Intergovernmental Transfers in Hard Times: Evidence from Brazilian local governments in the COVID-19 crisis.

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Abstract

The socioeconomic impact of fiscal transfers to local governments in developing countries is a subject of controversy in the literature. However, there is a lack of studies investigating the impact of those resources in exceptional circumstances, such as during crises and public emergencies. This article aims to evaluate whether the intergovernmental transfers impacted the response of Brazilian municipalities to the COVID-19 pandemic. To achieve this objective, we focused on the main transfer to local governments, the Municipal Participation Fund - FPM. Considering the program allocation rule, which increases resources to municipalities that experience changes in their population range, we employed a Regression Discontinuous Design. This approach can identify the impact of the FPM on the number of COVID-19-related deaths, hospitalizations, and healthcare expenditures. The findings suggest that higher per capita transfer from the FPM had a significant impact in mitigating the number of deaths and serious hospitalizations, as well as increasing healthcare expenditures, with primary care spending being the main channel. These results indicate that during crises, increased access to local resources is beneficial, which challenges some empirical findings and models suggesting that intergovernmental transfers in developing countries are always susceptible to capture by elites.

Keywords: *FPM, Intergovernmental transfers, COVID-19, RDD, natural experiment*

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Short Running Title: COVID-19 and Intergovernmental Transfers

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1. Introduction

The impact of intergovernmental transfers to subnational governments in developing countries is a subject of controversy. Nevertheless, these transfers finance approximately 60% of subnational entities' expenditures (Shah 2007). There is a range of theoretical models and arguments, especially in the case of developing countries, that suggest intergovernmental transfers are more susceptible to resource capture by local elites, having poorer investment allocation, lower bureaucratic quality, and fiscally irresponsible behaviors (Prud'homme 1995; Bardhan and Mookherjee 2000, 2006; Vigneault 2007).

On the other hand, there is a range of models indicating that the inherent incentives of receiving these transfers can lead to socially optimal or suboptimal resource utilization, depending on the existence of checks and balances mechanisms. One of these mechanisms, for example, is voter scrutiny, which pressures politicians to be accountable for their actions (Persson and Tabellini 2002; Besley 2006), contributing to transparency in resource allocation that aligns better with local preferences (Tiebout 1956; Oates 1999; Boadway 2007).

In Brazil, the focus of this study, fiscal transfers from the federal government to local governments through the Municipal Participation Fund (FPM) represent nearly a third of municipal revenues, making it a primary source of income for many Brazilian municipalities (Corbi et al. 2019). As predicted by theory, empirical evidence shows positive, negative, or null outcomes of FPM transfers.

Adding to the skeptical view, there is evidence that increased FPM transfers can deteriorate local political processes by raising corruption levels and decreasing the quality of candidates running for office (Brollo et al. 2013). Furthermore, increased resources received by municipal governments may not translate into greater public goods provision but, instead, lead to reduced local tax collection efforts (Regatieri 2013) and can increase the number of politically appointed employees (Alves and Araújo 2021). However, another set of evidence suggests that FPM transfers can improve education, reduce poverty and illiteracy (Litschig and Morrison 2013), and stimulate formal employment generation (Braga et al. 2017; Corbi et al. 2019). In the realm of health, there are indications that these transfers can also reduce morbidity and hospitalization rates

(Ribeiro 2015), although a similar effect on maternal and child health indicators has not been found (Cavalcanti 2018).

While various studies examine the effects of these resources, there is a gap in the research when it comes to transfers during exceptional circumstances. In times of crisis or disaster, public sentiment tends to be stronger, and a body of evidence shows that more informed individuals scrutinize the actions of policymakers, increasing incentives for accountability (Ferraz and Finan 2010; Pande 2011; Dias and Ferraz 2019). In this context, the use of resources in extreme situations may come under greater scrutiny, urging their better use. This is the main argument of this work.

In this paper, we use the critical period of the COVID-19 pandemic in the Brazilian context, i.e., a state of public calamity, to analyze the effect of these intergovernmental transfers, specifically from the FPM, to local governments. Given that the values of these transfers increase abruptly for municipalities whose population surpasses certain predefined cutoffs, this discontinuity allows for the application of a fuzzy Regression Discontinuity Design, following Corbi et al. (2019). By identifying statistically similar municipalities that received different amounts from the federal government, it is possible to isolate the effects of variations in the received transfers on the provision of health services.

In Brazil, throughout the pandemic, there were disagreements about virus containment actions between the Union, states, and municipalities (Abrucio et al. 2020; Ferigato et al. 2020). In April 2020, a decision by the Supreme Federal Court (STF) determined that subnational entities had the autonomy to define their strategies for tackling the new coronavirus. However, while this decision declared de jure autonomy for states and municipalities, the enforcement capacity for various actions depended on the financial capabilities of these entities, considering that they lack automatic mechanisms for economic shock absorption (Barbosa et al. 2022).

Specifically for municipalities, financial capacity is strongly related to the availability of intergovernmental transfers, as the traditional channels for increasing taxation are limited due to constitutional deadlines and a restricted capacity for exploiting tax bases - especially in the context of falling income and economic activity. In this scenario, resources from the FPM can represent a significant exogenous variation in the financial capacity of municipalities.

This paper contributes to the literature in three main aspects. First, it adds to the research on government responses to the new coronavirus pandemic (Hausmann and Schetter 2020), specifically focusing on the performance of developing countries (Alon et al. 2020). Second, it also contributes to the literature investigating how institutions can guide government actions, testing the potential channels raised by theoretical literature (Persson and Tabellini 2002; Besley 2006). Several studies identify that these institutions can influence fiscal (Giesenow et al. 2020) or health policies (Kudamatsu 2012), for example. Regarding the media as an institution, evidence suggests that governments are more responsive when citizens are better informed (Ferraz and Finan 2011), and governments also respond better to shocks that attract more media attention, such as natural disasters (Eisensee and Strömberg 2007) and the COVID-19 pandemic (Besley and Dray 2023). By combining both literatures, this article identifies that greater media coverage during exceptional circumstances can encourage the better use of public resources in the context of a developing country. Finally, it also contributes to research investigating the impact of intergovernmental transfers, particularly regarding health indicators (Ribeiro 2015; Cavalcanti 2018).

In addition to this introductory section, this text is divided into three more parts. The next section presents the institutional context of the FPM, details the data used, and proposes the methodology. Section three presents the results of the estimations, and section four concludes.

