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Article

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The effects of intergovernmental transfers on the local fiscal incentives of Brazilian municipalities

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ABSTRACT

The objective of this work is to analyze the impact of fiscal decentralization on the behavior of Brazilian municipal policymakers. This work uses the first three cutoffs of the transfer rules of the Municipal Participation Fund (FPM) and applies a regression discontinuity designs (RDD) to capture the effects that have impacted municipal budget rates from 2013 to 2016. The comportment hypothesis is that transfer gains can generate (a) perverse incentives, if the gains are earmarked for personnel and administrative expenses or if they decrease revenue, or (b) beneficial incentives, if the main gains are spent on education or health. The results found for the estimates of the data panel model suggest that an increase in exogenous revenue generates a significant increase only in spending on administrative and sports and leisure functions and that the possible channel for this increase in expenses should be aimed at increasing the number of employees with commissioned position. These results indicate that the transfers generate only perverse incentives. This article explores how local managers allocate their resources according to their additional budget. Unlike the other works, we look for the mayor's behavior in relation to spending on the employment of commissioned civil servants, which can lead to perverse incentives.

Introduction

After the ratification of the 1988 Brazilian Federal Constitution, Brazil underwent a process of decentralization, maintaining the collection of main taxes under the responsibility of the central government and decentralizing spending through federal transfers to subnational governments and through allowing these subnational governments to raise new taxes by themselves. As for local governments, the transfers come mainly from the Municipality Participation Fund (FPM), which, due to the constitutional establishment, has resource allocation rules that imply an increase in received transfers that discontinue after the funds are exceeded on different cutoffs of the population bandwidths. This exogenous behavior allows one to analyze the Fund's impacts based on a regression discontinuity design (RDD).

In most empirical studies, there are no consistent answers about the impact of fiscal decentralization on political institutions and public policies, since fiscal decentralization may have heterogeneous effects due to differences in policy implementation and responsibility in the country where the policy is adopted (Weingast 2009; Mookherjee 2015; Lewis and Smoke 2017; Salinas and Solé-ollé 2018; Acosta and Meneses, 2019; Jia Et Al. 2020; Miyazaki, 2020). Despite this, Martinez-Vazquez

et al. (2016) highlight that well- designed and well-implemented decentralization policies have favorable economic results.

For the Brazilian scenario, we question here what benefits arise when municipalities receive an exogenous amount of revenue. Authors such as Brollo (2013), Litschig and Morrison (2013), Monasterio (2014), Castro et al. (2016) and Araújo and Mattos (2021) argue that intergovernmental incentives could generate perverse results for (negatively affect) local government regarding factors related to their income, expenses and savings. Corbi et al. (2019) found that FPM surcharges have positive impacts on wages and employment in the private and public sector.

Aligned with this literature (cited above), the objective of this paper is to analyze changes in the budgetary behavior of small municipalities (whose population numbers are in the first three ranges of the FPM) that is generated by gains from transfers from the Municipal Participation Fund, using a period corresponding to full municipal term of office of a mayor (2013–2016). This period stands out because of the instability of the Brazilian public governance, with a growth rate of -1.86% in the average municipal GDP. We worked with the basic hypothesis that the results found are in line with the general precept of normative theory (which argues that large countries with wide cultural diversity obtain greater gains from decentralization) that decentralization policies

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generate beneficial incentives and, efficiency gains.

Although we follow a strategy widely applied for other authors in Brazil to apply the FPM as an instrument for the analysis of a discontinuous regression designs, our research differentiates itself by using recent periods without indications of population manipulation and for incorporating definitions of incentives applied by Lewis and Smoke (2017). In our analysis, we specifically look at how resources exogenous to municipal budgets can affect their respective fiscal behaviors. Additionally, we verify the impacts on employment in the public service, a variable studied by Corbi, et al., (2019), and highlight the heterogeneous effects¹ between statutory and commissioned employment (a position of political trust).

The finds show that, for small Brazilian cities located around the first three cutoff points of the FPM, there is no evidence that the linked transfers of the FPM have on health and education spending, but the results show that these are significant in the increased expenses of administrative functions. On the revenue side, there is no evidence that the increase in exogenous revenue generates changes in Own Revenue behavior. With the sign of increased spending in municipal administrative functions and no effect on own collection. We seek to understand the channel in which expenditures are allocated, our find that these expenses should increase the number of employees with commissioned positions (political ties) and reduction in fiscal autonomy (evidence of fiscal laziness). Finally, we conclude that there are perverse incentives in the neighbor to the FPM jump.

Our study is structured as follows: the second section portrays the methodological aspects in relation to RDD and detailing the data, while the third section is intended to present the results found in the estimation. Finally, we present the final remarks and discussion of some policy implications.

Institutional framework and data

Federal transfers system

In Brazil, historical shifts between centralization and decentralization culminated with the 1988 Federal Constitution, ushering in an era of substantial intergovernmental changes. This period marked a decentralization movement, entrusting federal entities with the responsibility to craft and implement public policies tailored to local needs, alongside a distribution of administrative roles across various government levels. Municipal governance is administered by an elected city mayor and council, with the mayor responsible for executive functions and the council for legislative tasks. Since 2000, mayors are subject to a two-term limit, with elections held every four years and a clear separation of powers maintained between the executive and legislative branches.

The municipal governments have a crucial role in providing public goods and services, particularly in education, health, and infrastructure. Most of the municipal funding comes from intergovernmental transfers, either from the federal or state governments. The most significant source of revenue for these municipalities is the Fundo de Participação dos Municípios (FPM). The FPM was established in 1965 by Constitutional Amendment 18, but it was initially established to maintain tax centralization by the Union. A shift towards decentralization began in 1988 with Complementary Law No. 59, subsequently increasing the FPM's share from 10 percent to 20 percent, and then to 24.5 percent in 2014.

The FPM has three different transfer categories with different destinations (Capitals, Reserves and Interior) and the distribution of funds is based on municipal population bands, using the results of the previous Demographic Census. The Capital FPM provides the transfers made only to the capitals of each Federation Unit, which corresponds to 10 % of the total FPM. The Reserve FPM is a part reserved for municipalities in the interior (which are not capitals) with a population greater than 142,633 inhabitants. And the Interior FPM, is the funding that goes to all others

municipalities, corresponding to 86.4 % of the FPM. To understand the calculation, the Court of Audit (Tribunal de Contas da União - TCU) determined a list of coefficients ranging from 0 to 4 (Table 1), where the size of the population can vary.

To obtain the result of the Interior FPM, it is necessary to analyze in which enumeration of the coefficient the population of the municipality is located and the sum of all municipalities and their respective coefficients. For the transfer calculation, the TCU summarizes the calculation as follows:

$$Quota = \frac{Cx(PExFPM)}{S} \quad (1)$$

where *Quota* is the municipal quota, *C* is the individual coefficient of the municipality, *PE* is the share of the state of origin in the total FPM. *FPM* is the amount of resources from the Interior FPM (86.4 %) and *S* is the sum of all coefficients of the respective state. This share is calculated with the state population size on July 1, 1989, according to population estimates from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE), and the estimates have not been updated since then.

Comparing the federalist systems of other countries (Table 2), Brazil and the United States share the common feature of being federations, but their approaches to fiscal autonomy and distribution of competences among government levels are distinct. In Brazil, fiscal autonomy is moderate, with a tax-sharing system between the Union, states, and municipalities. In 2022, Brazil's tax revenue reached R\$ 3.3 trillion, amounting to 33.71 % of the GDP, with municipalities collecting just 6.95 %, states 25.48 %, and the Union leading with 67.58 % of the total (STN, 2023). The FPM is a key example of this dynamic, serving as a mechanism for redistributing resources to promote fiscal balance among municipalities. In the United States, fiscal autonomy is more pronounced, with distinctly separate taxes for each government level and federal transfers often linked to specific projects.

Portugal, as a unitary republic, presents a stark contrast to the Brazilian and American systems. Here, fiscal centralization is more pronounced, with the central government playing a dominant role in tax collection and resource distribution. Transfers to municipalities are centralized, and local autonomy is limited compared to federations.

China, although a unitary state, has unique characteristics due to its size and regional diversity. There has been a recent trend towards fiscal decentralization, with provinces and cities gaining more autonomy. However, central control remains very strong, with the central government maintaining a significant role in determining fiscal and economic policies.

Brazil, like to the United States, operates as a federation. However, its federal structure exhibits significant distinctions, particularly in the manner autonomy is exercised and powers are divided. In Brazil, fiscal autonomy is categorized as moderate, underpinned by a system of tax sharing. This stands in contrast to the systems noted in the aforementioned countries.

In terms of governmental competencies, Brazil demonstrates a

Table 1

Classification of municipal population sizes and corresponding FPM allocation coefficients.

Local population range	Coefficient	Local population ranges	Coefficient
Up 10,188	0.6	61,129 to 71,316	2.4
10,189 to 13,584	0.8	71,317 to 81,504	2.6
13,585 to 16,980	1.0	81,505 to 91,692	2.8
16,981 to 23,772	1.2	91,693 to 101,880	3.0
23,773 to 30,564	1.4	101,881 to 115,464	3.2
30,565 to 37,356	1.6	115,465 to 129,048	3.4
37,357 to 44,148	1.8	129,049 to 142,632	3.6
44,149 to 50,940	2.0	142,633 to 156,216	3.8
50,941 to 61,128	2.2	Above 156,216	4.0

Note: Decree Law No. 1881/1981.

Table 2
Comparative analysis of fiscal autonomy and governmental structures across federations.

Criterion	Brazil	United States	Portugal	China
Nature of the System	Federation	Federation	Unitary Republic	Unitary State with Regional Characteristics
Levels of Government	Union, States, Municipalities	Federal, State, Local Municipalities	Central Government, Municipalities	Central Government, Provinces, Cities, Counties
Fiscal Autonomy	Moderate; tax-sharing system	High; distinct taxes at each level	Low; fiscal centralization	Moderate; increasing fiscal decentralization
Competencies	Distributed, with overlaps	Clear, with some overlaps	Centralized, with limited local autonomy	Distributed, but with strong central control
Transfers	FPM, FPE, and other funds	Grants-in-aid, specific programs	Centralized transfers	Transfers from central government, specific funds
Fiscal Reform	Under discussion, focus on decentralization	Periodic, varying by administration	Reforms for greater local efficiency	Reforms for modernization and fiscal efficiency
Challenges	Regional inequality, dependence on FPM	Balancing levels, inequality	Centralization, administrative efficiency	Balancing growth and central control, regional inequality

unique distribution that is characterized by considerable overlaps—a notable feature of the Brazilian system. Additionally, the distinctiveness of Brazil's framework is further exemplified by its financial transfer system, which is marked by the FPM (Fundo de Participação dos Municípios - Municipalities Participation Fund) and the FPE (Fundo de Participação dos Estados - States Participation Fund).

Background

From reading the results presented in Fig. 1, more specifically by the scale on the left of the graph, we realize that the (nominal) values collected by the FPM have been growing over time, especially in the periods 2000–2007 and 2010–2016. This was due to constitutional amendments 55/2007 and 84/2014, which ensured that municipalities had a greater share of tax revenue from the income tax and tax on industrialized products, thus generating greater transfers from the FPM to municipalities.

The right side of the graph shows, in turn, that Brazil has been increasing its transfers in a proportion greater than the size of the population: numerically, it is observed that the average transfer was approximately R\$60 per person in 1997, while this proportion reaches an average of R\$400 per person in 2018.

The map depicted in Fig. 2 below illustrates the spatial heterogeneity across Brazil concerning the economic profile of municipalities in terms of per capita public revenue. The data delineates a stark regional disparity: municipalities in the North and Northeast regions, which

traditionally have the lowest socioeconomic indicators in the country, also report the lowest per capita revenue figures. Conversely, the Central-West, South, and Southeast regions, recognized for their higher socioeconomic levels, showcase the highest per capita revenue figures.

Through the results presented in Fig. 3, we realize, in general terms, that the population and FPM distributions show regional randomness. Due to the emancipation of the municipalities the larger municipalities, in general, generated losses of FPM revenue; in proportional terms, the large municipalities (both in terms of population and territory) continue to receive the highest amounts of the FPM. The results show that, considerably, the closer a location is to the central region of Brazil (the drier and hotter part of the country), the more the number of people living in the region and the more the number of transfers decrease.

