Federal Unconditional Transfers and Urban Services Provision: An Empirical Analysis for Brazilian Municipalities

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Motivation: The importance of federal transfers for small Brazilian municipalities

- Brazilian 1988 Constitution
  - Municipalities responsible for urban services
  - Small municipalities: Insufficient local tax resources
  - Intergovernmental transfers are an essential source of revenues of most of Brazilian municipalities

- FPM (*Fundo de Participação dos Municípios*): The most important intergovernmental transfers to municipalities
  - Non-conditional
  - Quite relevant for small municipalities (up to 156,216 inhabitants): 29% of revenues (local taxes only 6%)

Motivation: Why look at the impact of FPM on urban services?

- Lack of infrastructure and services of Brazilian cities (Brueckner et al., 2019)
- Contrary to education and health services, there is no minimum expenditure required by law for urban services
- In recent decades, urban services have lost importance in the budget (despite the growth in urbanization) (Bremaeker, 2017)
  - In 1972: Urban services and health and education services corresponded, respectively, to 26.7% and 20.5% of total spending
  - In 2016: The correpondent numbers were 10.1% and 54.8%

Motivation: Why look at the impact of FPM on urban services?

- The rule of transfers of FPM involves population-based discontinuities: A source of exogeneity of receipts
  - Municipalities with similar populations close to law thresholds receive very different values from the FPM

- Although some studies explore this rule to analyze the impact of FPM on corruption, health, education, and employment, **there is no research on its effects on the provision of urban services**

Objective: Starting to fill the gap...

- The objective of the research is estimate the impact of FPM resources on the provision of urban services by Brazilian small municipalities
  - Street paving
  - Public garbage collection
  - Public transport
  - Water supply via the general network
  - Sewage network
- Explore regional differences

Related Literature

- Previous works on the effects of FPM
  - Corruption: Brollo et al. (2013)
  - Educational and social indicators: Litschig e Morrison (2013), Gadenne (2017)
  - Local employment: Braga et al. (2017), Corbi et al. (2019)
- Literature on impacts of intergovernmental transfers for local governments (just some examples)
  - Tax effort of local jurisdictions in Germany: Buettner (2006)
  - Expenditures and local tax rates in Sweden: Dahlberg et al. (2008)
  - Transfers granted by the European Union (EU) to disadvantaged regions: Becker et al. (2010)

Background: Small Municipalities' receipts (up to 50 thousand inhabitants, 88.2% of the total)

Table: 1 - Municipalities' Receipts by Sources of Resources - 2013-2018

	Brazil	Midwest	Northeast	North	Southeast	South
Per capita values (R$)						
FPM	**427.37**	**408.24**	**445.52**	**331.65**	**434.52**	**436.24**
State-level transfers	406.19	591.62	198.90	273.29	601.29	594.08
Local taxes	**236.07**	**362.27**	**111.96**	**147.78**	**314.05**	**413.38**
Others	871.57	863.06	887.78	734.71	870.11	920.26
Shares (%)						
FPM	**22.0**	**18.3**	**27.1**	**22.3**	**19.6**	**18.4**
State-level transfers	20.9	26.6	12.1	18.4	27.1	25.1
Local taxes	**11.2**	**16.3**	**6.8**	**10.0**	**14.2**	**17.4**
Others	44.9	38.8	54.0	49.4	39.2	38.9

Background: Small Municipalities' expenditures (up to 50 thousand inhabitants)

Table: 2 - Municipalities' expenditures by Categories

	Brazil	Midwest	Northeast	North	Southeast	South
Per capita values (R$)						
Education	539.69	518.96	578.05	527.61	512.23	505.95
Health	377.25	460.18	315.15	261.75	461.06	423.06
Public administration	223.42	264.83	193.86	202.33	245.62	253.99
Urban services	**151.84**	**166.70**	**117.19**	**93.60**	**214.52**	**517.67**
Others	317.45	436.77	222.76	187.22	373.50	486.00
Shares (%)						
Education	33.5	28.1	40.5	41.5	28.3	27.4
Health	23.4	24.9	22.0	20.6	25.5	22.9
Public administration	13.9	14.3	13.6	15.9	13.6	13.8
Urban services	**9.6**	**9.0**	**8.1**	**7.4**	**11.9**	**9.4**
Others	19.7	23.6	15.6	14.7	20.7	26.4

The FPM rule: Founding and distribution

- The FPM originated in Constitutional Amendment nº 18 of December 1, 1965, being ratified in the 1988 Constitution
- FPM resources (**federal taxes**): 24.5% on the collection of Income Tax (IR) and Tax on Manufactured Products (IPI)
- FPM general distribution: 10% to the capitals, **86.4% to non-capital municipalities**, and 3.6% as a supplement for the most populous cities
- In 2018: FPM amounted to 2.8 times the resources for the *Bolsa Família* program (or about US$ 21.4 billion)
- **Discontinuities**: For a municipality i with approximately less than 150,000 people in a state s, the transfers are defined using a rule that apply thresholds according to the population