2. Institutional Framework: The Municipal ParticipationFund (FPM). [3]

Brazil operates under a federative structure, characterized by three tiers of government: the Union (federal government), states (intermediate level), and municipalities (local governments). This system of shared responsibilities is designed to facilitate decentralization in the implementation of public policies. The federal constitution delineates the allocation of powers among these government levels concerning public policies. The federal government wields extensive authority, encompassing matters of national security, foreign relations, and macroeconomic

[3] This section essentially follows the instructional material on the FPM prepared by the National Treasury Secretariat (2023).

policies, in addition to substantial regulatory powers across various public policy domains. States and municipalities similarly enjoy significant autonomy in legislating and executing public policies, notably in areas like healthcare and education. However, it's noteworthy that municipalities do not possess broad tax-raising powers. Consequently, decentralization in Brazil heavily relies on financial transfers to local governments, with a prominent role played by the FPM.

The FPM assumes a central role as the main fiscal transfer mechanism for Brazilian municipalities, enjoying constitutional status. The fund's financial resources derive from 25.5% of the total collections of the Tax on Industrialized Products (IPI) and the Income Tax on Earnings of Any Nature (IR), taxes falling under federal government jurisdiction. The origin of the FPM can be traced back to 1965 when a tax system reform concentrated IR and IPI taxes within the central government. This shift necessitated the creation of a mechanism to compensate for the loss of revenue at the local government level. It's worth noting that, with the progression of fiscal decentralization, the proportion of IPI and IR collections allocated to local governments gradually increased[4].

To determine the allocation of funds to each jurisdiction, the process relies on demographic criteria and per capita income levels within each state. Municipalities are categorized into three groups: Capital, Interior, and Reserve. The Capital category encompasses state capitals, while the Interior category includes all other municipalities. The Reserve category comprises municipalities from the Interior category, but only those with a population exceeding 156,216 inhabitants. The percentage breakdown of the total fund values among these three categories is 10%, 86.4%, and 3.6%, respectively. It's important to note that 3.6% of resources in the Reserve category are cumulative. This means that municipalities in the Interior category with populations exceeding 156,216 inhabitants gain access to an additional 3.6% of FPM resources. According to Mendes, Miranda, and Cosio (2008), the resource distribution mechanism for the Interior category follows the formula provided below:

$$V_{ie} = \frac{0{,}864 * FPM * FPM_{ie} * \theta_e}{\sum FPM_{ie}} \quad (1)$$

[4] The regulation of the fund is Decree-Law No. 1,881/1981 (National Treasury Secretariat 2023).

Where V_{ie} is the value to be received by municipality i located in state e, FPM is the total value to be distributed by the fund, FPM_{ie} is the coefficient relative to the population of municipality i located in state e (Table 1), θ_e is the participation of state e in FPM-Interior (Table 2). The sum of all coefficients of municipalities i in the state e is given by $\sum FP_{ie}$.

Table 1 – *FPM Population Coefficients*

Number of inhabitants	FPM_{ie} Coefficient	Number of inhabitants	FPM_{ie} Coefficient
Until 10,188	0.6	From 61,129 to 71,316	2.4
From 10,189 to 13,584	0.8	From 71,317 to 81,504	2.6
From 13,585 to 16,980	1.0	From 81,505 to 91,692	2.8
From 16,981 to 23,772	1.2	From 91,693 to 10,1880	3.0
From 23,773 to 30,564	1.4	From 101,881 to 115,464	3.2
From 30,565 to 37,356	1.6	From 114,650 to 129,048	3.4
From 37,357 to 44,148	1.8	From 129,049 to 142,632	3.6
From 44,149 to 50,940	2.0	From 142,633 to 156,216	3.8
From 50,941 to 61,128	2.2	More than 156,216	4.0

Notes: Elaborated by the authors based on the Decree Law 1881 of 1991.

It's important to note that the coefficients and allocations presented in Tables 1 and 2 pertain to the calculation for municipalities classified under the Interior category. This category encompasses the vast majority of Brazilian municipalities, approximately 90%. Therefore, the FPM assessment holds significant relevance. This is because the process of fiscal decentralization and the municipalization of public services, as established by the 1988 Constitution, was strongly underpinned by intergovernmental transfers, with the FPM emerging as the transfer mechanism experiencing the most substantial growth (Mendes 2005; Giambiagi and Além 2011). Additionally, in the first half of 2020, there was a noticeable internalization of the COVID-19 pandemic. Concurrently with the spread of the epidemic, an excess of deaths was observed in these municipalities (Silva, Jardin and Santos 2020). Therefore, given that municipalities in the interior are the primary beneficiaries of FPM transfers, it is essential to assess the behavior of these local governments in tackling the pandemic, especially concerning the potential increase in revenues.

Table 2 – *Share of States in the FPM Revenue*

State	θ_e - Share %	State	θ_e - Share %
Acre	0.263	Paraíba	3.1942
Alagoas	2.0883	Paraná	7.2857
Amapá	0.1392	Pernambuco	4.7952
Amazonas	1.2452	Piauí	2.4015
Bahia	9.2695	Rio de Janeiro	2.7379
Distrito Federal	0.000	Rio Grande do Norte	2.4324
Ceará	4.5864	Rio Grande do Sul	7.3011
Espírito Santo	1.7595	Rondônia	0.7464
Goiás	3.7318	Roraima	0.0851
Maranhão	3.9715	Santa Catarina	4.1997
Mato Grosso	1.8949	São Paulo	14.262
Mato Grosso do Sul	1.5004	Sergipe	1.3342
Minas Gerais	14.1846	Tocantins	1.2955
Pará	3.2948	TOTAL	100

Notes: Elaborated by the authors based on the Decree Law 1881 of 1991.

3. Identification Strategy and Data

3.1 Methodology

This paper aims to evaluate the impact of FPM transfers in tackling the COVID-19 pandemic, and as the cutoff points are well defined by Decree-Law nº 1,881/1981, we follow the literature that implements the Regression Discontinuity Design (RDD) to evaluate the impact of the FPM[5].