By law, municipalities within the same band and federation unit must receive the same amount, regardless of 1 % or 10 % more of the population in relation to the threshold. Another important factor is that the amount of federal transfers changes according to the cutoff points (the greater the range, the greater the amount of funds received). Following the example shown by Corbi et al. (2019), the population of the municipality of Anita Garibaldi (located in the south of the state of Santa Catarina), grew by just thirteen inhabitants between 2002 and 2003 (from 10,180 to 10,193), making with the municipality crossing the first threshold (10,188). As a result of the increase in the FPM coefficient from 0.6 to 0.8, its transfers from R\$ 1204,762 in 2002 rise to R\$ 1324,306 in 2003.

Fig. 4 shows the discontinuity of transfers given their population

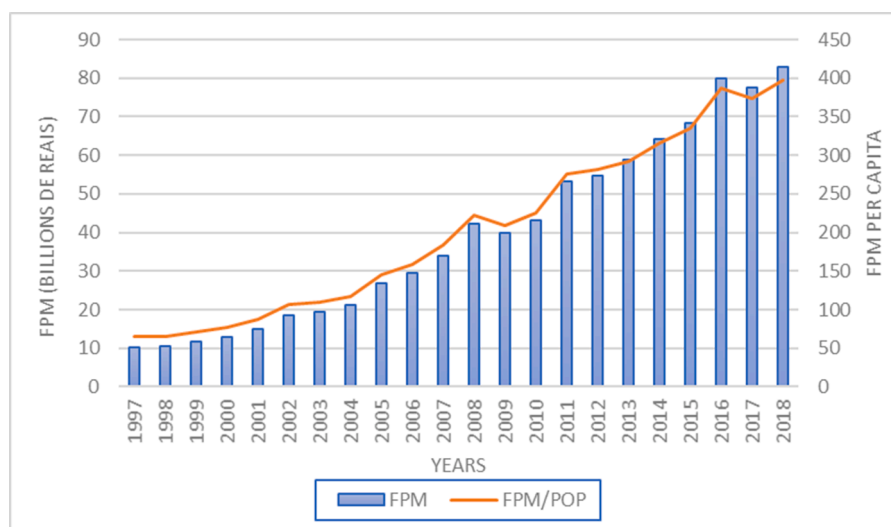


Fig. 1. Trends in FPM allocation coefficients for interior and capital municipalities: A historical analysis (1989–2016).
Note Data are collected from National Treasury Secretariat (STN)

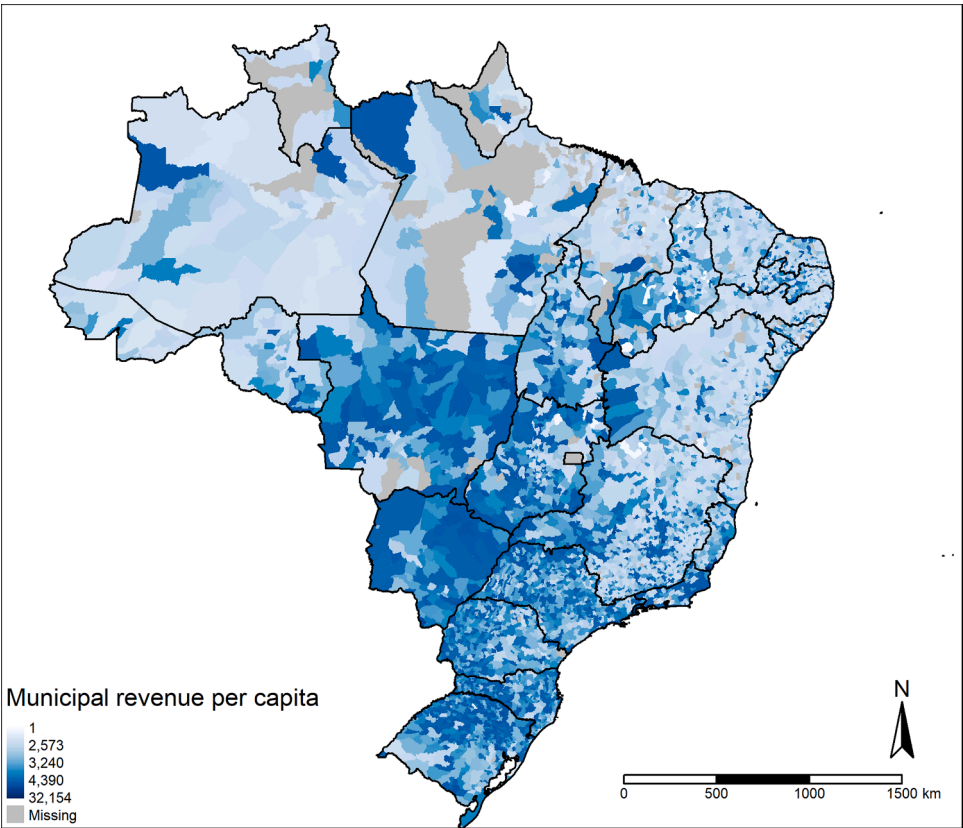


Fig. 2. Spatial distribution of municipal revenue per capita in Brazil (2016).
Note: Data are collected from National Treasury Secretariat (STN)

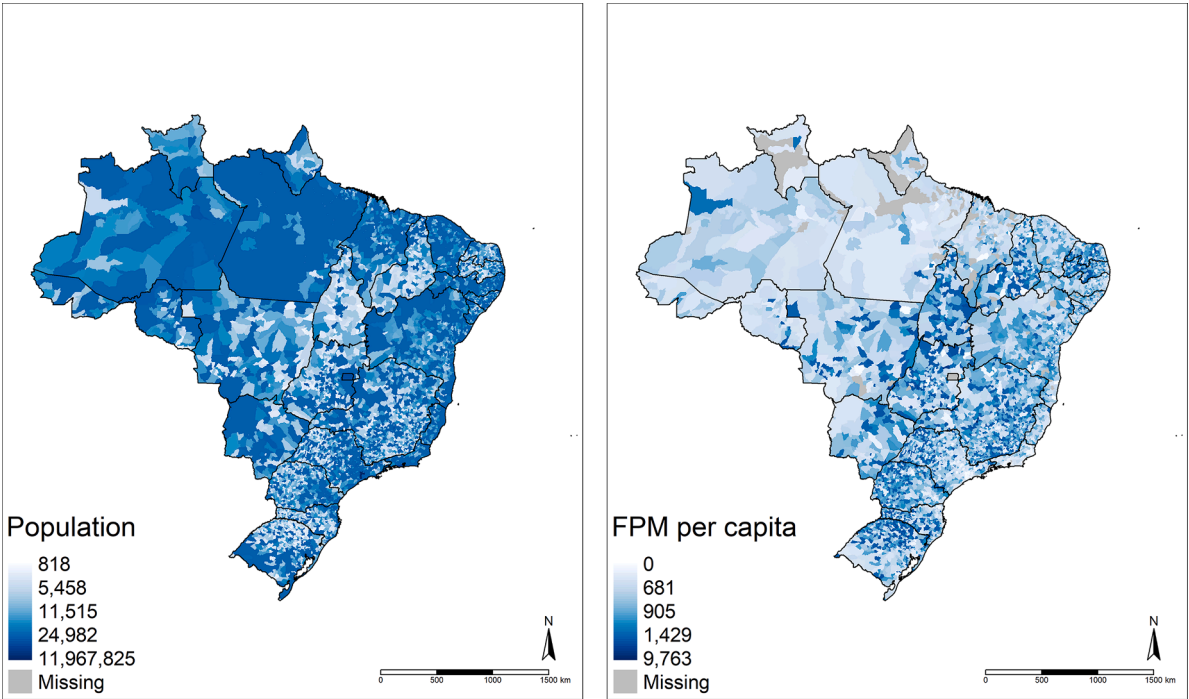


Fig. 3. Spatial distribution of FPM and population in Brazil (2016).
Note: Data are collected from Brazilian Institute of Geography and Statistics and National Treasury Secretariat.

levels in the municipalities. These results show that the effects are greater in small municipalities and that these impacts are decreasing for larger municipalities. In addition, the delineation of the research scope

to municipalities with a population up to the third FPM coefficient is substantiated by the methodologies adopted by [Corbi et al. \(2019\)](#), [Litschig and Morrison \(2013\)](#), [Monasterio \(2014\)](#), [Castro et al. \(2016\)](#),

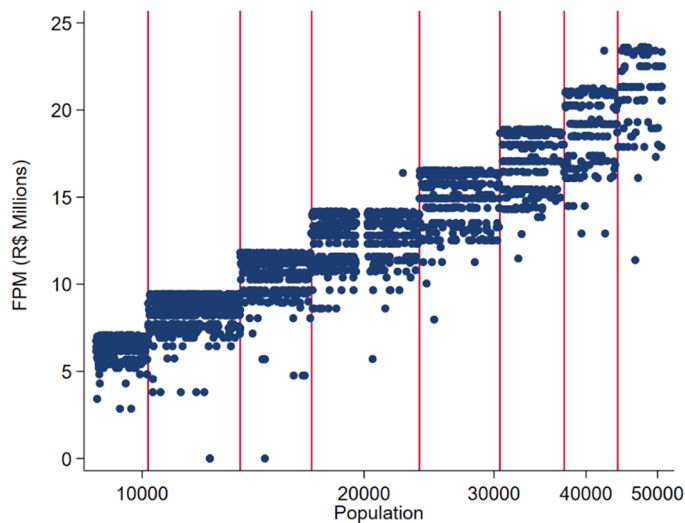


Fig. 4. Distribution of municipal populations within FPM coefficient brackets (2016).

Note: Data are collected from Brazilian Institute of Geography and Statistics and National Treasury Secretariat. The red lines represent the population thresholds assigned in the table

and Araújo and Mattos (2021). Therefore, it was determined that the municipalities that are to be the object of research are those with a population of up to the third FPM coefficient. In addition, the FPM was built so that the per capita transfer gains would be greater for small municipalities, which make up a large part of the proportion of municipalities in Brazil.

Fig. 5 spatially represents the municipalities that are on the left and right side of the first three thresholds of the FPM in a width of 10 % in 2016. It is noticed that, spatially, the municipalities are spread across all Brazilian regions and that, in some cases, the municipalities that are on the left and on the right are close to each other. It is also noted that small municipalities are concentrated in the Northeast and Southeast, in regions closer to the coast. In the cases of Pará, Goiás and Rio Grande do Sul (states with the largest number of municipalities in the North, Midwest and South, respectively), there are not many municipalities compared to the cases of São Paulo, Rio de Janeiro, Minas Gerais and all the states of the Northeast.

In addition, it is generally observed that some municipalities are reality close in populational terms but differs that some are on the right or left side of the bandwidth. The Southeast region presents more cases of small municipalities on the left side of the FPM, while the Northeast presents a more cases of small municipalities on the right side of the FPM thresholds.

Data

Municipal data used in this work was taken mainly from the National Treasury Secretariat (Secretaria do Tesouro Nacional – STN) and the IBGE, for the years between 2013 and 2016. Data from the FPM, its own revenue and expenses with personnel and with capital and expenses for functions (administrative, education, health, legislative, security and transportation, among others) was collected in STN portal. The population estimate of the IBGE was used with a lag of one year, since the value transferred from the FPM is based on the population estimate from the previous year. Finally, data on employment in the municipality were taken from the Basic Municipal Information Survey, also from IBGE.

In order to include unobservable characteristics within our model, we included carefully include some relevant covariates into the RDD specification that affect expenses. We have chosen the covariates basing on information from the municipality. Searching capture economic

aspects that may affect expenditure, we selected variables such as GDP per capita, number of employee and establishments, balance of trade and the length of roads available in the municipality. We also include two social variables, the number of people benefiting from the country's main social program (Bolsa Família Program) and the percentage of people with access to water and political variable, that is the possibility for a mayor manager to be re-elected. This last variable is represented by a binary variable, where 1 is the representation of the mayor manager, who has the possibility to be re-elected in the next election and where 0 is otherwise.

To contribute to the debate on the efficiency of tax management, the Federação da Indústria do Rio de Janeiro (FIRJAN) system created an indicator that seeks to measure the quality of tax management in municipalities, the FIRJAN Tax Management Index (IFGF). Its method comprises four indicators - Autonomy, Personnel Expenses, Liquidity and Investments. The indicators vary between 0 and 1, and the municipalities with the best management are close to 1.

