of the study was the relation	Government Size	Self-financing capacity; Expenditure's decentralization; Vertical imbalance; Transfers *per capita*; Urbanization; Public debt; Schools;	Yes

		municipalities from 1998 to 2001	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).		Teachers per student; Garbage collection rate; Unemployment rate; Water supply.	
6	Macedo & 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 & 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	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	Expenditure	Conditional transfers; Unconditional transfers; GDP; Tax Revenue; Population; Population²; Dummy surplus/deficit.	No

	& Paixão (2012)		expenditures and the transfers analyzed did not present an expansive effect and neither a flypaper effect.			
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 & 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 & 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 áreas.	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 & 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 & 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 & Vuletin (2016)	26 Brazilian states from 1985 to 2005 and also 23 Argentinean 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	Government spending	Output; Fiscal transfers; Socio-economic/geographical controls.	Yes

			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).			
22	Diniz, Lima & 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 municipalitiy 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 & 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 & 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,	Current expenditure	Grants; Gross Domestic Product; percentages of woman, youth, and elderly people above 60 years; populational density; the employment	Yes

			evidences of higher flypaper effect were found in municipalities with low tax autonomy.		and income Municipal Development Firjan Index (IFDM).	
27	Pansani, Serrano & 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 & 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 8: IBGE Query (*in portuguese*)

Dados do Pedido

Tipo de manifestação Acesso à Informação *Número 03005.173660/2020-17* *Esfera Federal* *Órgão destinatário IBGE – Fundação Instituto Brasileiro de Geografia e Estatística* *Serviço -* *Órgão de interesse -* *AssuntoAcesso à informação* *Subassunto* *Tag -* *Data de cadastro 30/10/2020* *Prazo de atendimento 23/11/2020* *Situação Concluída* *Registrado por Lucas Oliveira Gomes Ferreira* *Modo de resposta Pelo sistema (com avisos por email)* *Canal de entrada Internet*
Prezados, fiz um pedido (protocolo 03950003556201844) e o IBGE respondeu falando que as informações do pib municipal tem uma defasagem de dois anos. Porém, já estamos em novembro praticamente de 2020 e até o momento não foi disponibilizado o pib de 2018. Qual o motivo? Quando será divulgado?

Dados da Resposta

Prezado Sr. Lucas, *O IBGE disponibiliza no sítio https://www.ibge.gov.br/calendario-estudos-e-pesquisas-estruturais-e-especiais o calendário com as previsões de divulgação de seus estudos e pesquisas estruturais e especiais em 2020.* *Recomendamos que observe que a data de divulgação para o Produto Interno Bruto dos Municípios – 2018 está prevista para o mês de dezembro de 2020. Esta data tem se mantido tanto na previsão anterior quanto na atual da referida divulgação.* *Solicitamos que acompanhe, no link acima, as previsões da divulgação do Produto Interno Bruto dos Municípios -2018 e suas possíveis alterações.*

Appendix 9: Datasus Query (*in portuguese*)

Dados do Pedido

Protocolo 25820007125201875
Solicitante Lucas Oliveira Gomes Ferreira *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*
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 extraí as informações.* *http://tabnet.datasus.gov.br/cgi/deftohtm.exe?siab/cnv/SIABCbr.def*

Dados da Resposta

Data de Resposta 10/12/2018 12:34 *Tipo de Resposta Acesso Concedido* *Classificação do Tipo de Resposta Resposta solicitada inserida no e-SIC*
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*

Appendix 10: Descriptive Statistics

	Without Federal District				With Federal District				Municipalities			
Variables	**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).