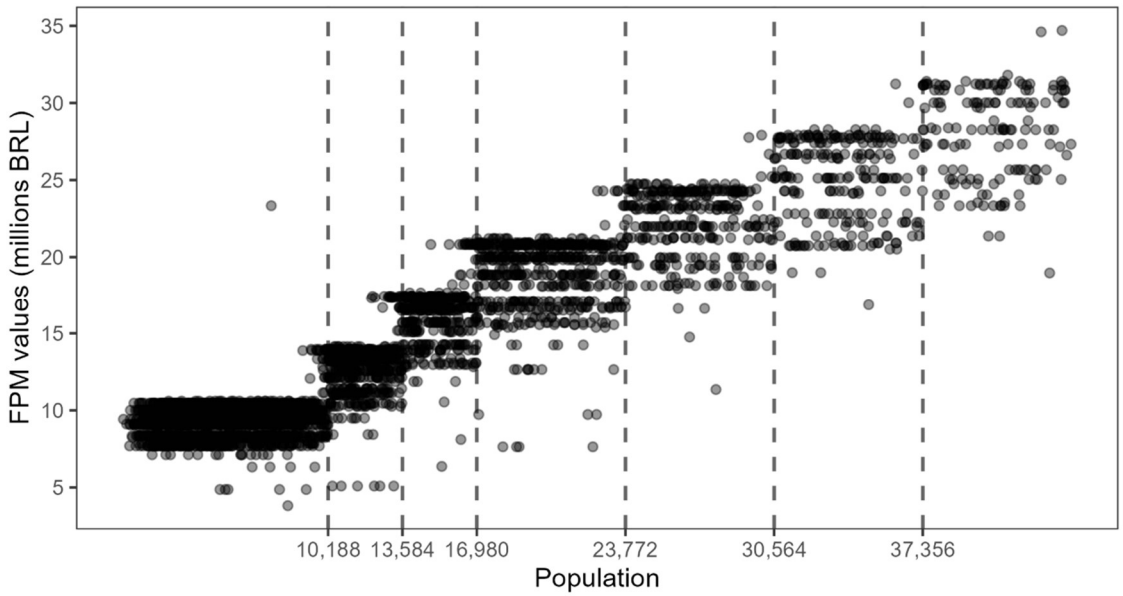
The RDD is used when the probability of receiving treatment depends on an attribution variable, usually called the running variable, and there is a cutoff point, *c*, that separates the treatment and control groups. In the present paper, the running variable used is the population and the cutoffs are the population ranges established by the FPM, since,

[5] This approach is used, for example, in Litschig and Morrison (2013), Brollo et al. (2013), Braga et al. (2017); Corbi et al. (2019), and Araújo and Alves (2022).

municipalities that change the range start to receive more/fewer resources. Figures 1 and 2 present the FPM values in 2021 in absolute and per capita terms for the first 7 population groups, respectively. More than 90% of Brazilian municipalities are located in these bands, and in addition, the discontinuities observed are greater. Therefore, those municipalities will be the target of our analysis. The identification of the causal effect involves the idea that municipalities with populations close to the cutoff points are similar, except for the fact that, when they are above (below) a cutoff point, the legislation allows the transfer of more (fewer) resources.

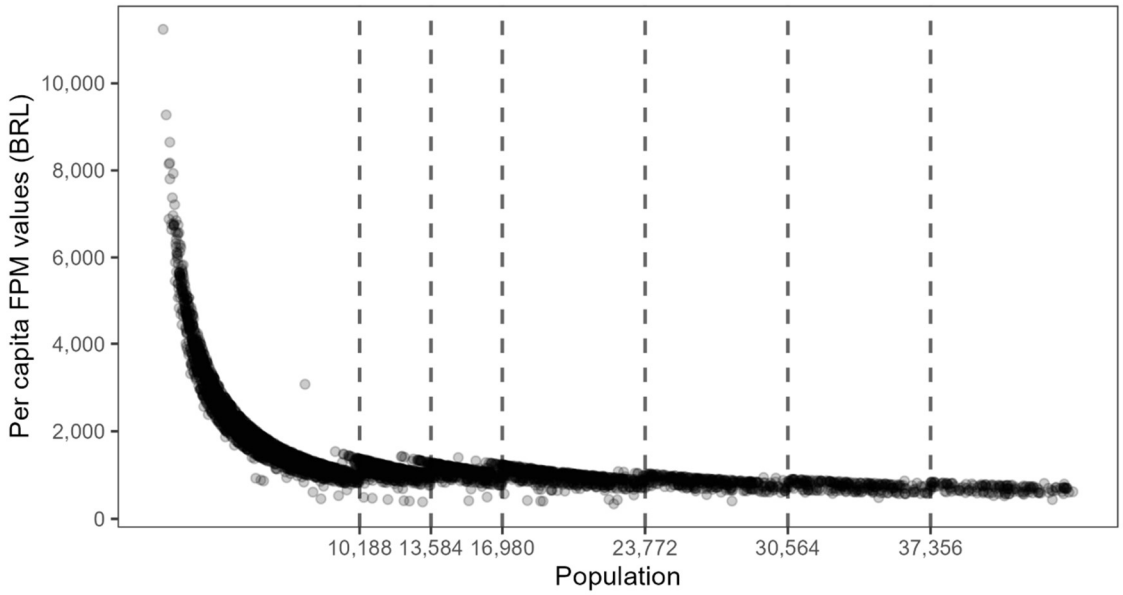
It is assumed that the probability of a municipality receiving more resources increases based on the cutoffs, and that the number of deaths and hospitalizations due to COVID, per 100 thousand inhabitants, does not directly depend on the population for municipalities close to the respective cutoffs. Therefore, it is investigated whether the increase in resources in per capita terms affects the variables of interest related to the management of the pandemic.

Figure 1 – FPM Values and population cutoffs– First 7 cutoffs



Notes: Prepared by the authors. Data from STN and IBGE.

Figure 2 – FPM *per capita* values and population Cutoffs– First 7 cutoffs



Notes: Elaborated by the authors. Data from STN and IBGE.

There are two approaches to implementing RDD: the sharp and the fuzzy case. The choice between the two cases depends on the discontinuity in the probability of receiving treatment. In the first case, sharp, the treatment is given using a deterministic function that goes from 0 to 1: 0 if the observation unit is below the policy cutoff point and 1 if it meets the cutoff point criteria. In the fuzzy case, the jump in probability is not exactly from 0 to 1, but rather partially determined by the discontinuity around the cutoff point.

One important issue with the FPM is the fact that it has imperfect compliance. As Regatieri (2013) points out, in theory, municipalities belonging to the same range and located in a given state should receive the same per capita values of FPM transfers. However, not all municipalities that can be treated receive treatment. Note that from the visualization of Figure 1, it can be seen that there are municipalities located to the left of the respective cutoff points receiving similar per capita resources as municipalities immediately to the right of the cutoff. In light of these observations, the hypotheses of the sharp case are violated, and the use of fuzzy RDD estimates is recommended. This occurs because, in practice, the fund does not only depend on the population values of the municipalities, but also on the political influence of these municipalities with the Union, or on judicial decisions that contest the population estimates done by the Brazilian

Institute of Geography and Statistics (IBGE) used for FPM transfers (Mattos, Rocha and Arvate 2011; Monasterio 2013).