When the average results of each variable of interest is evaluated, it appears that the revenue and expenditures in proportion to GDP are higher in municipalities in the states of the Northeast and North states. In the case of the Northeast, on average this proportion reaches 0.33 in revenue in relation to GDP and 0.31 in expenditure. In the North this ratio is slightly lower: 0.2 in revenue in terms of GDP and 0.18 in expenditure. As these are often poorer municipalities, the ratio of income and expenditures to GDP is high because these municipalities have small GDPs.

The results also show that the Northeast has the highest proportion of revenue from the FPM and is the region that has the second lowest proportion of its own revenue (second only to the North, which has the largest share of other transfers). These results show that the municipalities in the Northeast are more dependent than the others because they need more of the FPM. In some cases, if there were no transfer, the municipality would not be able to pay for its expenses.

For spending, it is observed that the Northeast also appears as the region that has the largest share of average spending on education. In contrast, the Southeast has a higher proportion of average health expenditures, and the North has a higher proportion of average administrative expenses. In other words, these regions have the greatest focus on spending their budgets on their respective functions.

Table 3

Methodology

Application of the RDD in empirical analysis

According to Thistlethwaite and Campbell (1960), RDD can be used when the probability of receiving treatment changes discontinuously. An intrinsic feature of this method is that the treatment group is given to individuals if and only if an observed covariate intercepts a known threshold. The advantages of this model are that it requires weaker hypotheses when compared to others. According to Lee and Lemieux (2010), the hypotheses required by the RDD are less arbitrary than other inference methods that use impact analysis, such as the difference-in-differences technique and propensity score matching.

This method considers that the probability that an individual or region will receive the benefits of some program (being part of the treatment group) is a discontinuous function of one or more fundamental variables for the impact of that individual or region (Buddelmeyer and Skoufias, 2004).

The other assumption of this method requires that the treatment group intercepts a known threshold and that the probability of receiving the program benefits behaves randomly. These two conditions are unique and allow one to identify the causal effect of the program, without imposing assumptions on the selection process, an assumption of error distribution, a functional form or arbitrary exclusive restrictions (Black et al., 2005).

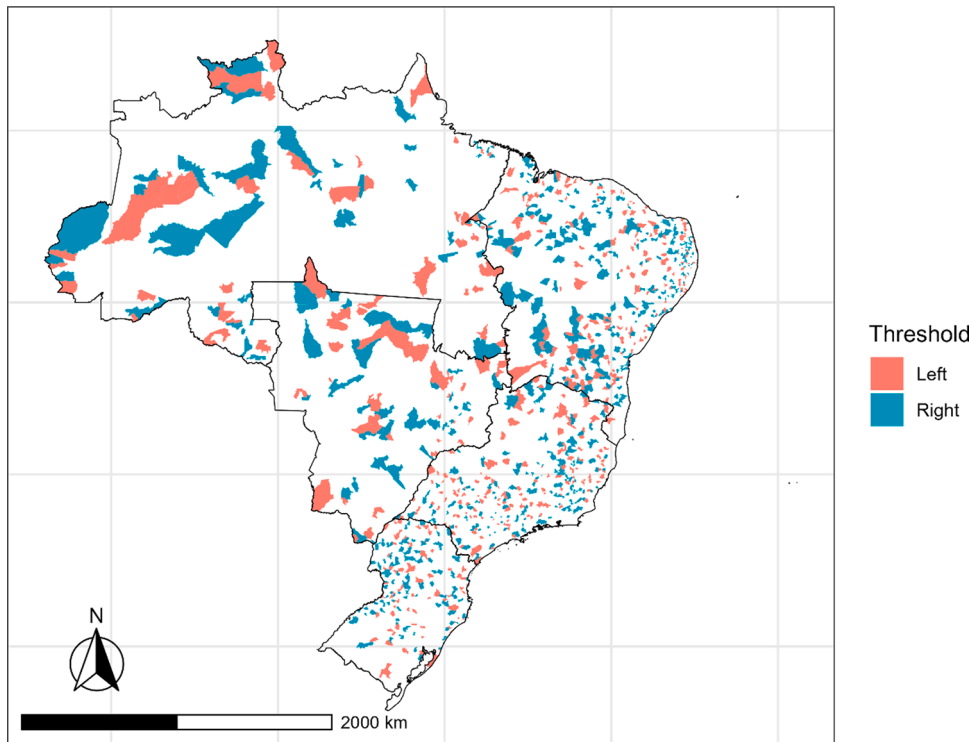


Fig. 5. Spatial analysis of municipalities at the first three FPM thresholds: (2016).
Note: Data are collected from Brazilian Institute of Geography and Statistics.

As seen in Fig. A2, not all municipalities end up showing discontinuity as their population increases. Therefore, the ideal is to use a Fuzzy RDD so that it is possible to separate the municipalities that actually had additional revenue gains by minimally increasing the population size. Considering these characteristics, we use a formal notation of how we model the impact indicators (results variables) of the beneficiaries of resources from the FPM on municipalities, close to the population groups, through the following equation

First step:

$$PE : T_{i,t} = f(P_{i,t-1}^c) + \gamma_{PE} \hat{T}_{i,t} + X\beta + \delta_i + \delta_{ct} + \delta_{st} + \varepsilon_{i,t} \quad (2)$$

Second step:

$$SE : Y_{i,t} = f(P_{i,t-1}^c) + \gamma_{SE} T_{i,t} + X\beta + \delta_i + \delta_{ct} + \delta_{st} + \varepsilon_{i,t} \quad (3)$$

The first step is the effect of the treatment on the levels of FPM, our instrument. In the second step, we use the results of the first step to find the fuzzy RDD results. The dependent variables $Y_{i,t}$ are diverse, since there are different budget components of the municipality.

The variables $X\beta$ are used control variables, while δ_{st} are state dummies that capture aggregate developments (at the national and state levels) such as federal tax revenues, common monetary policy and regional business cycles. They are responsible for upward trends in wages and earnings and for fluctuations at the federal level. It is necessary to include the state year constants, as the FPM is also a function of time-invariant state actions (δ_{st}) and the time variable coefficient (δ_{ct}) of all municipalities in the state.

It is known that the choice of bandwidth has a trade-off between consistency and efficiency, since the smaller the band, the more accurate is the information about the discontinuity but, also, the greater the chance of inflating the variance. For this reason, Calónico et al. (2017) developed the robust estimation is used to find a bandwidth value that minimizes the mean square error; that is, it finds a balance where there

is not much loss of efficiency and that maintains consistency. For this case, we use a one common mean squared error (MSE)-optimal choice for the RD treatment effect estimator. For Calónico et al. (2017), it is possible to find the optimal band from:

$$\tilde{\tau}(h) = e'_0 \tilde{\beta}_{Y+p}(h) - e'_0 \tilde{\beta}_{Y-p}(h) \quad (4)$$

$e'_0 \tilde{\beta}_{Y+p}(h)$ e $e'_0 \tilde{\beta}_{Y-p}(h)$ can be defined by:

$$\tilde{\theta}_{Y,p}(h) = \underset{\beta_-, \beta_+, \gamma}{\operatorname{argmin}} \sum_{i=1}^n \left\{ Y_i - r_{-p}(X_i - \bar{x})^{\beta_-} - r_{+p}(X_i - \bar{x})^{\beta_+} - Z_i' \gamma \right\}^2 K_h(X_i - \bar{x}) \quad (5)$$

Identifying assumptions

Manipulation test

Some studies such as those by Brollo (2013), Litschig and Morrison (2013) and Da Mata (2015) use the impact of the FPM in different outcomes and highlight the importance of carrying out manipulation tests at discontinuity as a necessary hypothesis for the validity of the results. We use the McCrary (2008) and Cattaneo et al. (2018) test to be able to validate the results made. Table 4 shows the results obtained from the test proposed by Cattaneo et al. (2018), and in the Appendix, the graphic tests of both Cattaneo et al. (2018) and of McCrary (2008) are presented.

The p -value greater than 10 % in all bands and in each threshold rejects the hypothesis of manipulation of the variable and indicates that the population estimates show no signs of manipulation for the results for any of the bandwidths chosen for the analysis. The graphical results can be seen in Appendix.

This result is different from that found by Monasterio (2014), which portrays the ability of municipalities to manipulate the population estimates made available in the demographic census. Araújo and Mattos (2021) argue that the results of population estimates do not present

Table 3

Descriptive analysis of municipal between 10 % at the first three bandwidth (2013–2016).

Variables	All Sample	Regions				
	(1) Brazil	(2) North	(3) Northeast	(4) Southeast	(5) South	(6) Midwest
Revenue/GDP	0.23	0.20	0.33	0.18	0.12	0.14
Revenue Composition						
% FPM	0.33	0.28	0.38	0.32	0.27	0.27
% Others Transfers	0.52	0.60	0.52	0.50	0.49	0.52
% Own Revenue	0.06	0.04	0.03	0.06	0.09	0.09
% ISS ^a	0.03	0.02	0.02	0.03	0.03	0.04
% IPTU ^b	0.01	0.00	0.00	0.01	0.02	0.01
% State Transfers	0.19	0.19	0.11	0.24	0.26	0.26
Expense/GDP	0.21	0.18	0.31	0.16	0.11	0.12
Expense Composition						
% People	0.53	0.52	0.55	0.51	0.49	0.52
% Capital	0.10	0.12	0.09	0.10	0.13	0.09
% Education	0.34	0.40	0.41	0.29	0.27	0.28
% Health	0.24	0.20	0.23	0.26	0.24	0.24
% Administrative	0.14	0.18	0.14	0.13	0.14	0.16
% Agriculture	0.02	0.02	0.01	0.01	0.03	0.01
% Sport and Leisure	0.01	0.01	0.01	0.01	0.01	0.01
% Special Charges	0.02	0.01	0.01	0.02	0.03	0.01
% Legislative	0.04	0.04	0.04	0.03	0.03	0.04
% Social Security	0.04	0.02	0.04	0.04	0.05	0.05
% Public security	0.00	0.00	0.00	0.00	0.00	0.01
% Transport	0.03	0.04	0.01	0.03	0.07	0.04
Public sector variables						
Direct Statutory employers	628.01	670.95	720.56	576.70	491.01	555.53
Direct Commissioned employers	61.15	63.70	79.23	42.68	38.42	76.14
Control Variables						
Firms	430.48	194.34	191.94	640.21	754.51	550.05
Employers	1649.34	947.57	915.94	2167.40	2787.90	2132.55
GDP (R\$ Million)	267.73	208.94	140.89	342.37	428.68	421.28
Possibility Reelection	0.81	0.81	0.80	0.82	0.77	0.89

Notes: Public budget variables were collected from the National Treasury Secretariat, public sector variables were collected from the Brazilian Institute of Geography and Statistics (IBGE - MUNIC), while employment and firm variables are from the Ministry of Labor, GDP in IBGE and Possibility of Reelection of the Supreme Electoral Court (TSE).

^a Services Tax (ISS).

^b Property and Urban Territorial Tax (IPTU).

Table 4

- Evaluation of population estimates for manipulation across FPM thresholds.

Population Thresholds	2 %	3 %	4 %	10 %	15 %
1° Threshold	-1.4643 (0.1431)	-1.4367 (0.150)	-0.9062 (0.3648)	-1.071 (0.2842)	-0.5797 (0.562)
2° Threshold	0.5903 (0.555)	0.5283 (0.597)	-0.2935 (0.7691)	-0.3019 (0.7628)	-0.7815 (0.434)
3° Threshold	0.959 (0.3375)	0.6227 (0.533)	-0.3091 (0.7573)	-0.1085 (0.9136)	-0.3504 (0.726)

Notes: P-value in parentheses. See Figs. A1-A6 in the Appendix for more details on the manipulation tests.

evidence of population manipulation as it is a diluted result of the demographic census (which has had evidence of manipulation). The tendency, then, is for population estimates to correct the census bias.

To present our results, we adopted the methodology proposed by Calonico et al. (2017) for application which provides a robust regression discontinuity design using bandwidths able to minimize the mean square error by means of balance between the variance and consistency of the estimators, returning the "optimum size" of our width band. For the Least Squares method in Two Stages (2SLS) we use the same bandwidth provided by the method.