The FPM rule: Discontinuities in the transfers

$$FPM_i^s = FPM^s \times \left(\frac{\lambda_i}{\sum_{i \in s} \lambda_i} \right) \quad (1)$$

- Where λ_i varies according to the population of the municipality between thresholds established by the law

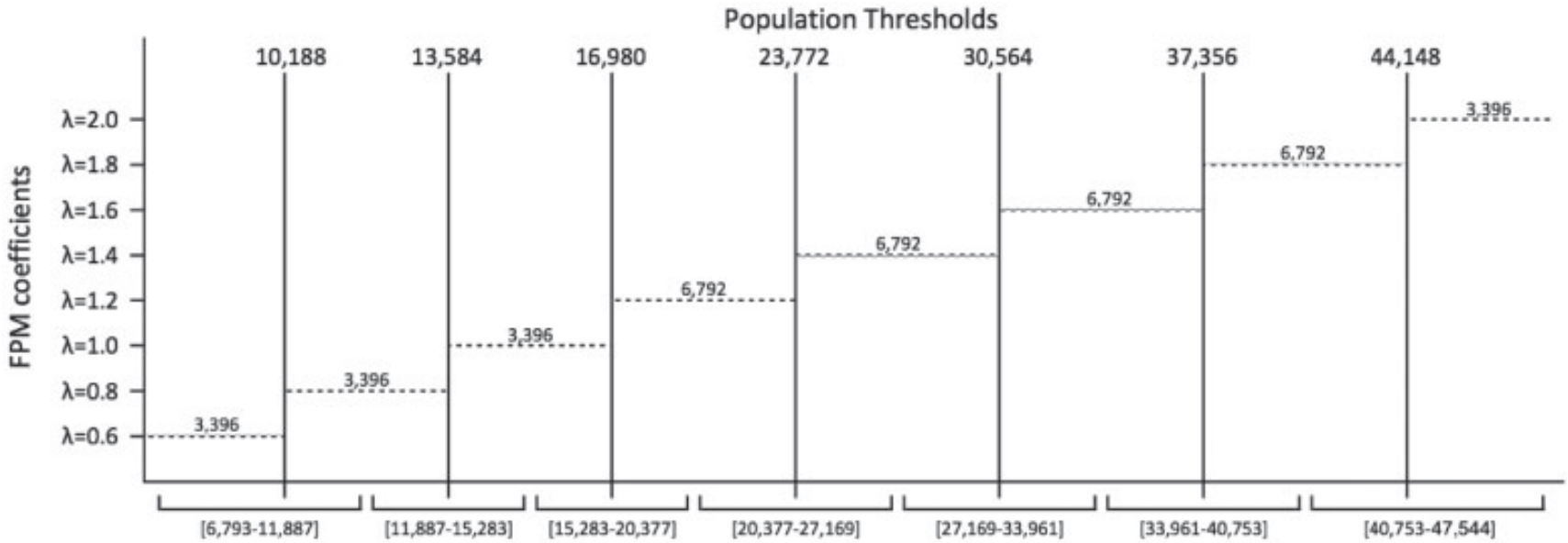
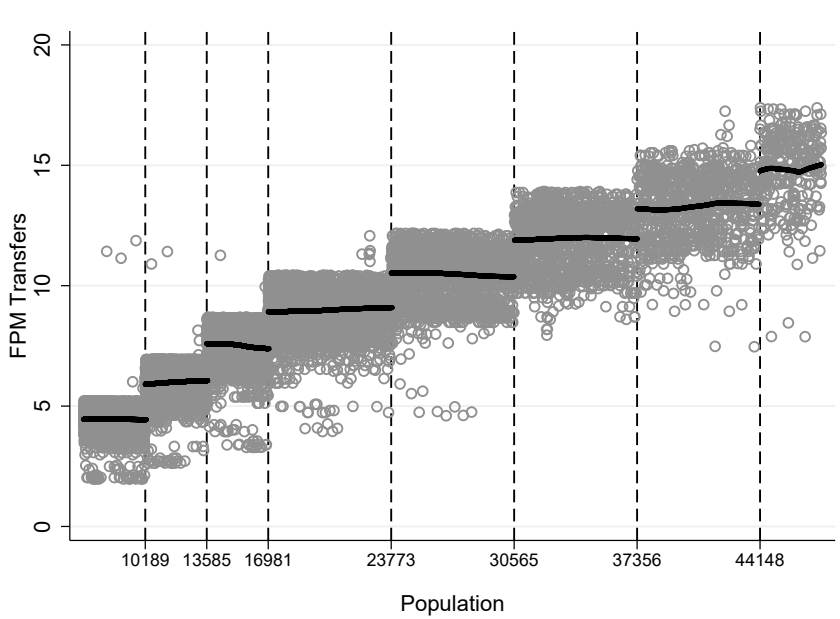