Therefore we followed the approach proposed by by Corbi et al. (2019), which implements a Two-Stage Least Squares approach and uses the theoretical values of the FPM as an instrumental variable of the observed values of the fund transfers. This strategy mitigates the imperfect compliance that exists when applying the rule. The estimated model follows the specification:

$$\text{1st Stage: } FPM_{pc_i} = \pi FPMteo_{pc_i} + f\left(pop^{c}_{i,1-t}\right) + \delta_s + v_i \quad (2)$$

$$\text{2nd Stage: } Y_{it} = f\left(pop^{c}_{i,1-t}\right) + \tau \widehat{FPM}_{pc_i} + \delta_s + u_i \quad (3)$$

In the first stage, equation (2), the observed values, FPM_{pc_i}, are regressed against the theoretical values established by the law, $FPMteo_i$; δ_s represents the fixed effect for States and v_i is the error term. The term, $f\left(pop^{c}_{i,1-t}\right)$ is a polynomial of the centralized population of the previous year, which captures how close (or far) a municipality i is from its respective cutoff point, c_i[6]. In the second stage, equation (3), Y_{it} represents several health indicators, such as deaths and hospitalizations due to COVID-19, deaths from Severe Acute Respiratory Syndrome (SARS) (both per 1000 thousand inhabitants), and several measures of health expenditure per capita. The treatment variable is $\widehat{FPM}_{pc}$ (the predicted FPM_{pc}) and the τ coefficient captures the causal effect of an increase in FPM on pandemic variables.

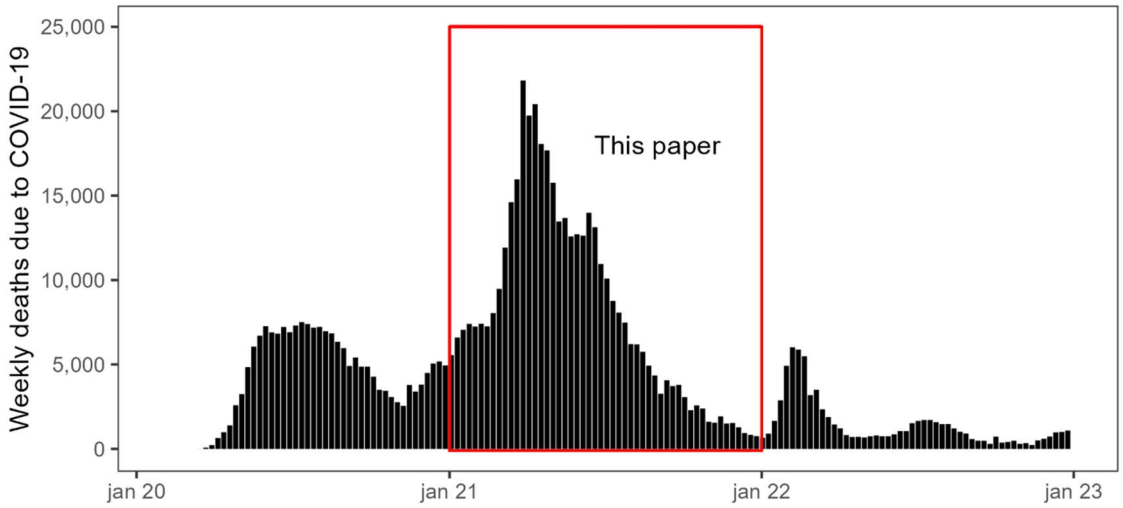
The RDD analysis undertaken in this work focuses on the neighborhood of 10%, 5%, and 3% of the first seven population cutoffs. This procedure was adopted by several articles that implement the RDD in the analysis of the FPM (Brollo et al. 2013; Litschig and Morrison 2013; Corbi et al. 2019; Araujo and Alves 2021) and aims to increase the number of observations around the cutoff points. Additionally, estimations were carried out using the optimal band proposed by Cattaneo, Idrobo, and Titiunik (2023).

[6] Following Araújo and Alves (2021), the polynomial was defined as follows $f\left(pop^{c}_{i,1-t}\right) = \frac{pop_{i,1-t} - c_i}{c_i}$.

As Angrist and Pischke (2008) point out, RDD estimates should not be sensitive to the inclusion of control variables, therefore the inclusion of covariates should be seen as a test of the robustness of the results found. The following variables were included as pre-treatment covariates: municipal GDP per capita, transferred ICMS per capita (a consumption tax, which is transferred from states to their respective municipalities), the percentage of people over 65 years old as a proportion of the municipal population (2010 demographic census), a dummy that indicates whether the municipality is part of a metropolitan region and, finally, a dummy, indicating whether a given municipality registered a higher proportion of votes in favor of Jair Bolsonaro in the 2018 presidential election[7].

Finally, a point to be highlighted is the period of analysis of this work. We used the year 2021. There are two main reasons for this choice. Brazil had two waves of COVID-19 (see figure 3). The second wave of Covid in 2021 was more serious in terms of the number of deaths. Secondly, in mid-2020 there was a large drop in FPM transfers, which was subsequently recomposed by the Union in subsequent months by MP 938/2020. In 2021 this problem was resolved.

Figure 3: Deaths COVID-19 waves in Brazil, weekly from 2020-2022



Notes: Our World in Data.

[7] The use of this dummy is justified, since in the fight against the pandemic there was divergence regarding the measures to be taken between the federal government and subnational entities (BRUCE, et al., 2022).

3.2 The Data

We used several data sources and most of them come from the year 2021. However, it's worth noting that the population was based on 2020 figures due to the legal FPM transfer mechanism, which uses the previous year as the baseline. Similarly, municipal GDP values were from the year 2020.

One of the main sources of COVID-19 pandemic data in Brazil is the Painel Coronavírus (Coronavirus Panel), provided by the Ministry of Health (MS). However, due to the bureaucratic notification process, it suffers from significant delays (Valente and Laurini 2021). In contrast, the SARS surveillance database, organized by SIVEP-GRIPE[8] and also under government administration (MS), stands out. This database is seen as the most robust data source for cases leading to deaths and hospitalizations (Oliveira et al. 2020), even though most cases of the new coronavirus are not severe (Gao 2020). This is attributed to its inclusion of crucial information such as the date of hospitalization, the onset of symptoms, and the occurrence of deaths for each case. It's noteworthy that the new coronavirus belongs to the SARS category. Therefore, from the SIVEP-GRIPE database, we use data on COVID-19 deaths and hospitalizations, as well as deaths from SARS, for the year 2021 and categorized according to the individuals' municipalities of residence.