Pre results

The first step is to find out what types of recipes can be discontinued.

What is expected is that no other transfer than those from the FPM generate discontinuity in the same situation of the population threshold. The results shown in Fig. 6 demonstrate that the FPM is quite significant and illustrate that the way the FPM is distributed generates discontinuity in these transfers. Fig. A7 in the appendix demonstrates the placebo test where we change the thresholds for the median between windows as the pivotal cutoff point and prove that the discontinuity is precise at the points determined by the constitution. Another aspect we can test is whether transfer incentives generate disincentives in the collection of local revenue.

Da Mata (2015) and Regatieri (2013) have found that the effect of the FPM reduces a municipality's incentives to collect taxes efficiently, raising the possibility that may exist the interaction between the FPM and municipalities' collection policies. According to the results presented in Table 5, transfer incentives do not change the local tax revenues. A large part of the municipal collections is gathered from IPTU and Services Tax (ISS) and these disaggregated rates also have no effects.

The last step in the analysis is to determine if the expenses are directed more toward personnel than capital. The results in Table 5 show that the discontinuity does not present statistically significant evidence of the capital expenditure (public investment). Personnel expenses, however, the effect is positive and at discontinuity the jump varies between 0.14 % and 0.22 % when the FPM transfers raise in 1 %.

Main results

All preliminary results point out for the increase in revenue and expenditure. What behavior with expenditures by function do municipalities display? There are two points that make it important to analyze

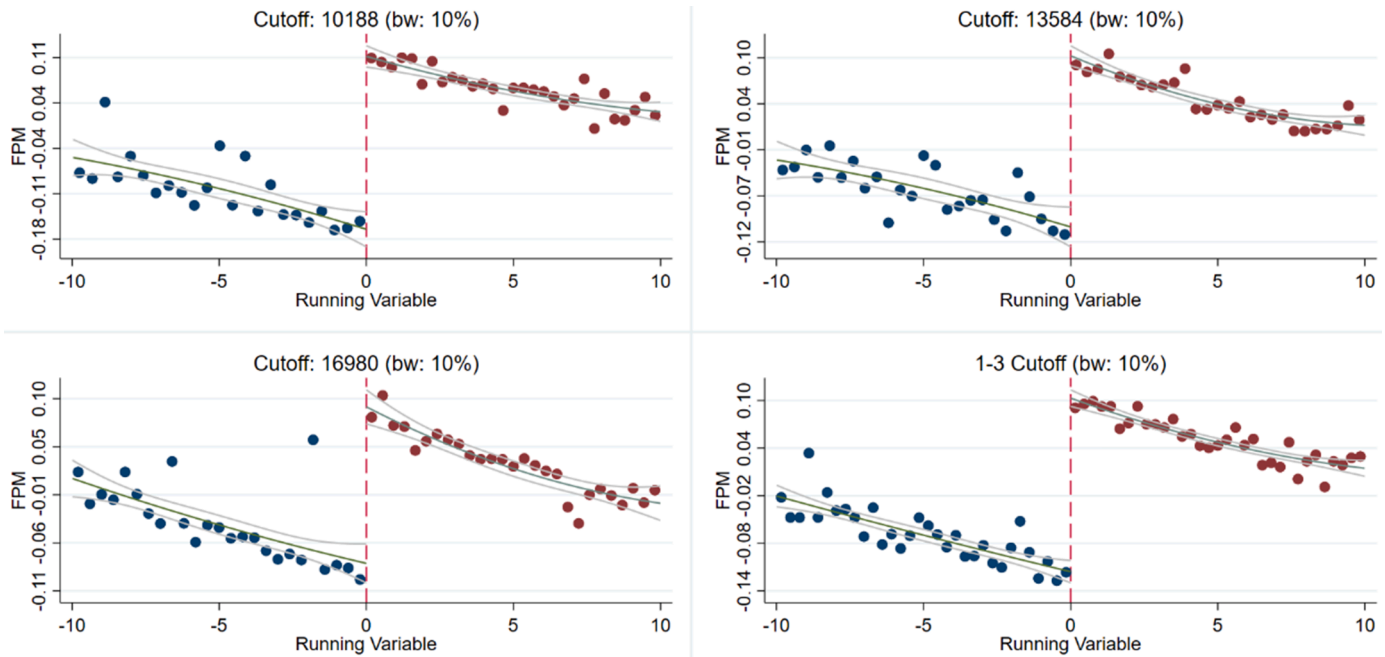


Fig. 6. Spatial distribution along the first three FPM thresholds (2016).

these behaviors. On the one hand, a municipality using these gains to increase its expenditures in areas such as employability¹ or legislation can imply perverse incentives. On the other hand, municipalities that spend more on health, education, security, sports and leisure and transportation lead us to believe that transfers generate beneficial incentives. The expectation is that the incentive for transfers follows the assumptions of the normative theory in which the country acquires positive points with decentralization.

Table 6 presents the results of estimating the impact of FPM revenue changes on municipal expenditure categories, utilizing two different methodologies: 2SLS and robust regressions for eight expense variables by function. Column (1) sets the stage with an instrumental variables (IV) panel estimation incorporating fixed effects. In column (2), we enrich this foundation by integrating a comprehensive suite of control variables. Transitioning to column (3), we employ robust estimation techniques with a linear specification. Culminating in column (4), our exploration delves into a robust nonlinear modeling approach, adopting a quadratic specification. For Robust estimations, we followed the specification proposed by Cattaneo et al. (2018) with covariate-adjusted RDD setup, to avoid omitted variable problems and we included the control variables described in the data section. The analysis spans various expenditure categories, including education, health, administrative, legislative, social security, public security, sports and leisure, and transport.

Spending on education and health (Panel A and B), which theoretically would be resources with a positive impact on local development, was not statistically significant. Others expenses functions, like legislative (Panel D), transport (Panel H), social security (Panel E) and public security (Panel F) do not change in response to an increase in revenue. For sports and leisure sector (Panel G) the results show that the coefficient is significant, presenting evidence that a 1 % increase in FPM revenue per capita increases spending on sports and leisure per capita by

1.27 %. Even though this increase has continued in greater proportions than that of the FPM, it is observed that the average expenditure of these municipalities on sports and leisure is extremely low (about 35.75 reais per capita).

Our analysis reveals a marked sensitivity within the administrative expenditure category (Panel C) to fluctuations in FPM revenue, demonstrating a pronounced propensity for municipalities to channel increased FPM funds into administrative domains. The coefficients illustrate a significant uptick in administrative spending corresponding with rises in FPM revenues, highlighting an inclination among municipalities to bolster the infrastructure of their "administrative machine" when financial conditions permit. Specifically, our findings from column (4) articulate a clear relationship: a 1 % per capita increase in FPM revenue correlates with a 0.78 % rise in per capita administrative expenditures. This pattern of fiscal behavior persists across various specifications,² underscoring the robustness of our results and indicating a consistent trend towards enhancing administrative capacities in response to fiscal expansions.

This discernible trend stands in stark contrast to the findings of Brollo (2013), Litschig and Morrison (2013), and Castro et al. (2016), whose investigations into the impact of additional revenue on performance outcomes unveiled a positive trajectory in expenses that our data does not corroborate. While these authors aimed to dissect the influence of augmented revenues on broader performance metrics, their observations of expenditure inclinations do not align with our analysis.

Extensions

Effects on target indicators of expenditure

The Federal Constitution of 1988 underscores the imperative for the universalization of essential services, with education and health being paramount due to their fundamental nature and profound long-term impacts. Our research progresses to a critical examination of how municipalities allocate their expenditures towards these vital sectors.

¹ According to Carneiro (1998) and Catafesta (2017), the Brazilian employability in the public sector has a negative view on the conduct of the public sector. Ethical, humanitarian and transparent aspects feed the discredit in the public sector and shows some limitations that the public administration still has.

² Even though we haven't posted the result, we also tested modeling with error correction for heteroscedasticity and the standard error was the same.

Table 5
Discontinuity of basic inputs.

	(1) 2SLS	(2)	(3) Robust	(4)
	Without Covariates	With Covariates	Linear Polynomial	Quadratic Polynomial
Panel A. Revenue				
FPM	0.234*** (0.045)	0.244*** (0.045)	0.247*** (0.041)	0.247*** (0.069)
N	4278	4,27	2147	2162
Bandwidth	10 %	10 %	5.3 %	5.33 %
Panel B. Expenses				
FPM	0.220*** (0.048)	0.228*** (0.048)	0.227*** (0.047)	0.228*** (0.073)
N	4276	4268	1561	2242
Bandwidth	10 %	10 %	3.9 %	5.54 %
Panel C. Non-FPM Transfers				
FPM	-0.099 (0.179)	-0.081 (0.179)	0.129 (0.110)	0.128 (0.158)
N	3138	3133	1506	1532
Bandwidth	10 %	10 %	5.29 %	5.35 %
Panel D. Own Revenue				
FPM	0.142 (0.160)	0.161 (0.158)	-0.409*** (0.128)	-0.274 (0.207)
N	4273	4265	1737	2101
Bandwidth	10 %	10 %	4.34 %	5.22 %
Panel E. IPTU				
FPM	0.365 (0.355)	0.348 (0.355)	-1.032*** (0.377)	-0.687 (0.605)
N	4083	4077	1326	1,93
Bandwidth	10 %	10 %	3.47 %	4.97 %
Panel F. ISS				
FPM	0.057 (0.275)	0.083 (0.270)	0.148 (0.201)	0.102 (0.312)
N	3039	3034	1003	1357
Bandwidth	10 %	10 %	3.72 %	4.96 %
Panel G. Person expenses				
FPM	0.118** (0.048)	0.126*** (0.048)	0.157*** (0.046)	0.175** (0.073)
N	4272	4264	1632	2,21
Bandwidth	10 %	10 %	4.09 %	5.45 %
Panel H. Capital				
FPM	0.308 (0.233)	0.319 (0.233)	0.211 (0.186)	0.024 (0.273)
N	4267	4259	1211	2168
Bandwidth	10 %	10 %	3.04 %	5.37 %
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No

Notes.* 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include year and state fixed effects. The bundled specifications include segment dummies. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

Despite the anticipation that increased Federal Participation Fund (FPM) revenues might bolster health expenditure, our findings previously disclosed a lack of evidence supporting this hypothesis. Consequently, one might infer a static approach towards the enhancement of health services in response to augmented FPM revenues.

Table 7 shows the discontinuous increase in municipal revenue in educational and health indicators, using the infant mortality rate and the age-grade distortion rate as examples for testing. The results revealing that, with the sole exception noted in column 3, increased FPM

Table 6
Impact of FPM revenue changes on municipal expenditure categories.

	(1) 2SLS	(2)	(3) Robust	(4)
	Without Covariates	With Covariates	Linear Polynomial	Quadratic Polynomial
Panel A. Education				
FPM	0.039 (0.070)	0.048 (0.070)	0.055 (0.080)	0.062 (0.111)
N	4236	4228	1019	1962
Bandwidth	10 %	10 %	2.6 %	4.93 %
Panel B. Health				
FPM	0.041 (0.104)	0.053 (0.104)	0.147 (0.102)	0.134 (0.144)
N	4234	4226	1109	1943
Bandwidth	10 %	10 %	2.82 %	4.88 %
Panel C. Administrative				
FPM	0.457*** (0.102)	0.461*** (0.102)	0.759*** (0.119)	0.778*** (0.171)
N	4242	4234	1156	2088
Bandwidth	10 %	10 %	2.94 %	5.24 %
Panel D. Legislative				
FPM	0.114 (0.101)	0.120 (0.102)	0.075 (0.126)	0.050 (0.209)
N	3546	3538	1038	1269
Bandwidth	10 %	10 %	3.18 %	3.88 %
Panel E. Social Security				
FPM	1.003*** (0.344)	1.001*** (0.344)	1.041* (0.550)	0.379 (0.686)
N	1992	1992	450	1266
Bandwidth	10 %	10 %	2.56 %	6.63 %
Panel F. Public Security				
FPM	1.035* (0.566)	1.054* (0.574)	-3.156*** (0.749)	-1.847* (0.740)
N	1,5	1498	396	962
Bandwidth	10 %	10 %	3.03 %	6.49 %
Panel G. Sports and leisure				
FPM	1.296*** (0.464)	1.307*** (0.465)	0.892** (0.369)	0.909* (0.548)
N	3893	3885	1253	2281
Bandwidth	10 %	10 %	3.46 %	6.03 %
Panel H. Transport				
FPM	0.649 (0.489)	0.657 (0.488)	-2.068*** (0.456)	-1.460** (0.740)
N	3256	3253	1071	1438
Bandwidth	10 %	10 %	3.56 %	4.68 %
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No

Notes.* 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include year and state fixed effects. The bundled specifications include segment dummies. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

funds do not significantly impact child mortality rates or the distortion rate in age-series schooling across various tests.