Finbra[9] serves as a comprehensive database that compiles information regarding the annual budgetary and financial performance of federal entities. In this system, municipalities themselves submit their fiscal and accounting data to the National Treasury. This database encompasses various revenue types received by municipalities, including their share of state ICMS revenues (consumption tax). Firstly, we collected the data on municipal health expenditures for 2021 at the most aggregated level available, reflecting the total amount of health expenses. For a more in-depth analysis, these health expenditures were further categorized into 'expenditures on basic care,' 'expenditures on

[8] With annual versions, this database undergoes constant updates: every Wednesday the information is updated. Therefore, the information used in this study may not be the same as that in future analyses. The last update of the data used was carried out on October 17, 2022. Available at: https://opendatasus.saude.gov.br/dataset/srag-2021-a-2023.

[9] Available at: https://siconfi.tesouro.gov.br/siconfi/pages/public/consulta_finbra/finbra_list.jsf.

hospital care,' and 'expenditures on epidemiological surveillance' (all on a per capita basis). This categorization based on functional expenses enables a better understanding of how FPM impacted the municipality allocation of the healthcare budget.

The data regarding FPM came from the National Treasury Secretariat (STN)[10], representing consolidated values for the entire year of 2021. Population estimates for municipalities were acquired from the IBGE; as mandated by law, they are submitted to the TCU (Federal Court of Accounts) and used for calculating FPM transfers. Additionally, GDP estimates, information regarding municipalities in metropolitan regions, and the proportion of residents aged 65 and older were directly obtained from IBGE[11]. Lastly, details on municipalities where the majority of votes in the 2018 election favored Jair Bolsonaro were obtained through the Superior Electoral Court[12]. Finally, Table 3 has been compiled to present descriptive statistics, providing an illustrative overview of the variables discussed in this section.

Table 3 – *Descriptive Statistics – Main Variables*

Variable	Mean	SD	Min	1º Quart.	Med	3º Quart.	Max
Population	20257.8	8962.1	9187	13023.5	17106.5	27569.8	41081
FPM per capita	960.9	194.9	342.6	821.5	954.6	1105.1	1482.9
Theoretical FPM per capita	937.3	186.2	263.8	803.8	937.7	1073.6	1375.4
GDP per capita	24971	28786.7	4924	10347.3	17214.2	30114.1	591101.1
ICMS per capita	767.9	891.3	81.1	290.7	541.7	988.7	16319.3
% Votes Bolsonaro 2018	0.4	0.2	0	0.2	0.3	0.5	0.8
COVID Deaths / 100K	139.3	96.5	3.2	61.7	118.3	202.1	534.1
SRAG Deaths / 100K.	155.7	103.1	3.2	74	133.9	219.3	584.4
Hospitaizations/100k	417.1	337.7	8.1	155.3	314.2	597.3	2099.3
Health Expendures pc	931.3	361.2	132.4	730.8	868.4	1042.5	4341.1

Fonte: Elaborated by Authors. Data from STN, IBGE and MS. These statistics consider only 1802 municipalities of our sample.

[10] Available at: https://sisweb.tesouro.gov.br/apex/f?p=2600:1:::NO:::

[11] Available at: https://www.ibge.gov.br/estatisticas/todos-os-produtos-estatisticas.html

[12] Available at: https://sig.tse.jus.br/ords/dwapr/r/seai/sigeleicaoresultados/partidos?p0_turno=2&session=101372185045676

4. Estimation and Results

4.1 Validation of Regression Discontinuity

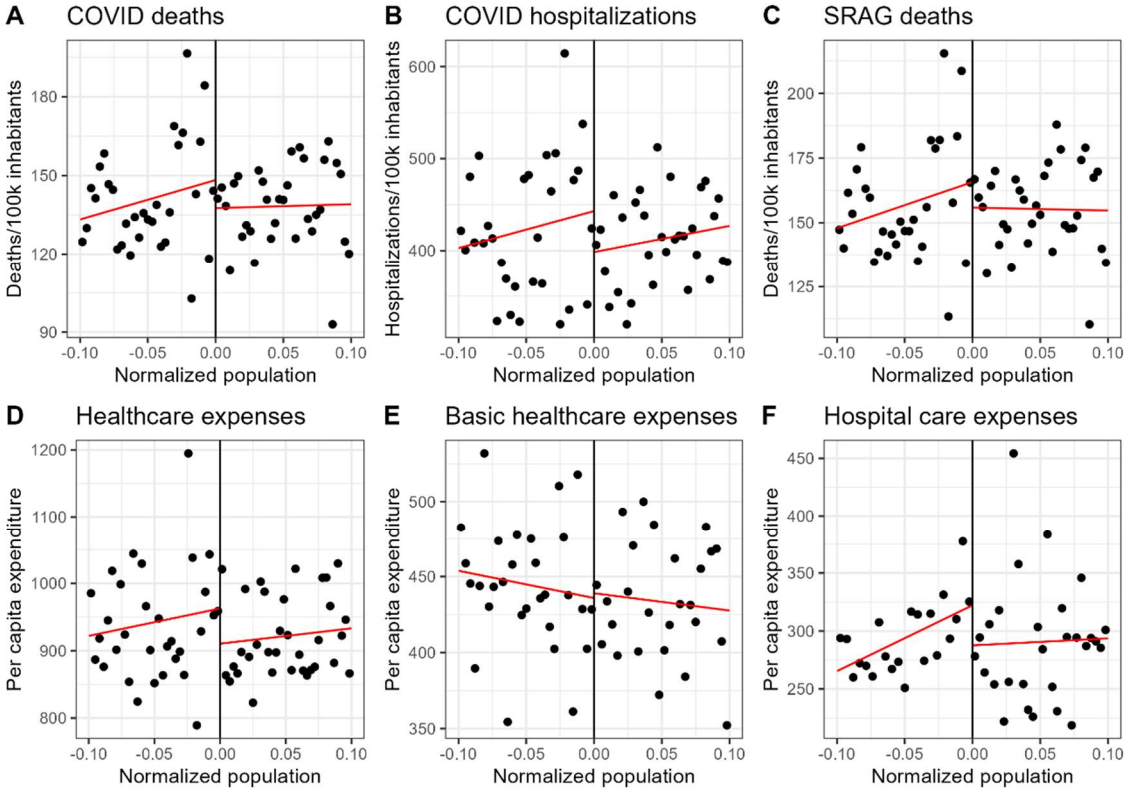
This subsection will examine the suitability of data and policies for the RDD methodology. We have opted to employ the methodology proposed by Corbi et al. (2019), which utilizes a fuzzy RDD approach, following equations (2) and (3) as detailed earlier, and employing Two-Stage Least Squares as our estimation method[13].

To assess the applicability of the RDD methodology, we follow the protocol outlined by Skovron and Titiunik (2015). The first robustness test involves a descriptive examination of graphs that relate the outcome variable to the running variable, specifically to verify if discontinuities occur only around the analyzed cutoff point. The graphs utilized in this test are presented in Figure 4, which comprises six distinct charts, each representing a health-related variable plotted against population estimates. Consequently, it can be noticed that the discontinuity is only observed in the outcome variables around the cutoff point. This observation indicates that the proposed methodology aligns descriptively with the framework intended by RDD, following the approach of Skovron and Titiunik (2015).

It is important to note in Figure 4 that health spending apparently decreases to the right of the cutoff point, considering the linear adjustment. However, this is not clear when we look at the spread of points around the cuts. As demonstrated in the results section, there is an increase in these expenses in the treated municipalities.

[13] For the first stage stage, we computed the values prescribed by the law (theoretical FPM) using data sourced from the STN, following equation (1).

Figure 4 - *Health Variables and Population Estimate*



Notes: Prepared by the authors. Data from STN, IBGE and MS.

A valid running variable should undergo minimal or no manipulation by municipalities to the extent that we do not reject the hypothesis of treatment exogeneity. We conducted the McCrary density test (McCrary 2008), which has the null hypothesis of density continuity of the running variable at the cutoff point. Rejecting the null hypothesis indicates a potential manipulation around the cutoff. The p-value obtained from the test was (0.7254), and we didn´t reject the null hypothesis, therefore, there is no evidence of data manipulation concerning the FPM.

The subsequent step involves assessing whether the covariates intended for RDD estimation are influenced by the running variable at the cutoff point, as recommended by Skrovon and Titiunik (2015). So, we run the RDD estimations considering the municipalities' GDP *pc* for 2020 and ICMS *pc* transfers for 2021. None of the estimated

coefficients were statistically significant[14], showing that these covariates had no discontinuity around the cutoff.

As the final stage of validation, the protocol includes placebo tests, designed to determine whether potential artificial cutoffs have any local impact. If these artificial cutoffs produced a local effect, it could undermine the ability of the proposed methodology to accurately identify the FPM impact. When conducting these tests for the outcome variables, it became evident that all sharp estimates, within their confidence intervals, exhibited coefficients around zero for the simulated cutoffs[15].

4.2 Results and Discussion

This subsection presents the findings from our RDD estimations. To capture the elasticities, we have adopted the *Log-Log* functional form, which can be interpreted as follows: a one-percent change in FPM per capita corresponds to a direct one-percent impact on the outcome variables, namely, deaths, hospitalizations, and health expenditures. We applied fixed bandwidths of 10%, 5%, and 3%, and the selection of the bandwidth using the Minimum Mean Square Error (MSE) methodology (Cattaneo, Idrobo, and Titiunik 2023). The main results are displayed in Table 4.

Firstly, when examining those local estimates, the dependent variables related to deaths, hospitalizations, and health expenses, were all statistically significant across all model specifications. The estimated impact of the FPM consistently aligns with the initial hypothesis. Starting with the model with a 10% bandwidth and covariates control (2), a 1% increase in FPM per capita decreases the deaths from COVID-19 by 0.45% and hospitalizations by 0.41%, both measured per 100 thousand inhabitants. Additionally, the FPM impacted positively health expenditure per capita by 0.22%. When analyzing the coefficients for deaths in our estimates, it becomes apparent that the magnitude was higher for COVID-19 cases compared to SARS: given that COVID-19 is a subset of

[14] The results of sharp estimations, using the triangular kernel, showed results in the expected direction, with the LATE effect for the GDP per capita covariate having a p-value of (0.4975). The same was done for the covariate of ICMS transfers: (0.1412).

[15] The test used used quantiles 0.25 and 0.75 around the cutoff. The p-values of the test estimates were, for the outcome variables of deaths and hospitalizations due to COVID-19, deaths due to SARS, and health expenses, respectively, (0.1236, 0.0877, 0.1391, 0.0775).

SARS, it suggests that transfers such as the FPM may be more effectively targeted during high-severity crises. These findings deviate from previous literature, which found no impact of the FPM on health indicators and expenditures during "normal times" (Araújo and Alves 2021), that is, outside the context of a large-scale crisis like the COVID-19 pandemic.

The impact remains statistically significant and with similar magnitude even when we reduce the Bandwidth to 5% or 3% or use the MSE methodology (mserd). Furthermore, it's important to highlight that, in general, these impacts remained robust even when covariates were included in the model. The only exception was observed in the analysis of health expenditures when the statistical significance diminished upon the inclusion of covariates for the model with MSE methodology.

In light of these results, a hypothesis emerges: increased resource transfers, coupled with greater autonomy and responsibility granted to municipalities in pandemic management, led to more effective governance. This was reflected in reductions in both deaths and hospitalizations, contrary to certain aspects of the existing literature. For instance, Ribeiro (2015), looking at data from the period 2002-2010 suggests that although there is a negative impact on morbidity indicators and general hospitalizations in municipalities receiving more resources per capita, there were no robust effects on spending on preventive measures, such as the number of primary care doctor visits. In a similar vein, Cavalcanti (2018) indicates a lack of impact on maternal and child health indicators.

Table 4 – *Baseline Results – Log-Log Model*

	Local *IV* estimations						Additional Bandwidth's		
Bandwidth	10%	10%	5%	5%	3%	3%	mserd	mserd	Obs
Outcome	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Treatment Variable: FPM per capita - *Log-Log*								
COVID Deaths / 100K.	-0.44***	-0.45***	-0.45 ***	-0.56 ***	-0.53***	-0.61***	-0.47**	-0.54***	443
	(0.09)	(0.09)	(0.14)	(0.15)	(0.18)	(0.19)	(0.20)	(0.21)	-
SRAG Deaths / 100K.	-0.36***	-0.38***	-0.36***	-0.48***	-0.43 **	-0.48 ***	-0.38 **	-0.41 **	446
	(0.08)	(0.09)	(0.13)	(0.14)	(0.18)	(0.18)	(0.19)	(0.19)	-
Hospitaizations/ 100K.	-0.41***	-0.41***	-0.45 ***	-0.48 ***	-0.60***	-0.55 ***	-0.71***	-0.73***	537
	(0.09)	(0.10)	(0.14)	(0.15)	(0.19)	(0.19)	(0.18)	(0.19)	-

Health Expendures pc	0.22 ***	0.17 ***	0.23***	0.18 **	0.20 **	0.20 **	0.22 ***	0.14	630
	(0.04)	(0.04)	(0.06)	(0.07)	(0.09)	(0.09)	(0.07)	(0.09)	-
Covariates	No	Yes	No	Yes	No	Yes	No	Yes	
State Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	1802	1802	841	841	501	501	-	-	

Notes: Author's elaboration. Data from STN, IBGE, TSE, and MS. Robust standard errors are in parentheses, and *, **, and *** indicate that the coefficients are significant at the 10%, 1%, and 0.1% levels, respectively. Due to the selection of bandwidths using "mserd," the number of treated observations also varied (column 9) depending on the outcome variable used. The covariates used were: municipal per capita GDP, per capita ICMS transfers, proportion of residents over 65 years old (for the year 2010), indicator if it belongs to a metropolitan region, and finally, indicator if the municipality had more votes in favor of Jair Bolsonaro in the second round of the 2018 presidential election. First stage results: theoretical values of the FPM shows a significant association at 0.1% level with the actual FPM in our log-log model in every bandwidth. The coefficient ranges from 1.00 to 1.02 without controls, and from 0.96 to 0.98 with controls, consistently indicating a near-proportional relationship.