According to Article 37 of the Federal Constitution of Brazil, commissioned positions are public offices, whose occupations can be freely in the public power that are freely appointed and dismissed, establishing that public entities are responsible for delineating the codes for contracting commissioned positions. For [Ferreira \(2014\)](#), the

Table 7
Effect of FPM Revenue on Child Mortality Rates and Educational Attainment.

	(1) 2SLS	(2)	(3) Robust	(4)
	Without Covariates	With Covariates	Linear Polynomial	Quadratic Polynomial
Panel A. Child mortality rate				
	4.157 (4.378)	4.032 (4.381)	10.963*** (2.856)	9.035* (4.655)
N	4,25	4242	1305	1939
Bandwidth	10 %	10 %	3.32 %	4.84 %
Panel B. Distortion rate age series				
	-1.575 (1.766)	-1.528 (1.765)	-3.108** (1.346)	-1.752 (1.731)
N	2943	2938	959	2533
Bandwidth	10 %	10 %	3.44 %	8.55 %
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No

Notes.* 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include year and state fixed effects. The bundled specifications include segment dummies. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

absence of requirements for the appointment of a commissioned position encourages the old practice of Brazilian clientelism, making the easy access to public offices a bargaining chip for favors between sponsors and leaders.

These factors are also highlighted by Bernardi and Campos, 2010, who states that the choice of commissioned employees directly affects the efficiency of public management. For Rodrigues (2012), the commissioned public office must be assigned to a qualified individual, and therefore, it is essential that their performance is linked to high levels of knowledge and the application of modern management models. In other words, they should be linked to be public administration and society and not to political or family ties. Drawing from Reis (2018), we can complete the theoretical overview showing that the salary of commissioned positions can, in some situations, be higher than the effective positions, indicating that the issue besides responsibility weight also has a great deal of weight in the public budget. (For example, a secretary advisor receives R\$8138.24 without a schooling requirement, while an administrative assistant receives R\$2005.41 with the minimum requirement of a high school education).

As the results presented in the previous section show that a large part of the increase in spending by small municipalities is intended for administrative expenses, we seek to look for some evidence of how these expenditures are made, that is, how municipalities are spending this increase in revenue. Thus, we also tested how the number of commissioned positions behaves with the addition of the FPM. As in the previous section, we estimated this result using the fuzzy RDD.

The data is only information about the people employed in the municipal public service and not the complete group of a municipality's formal employees. Corbi, Papaioannou and Surico (2019) analyze this discontinuity in formal employment in the public and private sector and the salary gains for municipalities close to the FPM range. However, our objective here is to assess how the increase in municipal public administrative expenditure affects the hiring of effective civil servants and commissioned positions. A heterogeneity of the effect between commissioned and statutory positions, shows that the effects found by

Table 8
Effects of FPM Allocations on Commissioned Employment.

	(1) 2SLS	(2)	(3) Robust	(4)
	Without Covariates	With Covariates	Linear Polynomial	Quadratic Polynomial
Panel A. Total direct commissioned employees				
FPM	42.307*** (12.647)	41.612*** (12.577)	47.875*** (13.140)	48.881*** (15.730)
N	3213	3207	972	2743
Bandwidth	10 %	10 %	3.22 %	8.44 %
Panel B. Total indirect commissioned employees				
	-0.537 (2.691)	-0.591 (2.680)	-3.459** (1.722)	-0.936 (3.419)
N	507	507	173	236
Bandwidth	10 %	10 %	3.81 %	5.05 %
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No

Notes.* 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include year and state fixed effects. The bundled specifications include segment dummies. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

Corbi et al. (2019), despite showing a better performance in the labor market, arise from a perverse incentive that is the practice of political clientelism.

In Table 8, the results show evidence that increases in transfers rise the number of employees commissioned in direct administration.³ A 1 % increase in FPM expands in commissioned positions in direct administration by 0.79 %. In other words, for every 2 % increase in FPM, a new commissioned job is created. Thus, even if it is necessary to explore other public spending mechanisms, it is possible to see that part of the additional revenue is being used to increase the number of commissioned positions in the city hall, which indicates perverse incentive.

Effects on target indicators fiscal

In the sense of management quality, it is expected that the increase in transfers by the government via FPM will generate benefits in the sense of municipal fiscal management. To measure quality, we use the tax management index (IFGF). The results presented in Table 9 show that the only indicator that is affected by the increase in transfers is government autonomy. With the increase in transfers, it is possible to see in Table B8 column (8) that 1 % more federal government resources decrease between 0.18 % and 0.28 % the autonomy capacity of the municipal government, indicating, in a way, loss of the quality of the municipal government.

As shown by Jia et al., 2020 for China, our results indicate that even if the decentralization policies aim to improve the autonomy of local governments, they end up harming local tax execution due to the

³ Direct public administration is made up of bodies that are directly linked to the head of the Executive Branch in the case of the Municipal Government, to the Mayor. Indirect public administration, in turn, is composed of entities that, through the decentralization of government powers, were created to play roles in the most varied sectors of society and provide services to the population.

Table 9
Effect of FPM revenue on FIRJAN municipal development index .

	(1) 2SLS Without Covariates	(2) With Covariates	(3) Robust Linear Polynomial	(4) Quadratic Polynomial
Panel A. IFGF Autonomy				
FPM	−0.199*** (0.041)	−0.196*** (0.041)	−0.160*** (0.047)	−0.135** (0.064)
N	4182	4174	1645	3268
Bandwidth	10 %	10 %	4.2 %	7.84 %
Panel B. IFGF Investment				
FPM	0.165* (0.094)	0.166* (0.094)	−0.055 (0.080)	−0.077 (0.121)
N	4182	4174	1,22	2,02
Bandwidth	10 %	10 %	3.14 %	5.13 %
Panel C. IFGF Liquidity				
FPM	0.287*** (0.096)	0.292*** (0.096)	−0.201** (0.084)	−0.155 (0.127)
N	4182	4174	1341	2119
Bandwidth	10 %	10 %	3.45 %	5.34 %
Panel D. IFGF Personel				
FPM	0.317*** (0.096)	0.323*** (0.096)	0.256*** (0.084)	0.155 (0.125)
N	4182	4174	1236	2131
Bandwidth	10 %	10 %	3.18 %	5.38 %
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No

Notes. * 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include year and state fixed effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

increase in fiscal transfers. Our results show that differences in transfers in very similar municipalities give municipalities the disincentive to seek greater autonomy. Miyazaki, 2020 finds in Japan that higher tax equalization rates on transfers give municipalities incentives to increase tax collections on companies exempt from the transfer scheme. Other studies such as Gadenne (2017) for Brazil and Martinez (2019) for Colombia also show that the way in which local governments are financed (by their own taxation or by transfers from higher federative entities) changes the behavior in the execution of expenditure.

Robustness test for bandwidth sensitivity

Following Spruk and Kovac (2020), we explore the significance of uncertainty regarding the de facto boundaries of colonial jurisdiction on our regression discontinuity (RD) estimates, particularly within the context of our study where the bandwidth ranges from 1 % to 10 %. To assess the robustness of our RD estimates, we reevaluate the influence of jurisdictional boundaries, examining if the assumption of local randomization remains valid. This approach is in line with the methodologies utilized by Rosenbaum (2007) and Calonico et al. (2015, 2016b), where a balance test is applied to both outcomes and covariates to identify any potential deviations from the local randomization assumption within our selected bandwidth.

In this process, we closely examine the distribution of covariates and outcomes between control and treatment groups, under the premise that, in the absence of treatment, these distributions should not significantly differ a concept that mirrors the "as if random" treatment

assignment within department-level jurisdictions as suggested by historical colonial boundaries. By meticulously analyzing the data within our defined bandwidth of 1 % to 10 %, we replicate the fundamental RD framework without dividing the spatial sample, adjusting the intervals to fit our study's specific context.

The outcome of these robustness tests revealed a noteworthy consistency in the results across all bandwidth windows tested. Despite the variations in the range of data considered, the core findings of our study remained unaffected, indicating a high level of model stability. This consistency is particularly significant as it suggests that our models are not overly sensitive to the choice of bandwidth, thus providing a strong foundation for the reliability and applicability of our results. Such robustness enhances the credibility of our research, affirming that the conclusions drawn are not artifacts of specific methodological choices but are reflective of underlying economic phenomena.

Fig. 7

Heterogeneity by region

Our study extended beyond the initial focus on the country to include a region-specific approach across Brazil. This was undertaken to determine whether the effects of fiscal decentralization on municipal policymaker behavior, particularly in relation to the use of the Municipal Participation Fund (FPM), were consistent or exhibited variations across different regions.

Fig. 8 below shows the coefficient results found in column (4) of Table 6. The result in red points the same result found in Table 8 and the results at each point indicate the coefficients entered for each region with the same bandwidth (8.44 %). The RDD analysis revealed notable differences in fiscal behavior across Brazilian states and regions. The pattern of a significant increase in expenditures on administrative, propelled by an increase in commissioned position employees, was found on Brazilian south and northeast region but not evident in other regions. Furthermore, while the southern region had a result closer to what we found in our aggregate estimation, the Northeast region presented a higher coefficient, indicating a greater effect of spending on administrative and employability of commissioned positions to the detriment of the increase in revenues of the municipalities in the region.

Final remarks

The present work has sought evidence of what incentive additional resources generate in the municipal budget. In general, we find perverse incentives in the neighbor to the FPM jump. There are other mechanisms (not explored here) that can interact with our results and can help explain the impact of larger transfers, such as analyses of economic growth and social inequality.

The results obtained indicate that the exogenous increase in FPM revenues is strongly associated with administrative expenses and that a possible destination of this expense is related to the increase in the number of commissioned positions. These results show consistency, since our results are consistent with the specifications used.

The fact that this analysis is limited to a specific period and only for small municipalities means that this research has little external validity. That is, this experiment becomes conclusive only for this period and for these municipalities in question. The expectation is that, for future research, these effects will be explored over a longer period. These results allow managers and the local population to reflect on how public policies are being applied and the short- and long-term implications of these policies.

Even though we have found a positive impact on number of commissioned positions, it is also necessary to interpret these results with caution. It is also necessary to explore other factors related to the public machinery to conclude that these incentives are totally perverse, even if the increase in commissioned positions gives us some indication of the political use of additional resources.