When considering the impacts of FPM on municipal budgets, the results presented in Table 4 show that an increase in transferred funds leads to positive effects on healthcare spending. This finding diverges from part of the literature that examines the relationship between direct transfers and local municipal management (Bardhan and Mookherjee 2006; Vigneault 2007). Araújo and Alves (2021), who analyzed a panel of municipalities from 2012 to 2016, found no impact of FPM on healthcare expenses. According to the authors, the existence of legislation mandating minimum percentage allocation for healthcare expenses suggests that any additional contributions from the fund tend to be channeled into other public expenditures.

For a better understanding of the positive result of FPM on budgetary management in healthcare, we conducted a more detailed analysis of healthcare expenditure. The results are presented in Table 5. Starting with the local estimates, concerning primary healthcare (PHC), all results displayed a consistently positive and statistically significant pattern across all bandwidths, remaining robust even after the inclusion of covariates. In contrast to these results, expenditure on hospital care (HC) exhibited a negative and statistically significant trend regardless of covariate inclusion; however, these estimates lost statistical significance at the 3% bandwidth when covariates were introduced. Furthermore, estimates related to expenditure on epidemiological surveillance (ES) showed negativity and statistical significance only at the 10% bandwidth, without proving to be robust in the presence of covariates. Similar patterns emerged when utilizing bandwidths proposed by the MSE methodology. In general, the estimates preserved these characteristics and maintained their robustness in the presence of covariates, except for

expenditure on HC, which once again ceased to be statistically significant when covariates were controlled for.

We observed that increases in FPM per capita led to corresponding increases in spending on basic care, along with reductions in spending on hospital care. This suggests that treated municipalities strategically allocated and reallocated their budgets to enhance initial contact with individuals infected by COVID-19, primarily focusing on primary care. This strategic shift may explain the decrease in hospitalizations for severe cases and the associated reduction in hospital expenses. However, it's worth noting that there is no strong evidence indicating a significant impact on spending related to epidemiological surveillance.

Health literature points out that the importance of Primary Health Care (PHC) lies in its territorial responsibility and community focus, key factors that likely influenced how the pandemic was mitigated. In efforts to contain and minimize the risk of the spread of COVID-19, PHCs are actively involved in epidemic risk management, including reporting and monitoring cases and monitoring home isolation of cases, along with contact quarantine – all of which are critical to mitigate the epidemic (Medina et al. 2020; Silva et al. 2022). PHC also plays a crucial role in the health network by focusing on identifying and guiding individuals with mild symptoms of COVID-19, establishing distinct pathways to segregate those with respiratory problems from those who require in-person care for other concerns, thus reducing the burden. on specialized services and the containment of public spending (Medina et al. 2020; Silva et al. 2022; Gois-Santos et al. 2020).

In Brazil, a primary strategy involves the reorganization of health professionals' workflows, with a strong emphasis on health education for self-care during the pandemic, stressing the significance of proper mask usage and frequent handwashing; also, patients seeking care are advised to steer clear of crowded spaces and wear masks (Silva et al. 2022; Gois-Santos et al. 2020).

Table 5 – *Additional Results I – Log-Log Model*

	Local *IV* estimations						Additional Bandwidth's		
Bandwidth	10%	10%	5%	5%	3%	3%	mserd	mserd	Observations
Outcome	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Treatment Variable: FPM per capita - *Log-Log*								

PHC Expenditures pc	0.67***	0.63 ***	0.65 ***	0.57 ***	0.67 ***	0.73 ***	0.56 ***	0.48 **	519
	(0.09)	(0.10)	(0.16)	(0.20)	(0.23)	(0.25)	(0.19)	(0.23)	-
HC Expenditures pc	-1.27***	-1.19 ***	-0.98***	-0.76 *	-0.66*	-0.34	-0.93 ***	-0.76	473
	(0.20)	(0.24)	(0.30)	(0.42)	(0.38)	(0.57)	(0.33)	(0.51)	-
ES Expenditures. pc	-0.42 *	-0.48 *	-0.43	-0.41	0.04	0.005	0.14	-0.13	371
	(0.24)	(0.27)	(0.35)	(0.40)	(0.50)	(0.57)	(0.46)	(0.54)	-
Covariates	No	Yes	No	Yes	No	Yes	No	Yes	
State Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	1338	1338	616	616	367	367	-	-	

Notes: Author's elaboration. Data from STN, IBGE, TSE, and MS. Robust standard errors are in parentheses, and *, **, and *** indicate that the coefficients are significant at the 10%, 1%, and 0.1% levels, respectively. Due to the selection of bandwidths using "mserd," the number of treated observations also varied (column 9) depending on the outcome variable used. The covariates used were: municipal per capita GDP, per capita ICMS transfers, the proportion of residents over 65 years old (for the year 2010), indicator if it belongs to a metropolitan region, and finally, indicator if the municipality had more votes in favor of Jair Bolsonaro in the second round of the 2018 presidential election. First stage results: theoretical values of the FPM shows a significant association at 0.1% level with the actual FPM in our log-log model in every bandwidth. The coefficient ranges from 1.00 to 1.02 without controls, and from 0.96 to 0.98 with controls, consistently indicating a near-proportional relationship.

To quantify the budget reallocation, we examined disaggregated health expenditures as a proportion of the total. To facilitate interpretation in terms of percentage points (p.p), a *Level-Level*[16] model was employed, as illustrated in Table 6. These results are consistently aligned with our previous findings. The proportion of spending on basic care exhibited a positive effect while spending on hospital care showed a negative effect, with similar magnitudes. These effects remained robust even when covariates were included and Bandwidths selected via the MSE methodology were employed. As a result, an increase of R$100 in FPM per capita corresponds to a 2.43 p.p. increase in spending on basic care relative to the total, accompanied by an almost symmetrical 2.69 p.p. reduction in the proportion of spending on hospital care.