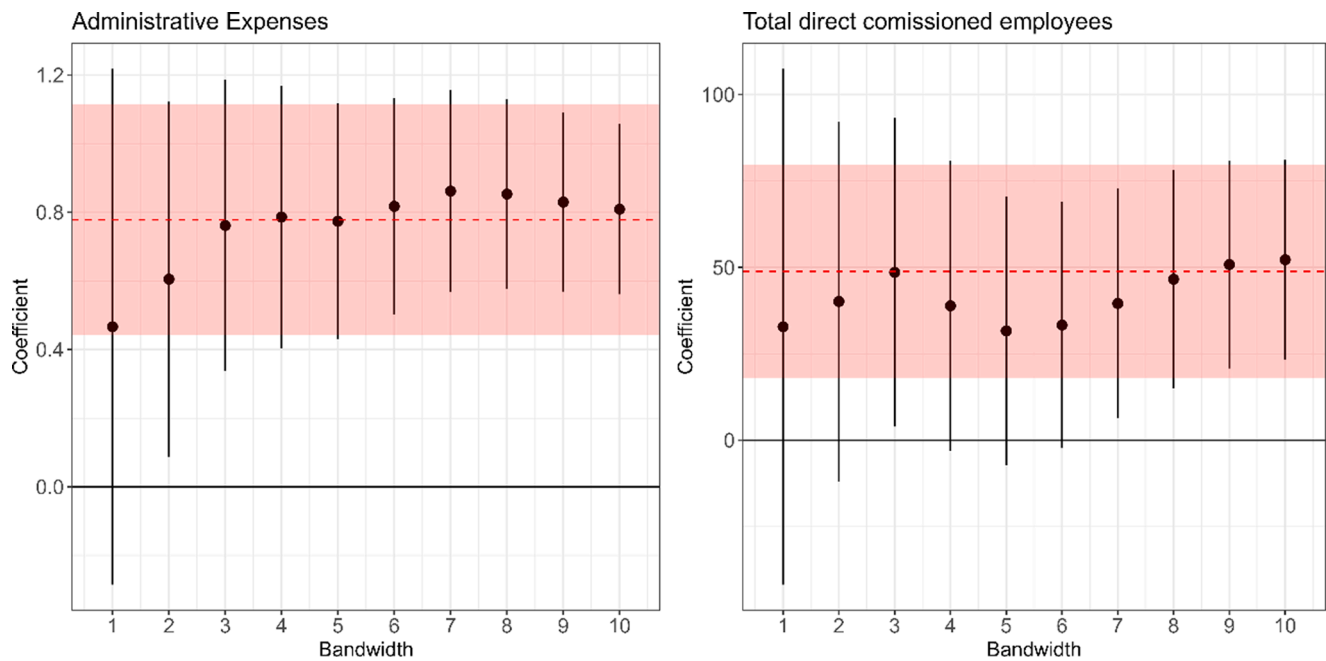


Fig. 7. Robustness Check: RD effect distribution under alternative window selection.

Notes: This figure plots estimates from the regression discontinuity robust with a 95 % confidence interval using the same bandwidth as the main specification for Administrative Expenses (5.24 %) and Total direct commissioned employees (8.44 %). All specifications include year and state fixed effects. The dashed line represents the coefficient found in the aggregated result, while the shaded red region represents its confidence interval. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

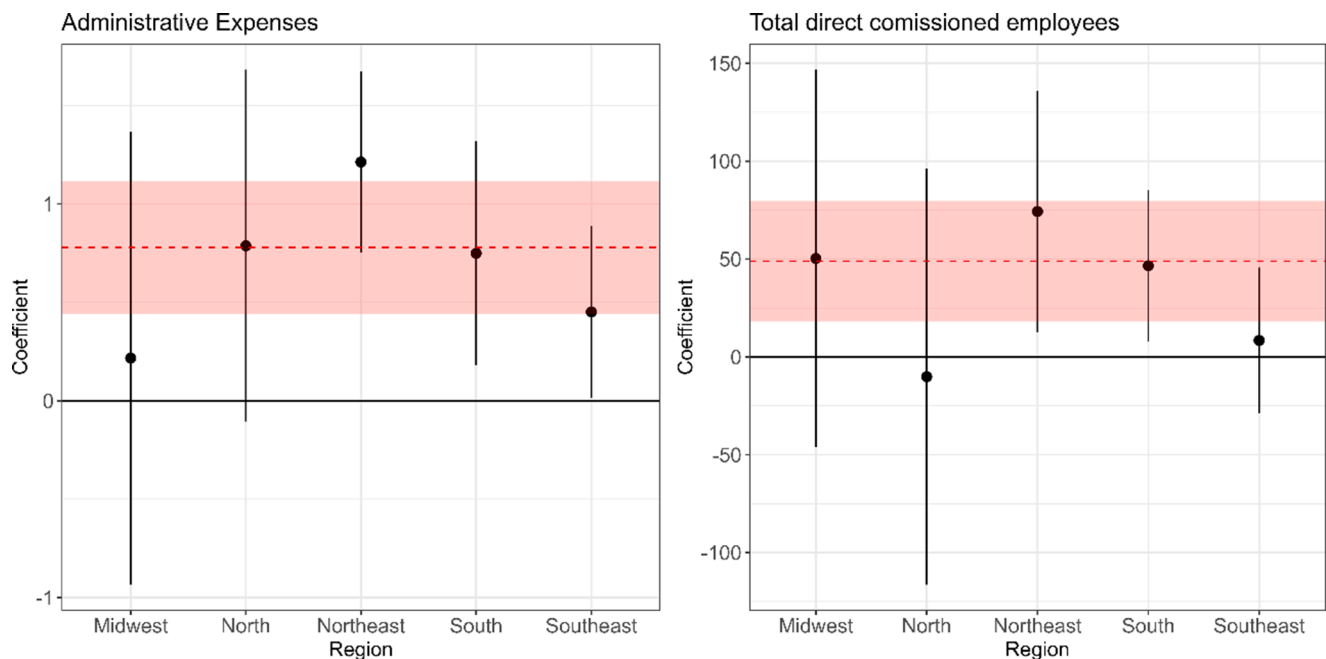


Fig. 8. Effect of FPM revenue by region.

Notes: This figure plots estimates from the regression discontinuity robust with a 95% confidence interval using the same bandwidth as the main specification for Administrative Expenses (5.24 %) and Total direct commissioned employees (8.44 %). All specifications include year and state fixed effects. The dashed line represents the coefficient found in the aggregated result, while the shaded red region represents its confidence interval. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of establishments, number of employees, Balance of Trade, Number of beneficiaries per social program, Percentage of people with access to the sewage network, and Road extension.

This research has significant implications for public policy in Brazil. Firstly, it underscores the need for more transparent and accountable mechanisms in the allocation of federal funds to municipalities. The

evidence of increased administrative expenses and the hiring of commissioned positions in response to increased FPM revenues suggests a potential misallocation of resources, which could be addressed

through policy reforms aimed at ensuring that these funds are used more effectively for public welfare and development.

Additionally, the study raises important questions about fiscal decentralization in Brazil and its impact on local governance. The findings indicate that while decentralization is intended to empower local governments, in practice, it may lead to fiscal inefficiencies and a lack of autonomy. Policymakers could use these insights to revisit and refine decentralization strategies to ensure that they foster local development and reduce dependencies on federal transfers.

In conclusion, this study serves as a valuable resource for policymakers and administrators seeking to enhance fiscal responsibility and

governance efficiency in Brazil's municipalities. It provides empirical evidence that can inform the design and implementation of policies aimed at optimizing the use of federal funds at the local level and ensuring that they contribute positively to municipal development and governance.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Other results

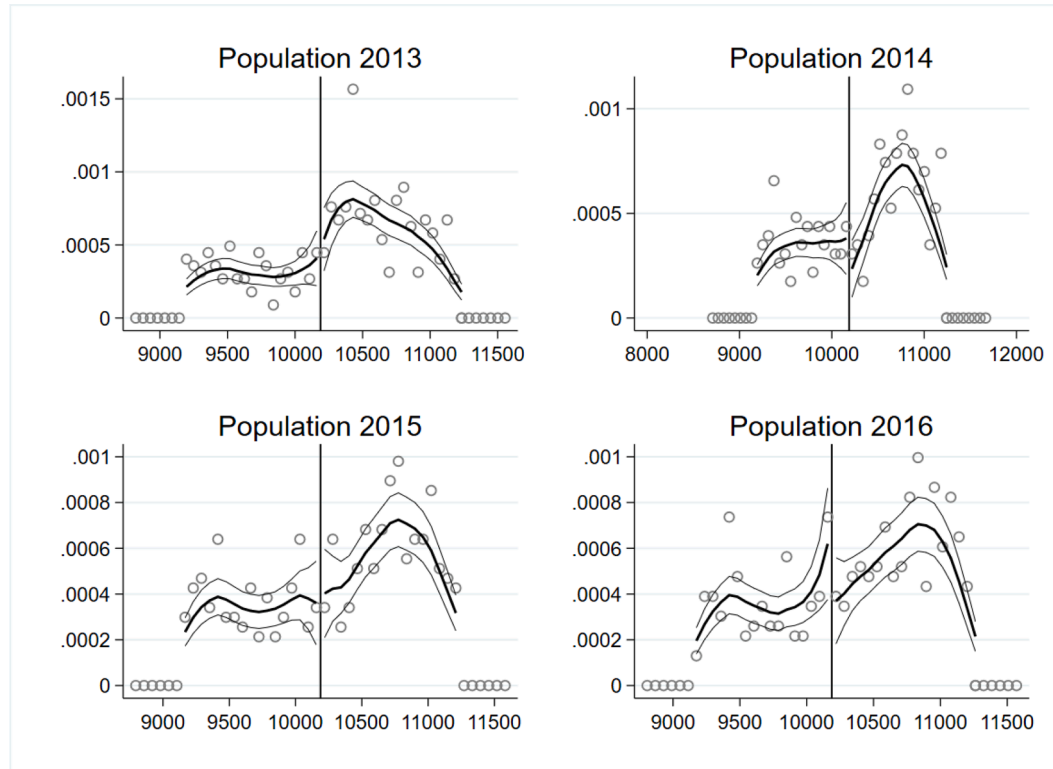


Fig. A1. Mcrary population manipulation test per year- IV Pooled 1st Cutoffs.

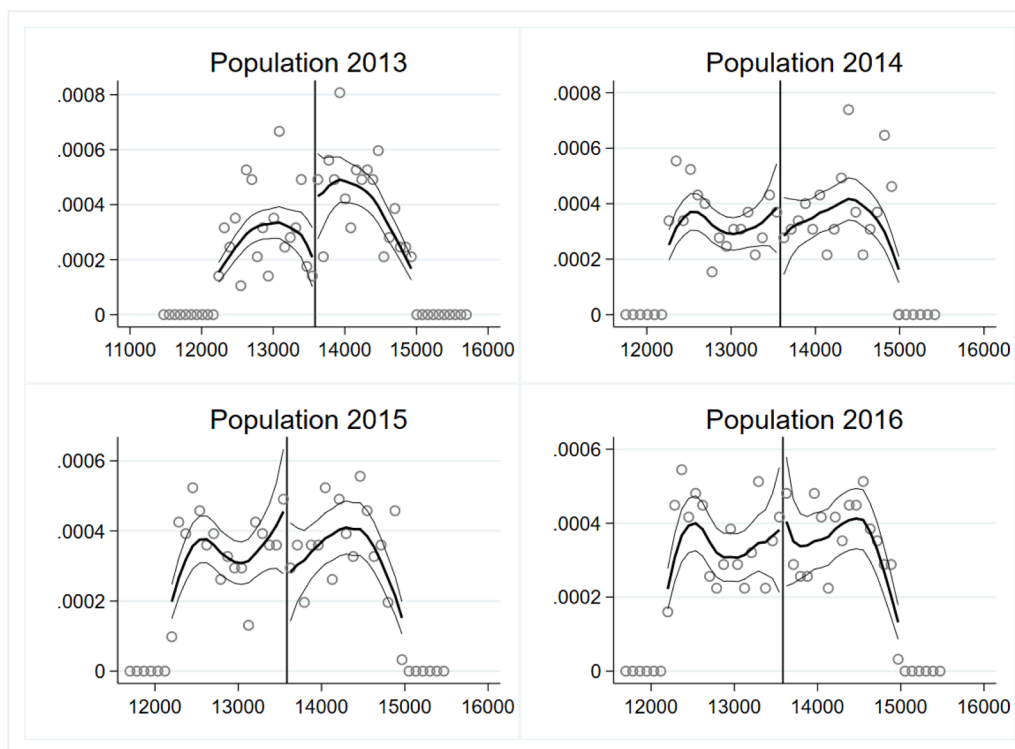


Fig. A2. Mccray population manipulation test per year- IV Pooled 2st Cutoffs.

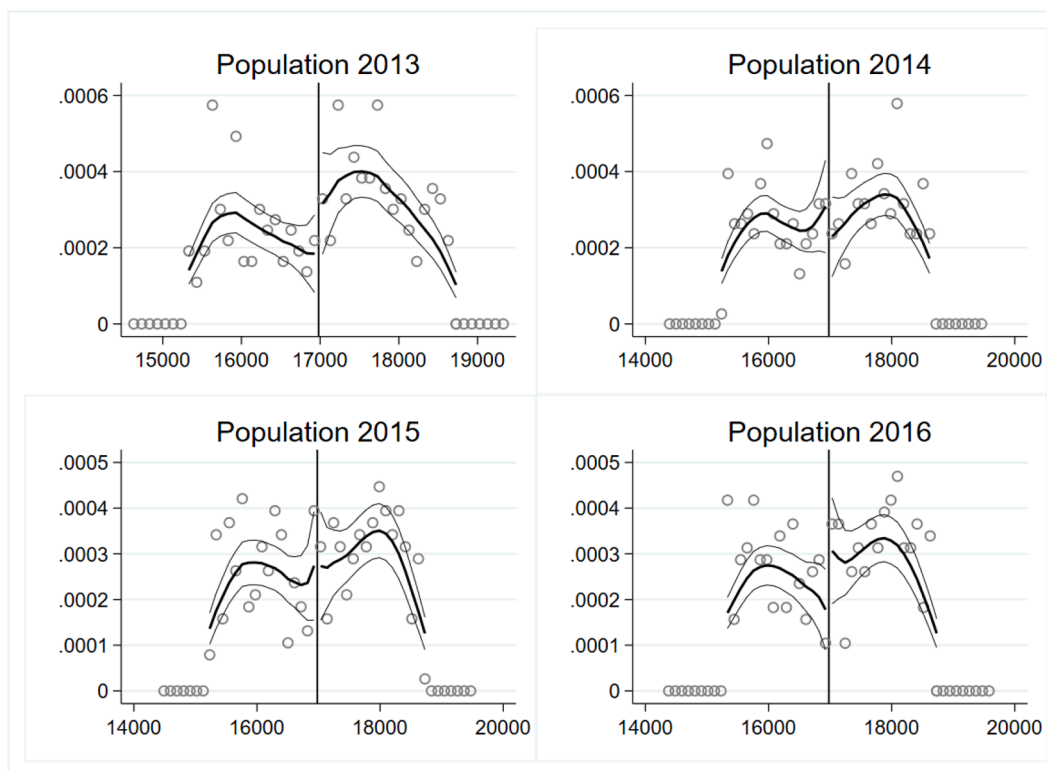


Fig. A3. Mccray population manipulation test per year- IV Pooled 3st Cutoffs.

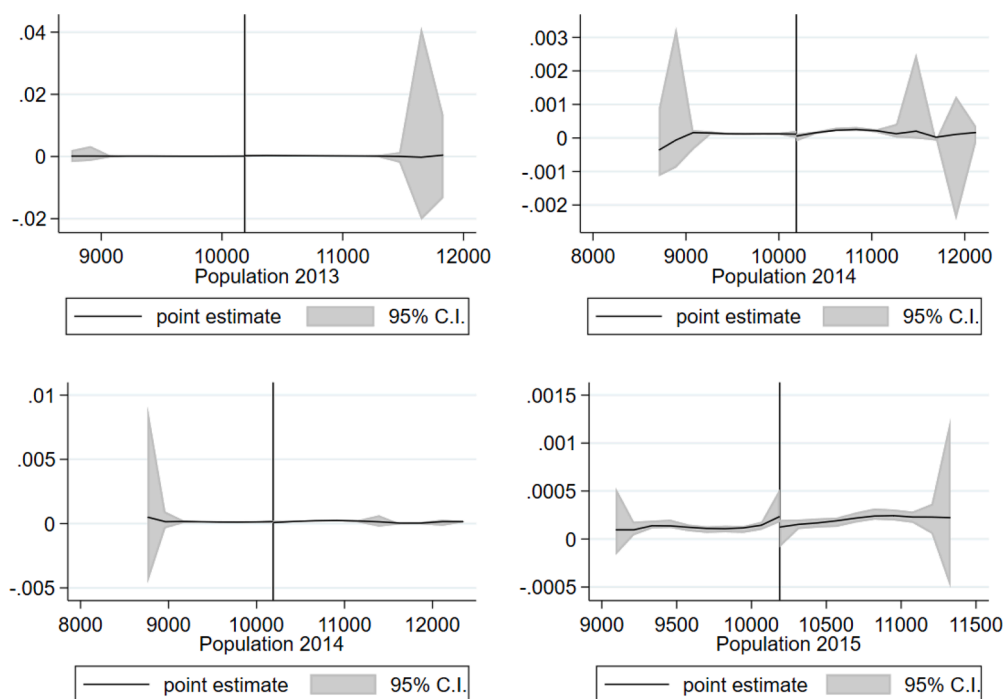


Fig. A4. Population manipulation test - IV Pooled 1st Cutoffs.

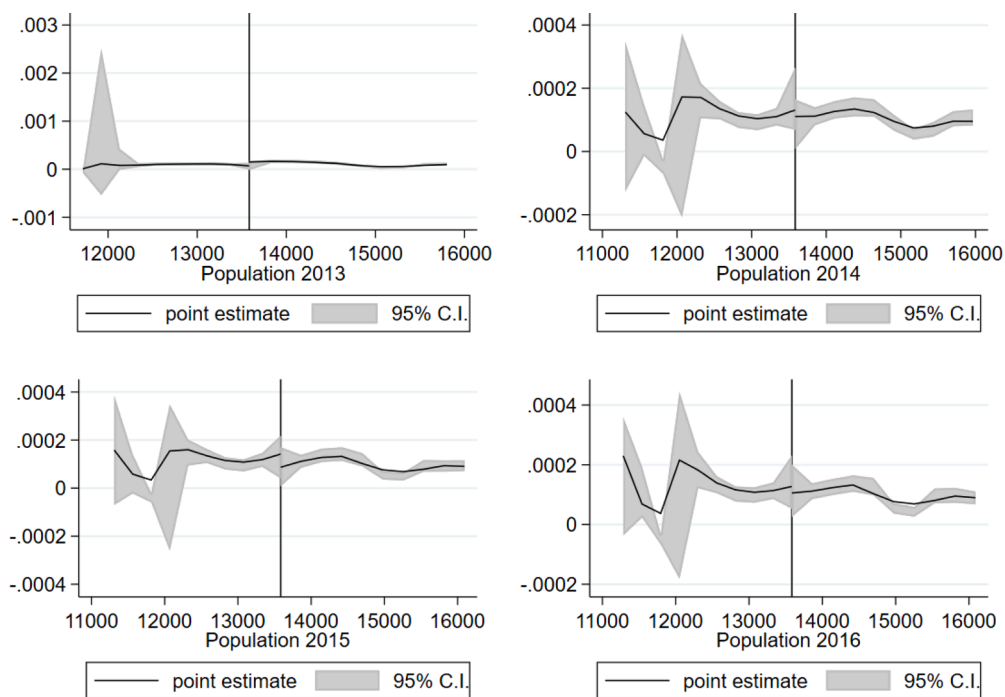


Fig. A5. Population manipulation test - IV Pooled 2nd Cutoffs.

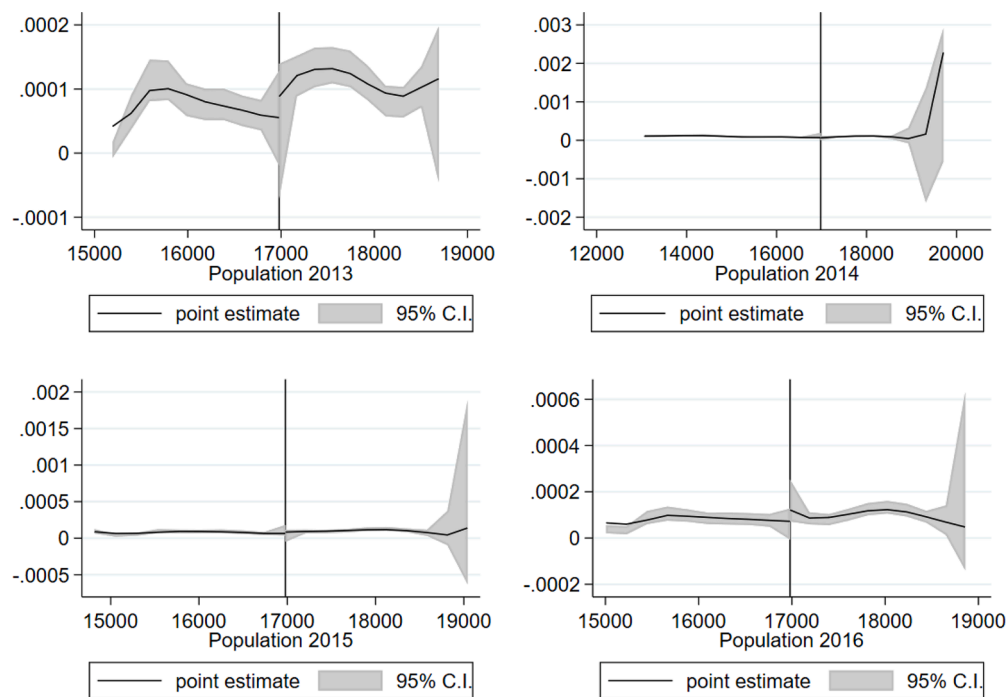


Fig. A6. Population manipulation test - IV Pooled 3st Cutoffs.

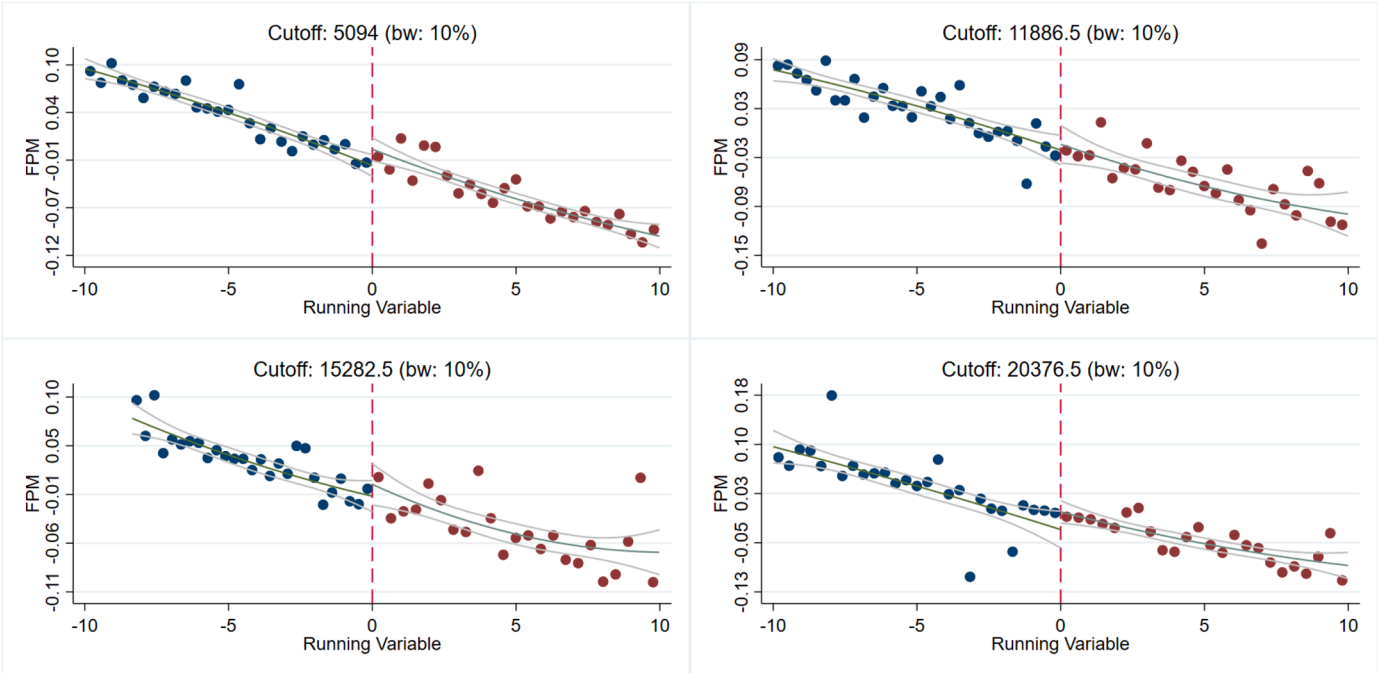


Fig. A7. Placebo test for population.