[16] In this analysis, the FPM per capita values are measured at R$100.

Tabela 6 – *Additional Results II – Level-Level Model*

	Local *IV* estimations						Additional Bandwidth's		
Bandwidth	10%	10%	5%	5%	3%	3%	mserd	mserd	Observations
Outcome	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Treatment Variable: FPM per capita - *Level-Level*								
Share PHC Expenditures	0.0243 ***	0.0223 ***	0.0218 ***	0.0188 ***	0.0236 ***	0.0239 ***	0.0202 ***	0.0181 **	503
	(0.003)	(0.004)	(0.005)	(0.006)	(0.006)	(0.009)	(0.005)	(0.007)	-
Share HC Expenditures	-0.0269 ***	-0.0235***	-0.0204 ***	-0.0172 ***	-0.0189 ***	-0.0185 **	-0.0203 ***	-0.018 ***	509
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.007)	(0.005)	(0.006)	-
Share ES Expenditures	-0.00115 *	-0.0009	-0.0014	-0.0013	0.0001	0.0001	-0.0002	0.0002	376
	(0.000)	(0.000)	(0.000)	(0.000)	(0.00)	(0.001)	(0.001)	(0.001)	-
Covariates	No	Yes	No	Yes	No	Yes	No	Yes	
State Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	1337	1337	615	615	366	366	-	-	

Notes: Author's elaboration. Data from STN, IBGE, TSE, and MS. Robust standard errors are in parentheses, and *, **, and *** indicate that the coefficients are significant at the 10%, 1%, and 0.1% levels, respectively. Due to the selection of bandwidths using "mserd," the number of treated observations also varied (column 9) depending on the outcome variable used. The covariates used were: municipal per capita GDP, per capita ICMS transfers, the proportion of residents over 65 years old (for the year 2010), an indicator of belonging to a metropolitan region, and finally, an indicator of the municipality had more votes in favor of Jair Bolsonaro in the second round of the 2018 presidential election. First stage results: theoretical values of the FPM shows a significant association at 0.1% level with the actual FPM in our log-log model in every bandwidth. The coefficient ranges from 0.99 to 1.01 without controls, and from 0.96 to 0.98 with controls, consistently indicating a near-proportional relationship.

Our findings suggest that the supplementary funds from the FPM was effectively directed toward bolstering health expenditures and concurrently reducing mortality rates and hospitalizations. A deeper analysis of these expenditures revealed that primary healthcare received the highest share of these additional contributions. Consequently, the increased investment in primary care emerges as the primary factor contributing to the decline in both hospitalizations and fatalities within these municipalities.

5. Conclusion

In the Brazilian context, the Municipal Participation Fund (Fundo de Participação Municipal), which is the primary federal government transfer to local governments, has yielded mixed or modest outcomes in terms of efficient resource management (Mendes, Miranda and Cosio 2008; Regatieri 2013; Araújo and Alves 2021; Cavalcanti 2018). The existing literature highlights that some of these challenges are associated with accountability issues, fiscal irresponsibility, and potential capture by local elites, often leading to the misallocation of resources. These are common hurdles faced by developing nations (Prud'homme 1995; Bardhan and Mookherjee 2000, 2006; Vigneault 2007).

Despite those numerous challenges, it is well-established that increased access to information empowers citizens and encourages political accountability (Ferraz and Finan 2010; Pande 2011; Dias and Ferraz 2019), potentially leading to more efficient utilization of public resources. Considering that during significant events media coverage tends to be more extensive, this study examines the impact of FPM transfers on the number of COVID-19-related deaths and hospitalizations in the context of the pandemic. It also evaluates their influence on the allocation of local government health budgets. In doing so, we aim to contribute to the literature by assessing whether the effects of FPM, often considered modest, become more pronounced in times of public emergency.

Considering that the allocation rule of FPM resources is based on population ranges, municipalities that transition between these ranges begin to receive more or fewer resources. Making use of this framework, we employed a RDD methodology and estimated the causal impact of these transfers. Our results showed that an increase in FPM had a significant impact in reducing COVID-19-related fatalities and severe hospitalizations. Delving deeper into the mechanism underpinning these impacts, one of the main channels was the increase in health budget expenditures.

The findings demonstrate that municipalities that received higher FPM resources exhibited elevated per capita health expenditure. Notably, a breakdown of health expenditures reveals a directed allocation of resources toward primary care spending. This category encompasses initiatives aimed at enhancing primary healthcare services and programs such as the *Programa Saúde da Família* (Gois-Santos et al. 2020). Consequently, the results illuminate that the treated municipalities strategically allocated their budgets towards mechanisms that enhanced initial contact with individuals afflicted

by COVID-19 (Medina et al 2020; Silva et al. 2022). This reallocation accounts for the observed decrease in hospitalizations for severe cases and a reduction in mortality rates.

Our results contributed to the literature by examining the impact of intergovernmental transfers in extraordinary situations, particularly during crises and public emergencies. In alignment with the accountability literature, our findings underscore the importance of increased budgetary resources in responding to healthcare crises, especially within the context of the COVID-19 pandemic. It is worth noting that previous research, conducted outside the pandemic context, failed to identify substantial effects of the FPM on healthcare expenditures (Araújo and Alves 2021) or indicators related to maternal and child health (Cavalcanti 2018). These disparities further emphasize the distinct impact of such transfers during periods of crisis, when politicians were under great scrutiny.

During the pandemic, conflicts between the federal government and subnational entities resulted in uncoordinated policies in response to the crisis (Abrucio et al. 2020). However, the constitutional nature of FPM transfers underscores the autonomy of this allocation mechanism, which operates independently of political factors: FPM transfers functioned as a system of checks and balances between local governments and the federal administration, providing increased autonomy and financial flexibility to municipal public budgets. As highlighted by our findings, this allowed for a more efficient allocation to areas of greater need within the constraints of the Constitution. Thus, our results align with a body of literature that emphasizes the advantages of decentralization in the provision of public goods and services, as exemplified by the models proposed by Persson and Tabellin (2002) and Besley (2006).

Given that the pandemic crisis had profound impacts on various sectors, this study paves the way for future research to examine whether the increased resources allocated through the FPM contributed to mitigating the pandemic's effects on areas such as education and the labor market. Furthermore, forthcoming studies could explore whether similar transfers could be effective in mitigating the effects of other public emergencies, such as floods, earthquakes, droughts, etc., not only for developing countries but also for developed ones.

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