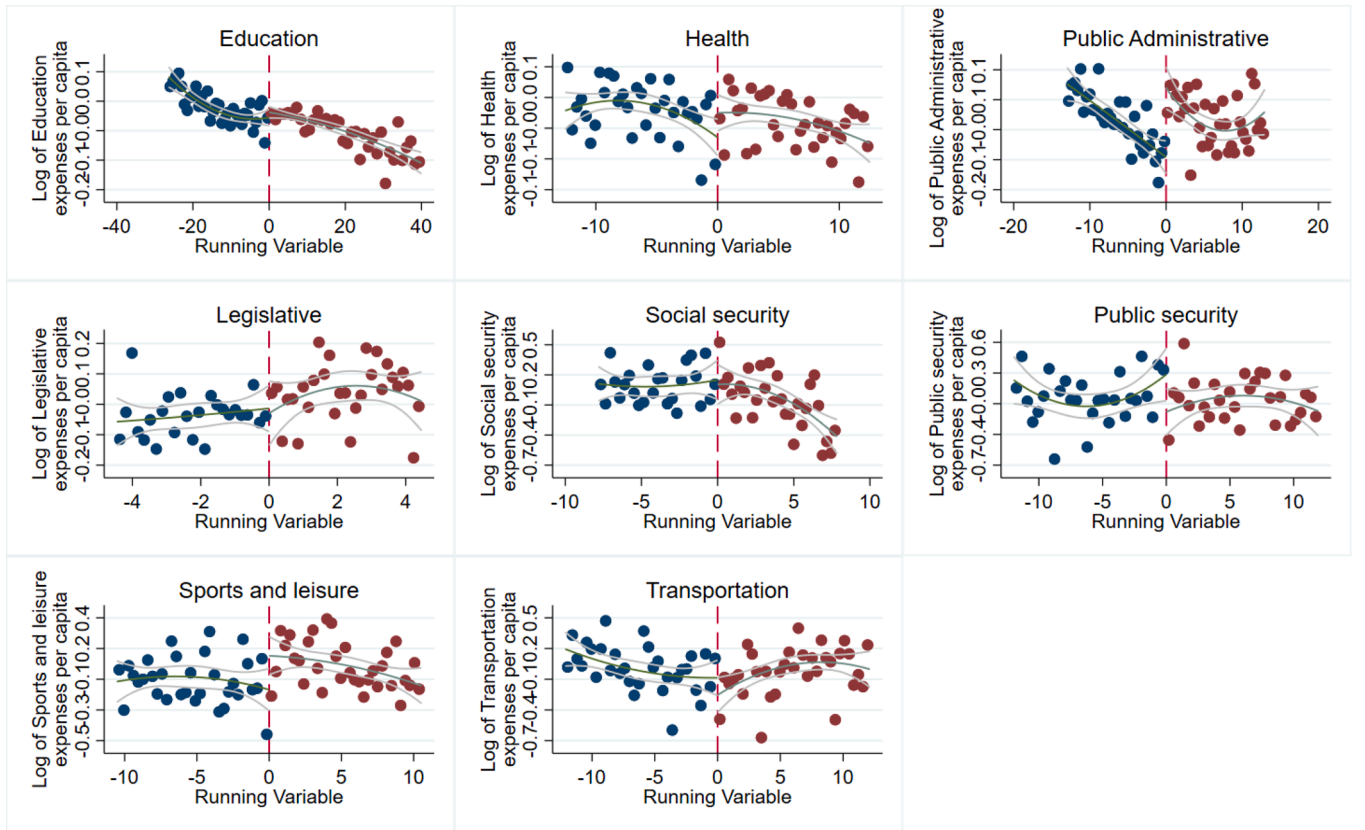


Fig. A8. Discontinuity of spending on the Education, Health, Administrative and Legislative function.

Notes: All specifications include fixed state effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of industries, number of companies, distance to the capital.

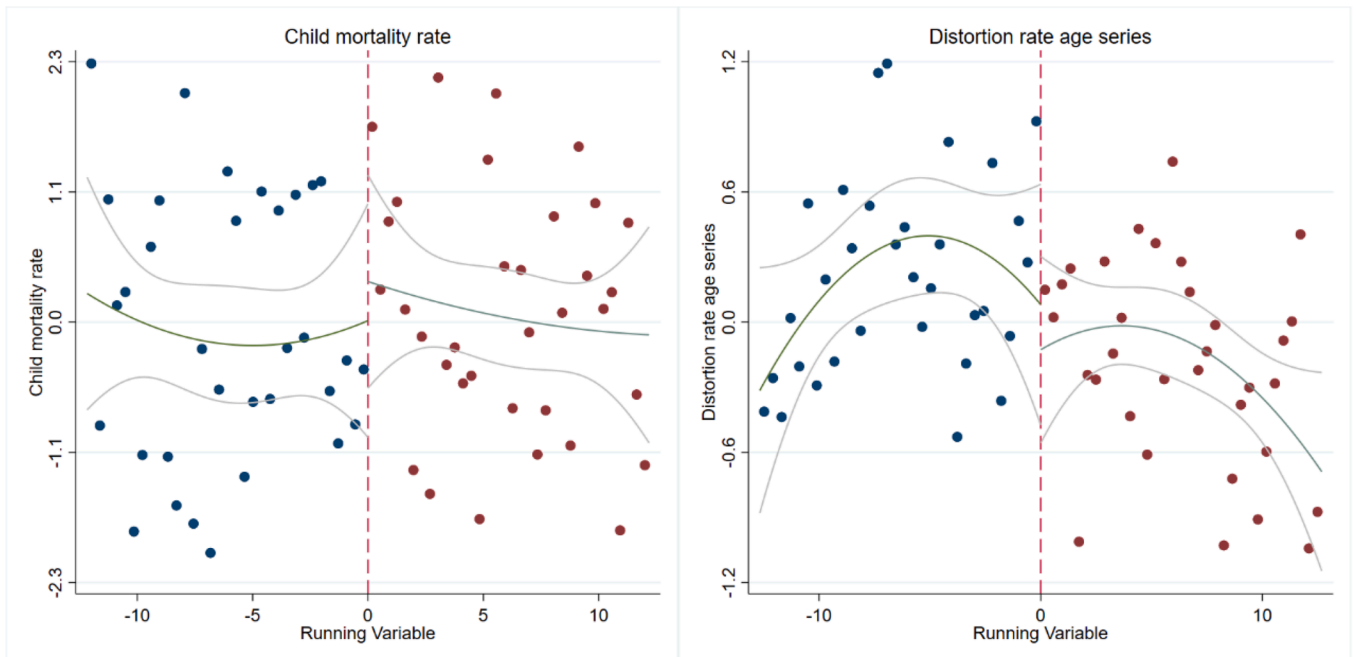


Fig. A9. Discontinuity on education and health services.

Notes: All specifications include fixed state effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of industries, number of companies, distance to the capital.

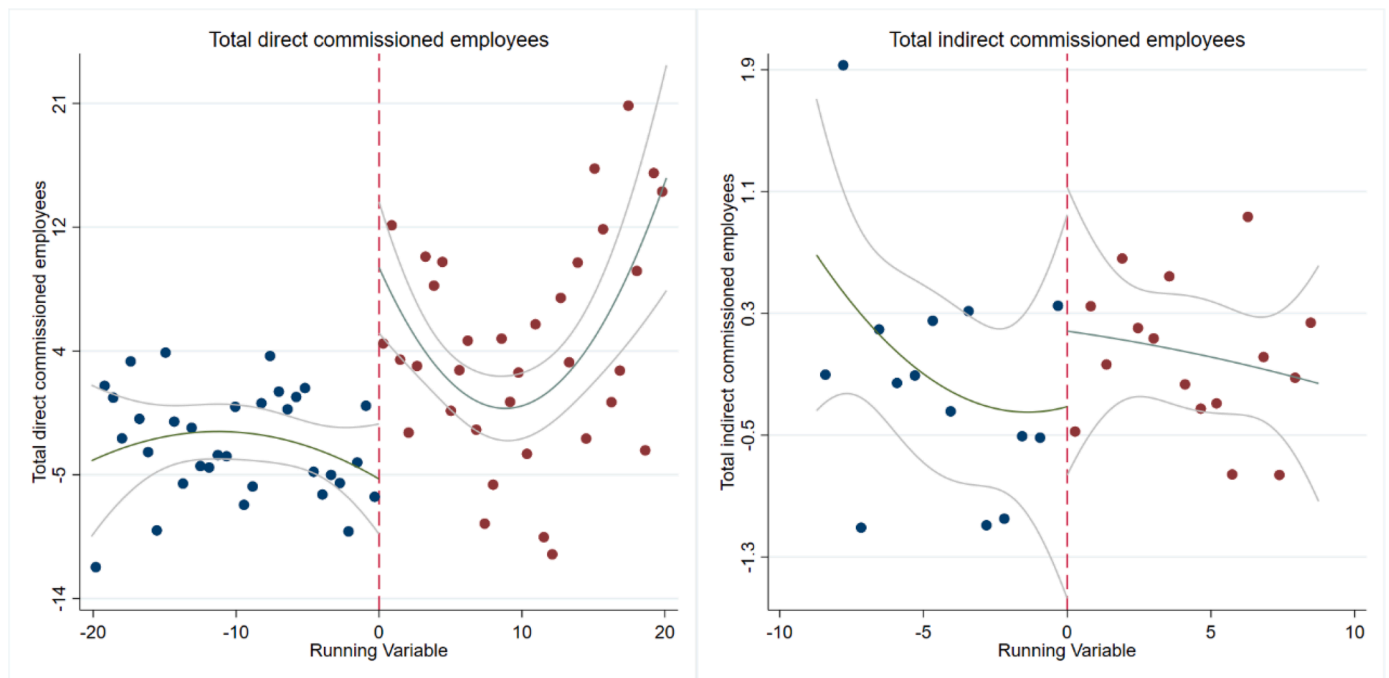


Fig. A10. Discontinuity in the number of commissioned and Statutory employees.

Notes: All specifications include fixed state effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of industries, number of companies, distance to the capital.



Fig. A11. Discontinuity in the indicators of the FIRJAN Municipal Development Index.

Notes: All specifications include fixed state effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of industries, number of companies, distance to the capital.

[Figs. A1-A11](#) and [Table A1](#)

Table A1

Covariate balance comparisons.

	(1)	(2)	(3)	(4)
	2SLS	Robust		
	Without Covariates	Linear Polynomial	Quadratic Polynomial	Cubic Polynomial
Panel A. Road extension				
FPM	-0.541	-1.016***	-0.800	-0.800

(continued on next page)

Table A1 (continued)

	(1)	(2)	(3)	(4)
Bandwidth	(0.439)	(0.303)	(0.505)	(0.505)
Panel B. GDP per capita	10 %	3.74 %	5.08 %	5.08 %
–0.058		–0.221*	–0.210	–0.218
Bandwidth	(0.068)	(0.117)	(0.182)	(0.192)
Panel C. Number of Establishments	10 %	3.7 %	5.12 %	4.49 %
–0.023		–0.000	0.035	0.174
Bandwidth	(0.034)	(0.086)	(0.170)	(0.199)
Panel D. Number of Employees	10 %	5.5 %	4.94 %	3.25 %
FPM	–0.094	–0.140	–0.177	–0.135
Bandwidth	(0.104)	(0.135)	(0.232)	(0.265)
Panel E. Probability reelection	10 %	3.95 %	5.28 %	4.19 %
FPM	–	0.244**	0.241	0.239
Bandwidth	–	(0.100)	(0.159)	(0.158)
Panel F. Percentage of people with access to the sewage network	10 %	3.81 %	5.34 %	5.38 %
FPM	0.044	–0.013	0.033	0.040
Bandwidth	(0.055)	(0.069)	(0.109)	(0.106)
Panel G. Number of beneficiaries per social program	10 %	3.85 %	5.76 %	6.06 %
FPM	–0.009	0.033	0.053	0.033
Bandwidth	(0.021)	(0.036)	(0.052)	(0.068)
Panel H. Balance of Trade	10 %	4.68 %	0.0845	4.71 %
FPM	1.063	3.079**	–0.123	1.695
Bandwidth	(0.992)	–1.467	–2.199	–2.524
Covariate	No	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	No	No	No

Notes. * 10 % of statistical significance, ** 5 % of statistical significance, *** 1 % of statistical significance. Robust standard errors of heteroscedasticity in parentheses. The bandwidth (%) is the percentage distance from the respective cutoff point. All specifications include fixed state effects. The bundled specifications include segment dummies. The pretreatment covariates include the Municipality's GDP Per Capita per capita, re-election dummy, number of industries, number of companies, distance to the capital.

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