Figure: 2 - FPM's thresholds and the value of λ_i

The FPM rule: Discontinuities in practice (2013-2018)



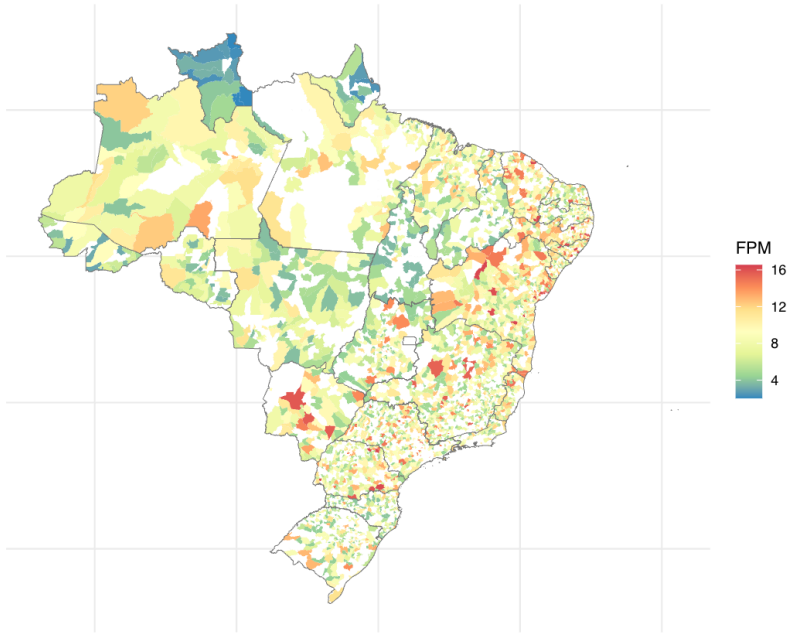


Figure: 3 - FPM transfers and thresholds, 2013-2018 (2018 R$)

Empirical strategy: A Fuzzy Regression Discontinuity Design

- The allocation of FPM transfers to municipal governments is a non-linear function of population
- FPM transfers change abruptly at several pre-determined population thresholds
- Hence, **population movements around the cutoffs can be used as a source of exogenous variation** to estimate the causal impact of FPM transfers (Angrist and Pischke, 2008)

Estimation Strategy: The fuzzy RDD specification

- Similar to that of Corbi et al. (2019)
- First stage: using the FPM transfers defined in law as instrument for the FPM effective transfers:

$$FPM_{icst} = \theta FPM^{law}_{icst} + f(pop^{c}_{is,t-1}) + \alpha_i + \alpha_{ct} + \alpha_{st} + \mu_{icst} \quad (2)$$

$$\forall pop_{ics,t-1} \in [pop^{c}_{t-1}(1-\delta), pop^{c}_{t-1}(1+\delta)], \quad \delta = 5\%, 3\%, 2\% \quad (3)$$

- Second stage regression

$$Y_{icst} = \rho FPM^{e}_{icst} + f(pop^{c}_{ist-1}) + \phi_i + \phi_{ct} + \phi_{st} + \varepsilon_{icst} \quad (4)$$

$$\forall pop_{ics,t-1} \in [pop^{c}_{t-1}(1-\delta), pop^{c}_{t-1}(1+\delta)], \quad \delta = 5\%, 3\%, 2\% \quad (5)$$

Estimation Strategy: Identification

- The transfers defined by the law are good instruments for the FPM effectively transferred
- Municipal revenues also must change abruptly at the cutoffs (there is a mechanism linking the FPM resources to potential changes in the provision of urban services)
- No other covariate relevant for the provision local urban services move abruptly at the FPM thresholds (for example, another source of local receipts)
- Municipalities have imprecise control over the running variable (the municipality population) (Lee and Lemieux, 2010)

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Data: Sources and sample definition

- FPM rule and municipalities' finance: *Secretaria do Tesouro Nacional* - Ministry of Finance
- The municipalities' population: Brazilian federal statistical agency, the IBGE (*Instituto Brasileiro de Geografia e Estatistica*)
- Urban services provision: Cadúnico, a federal dataset for low-income families (up to 3 minimum salaries), and RAIS (for transport services), a federal dataset on formal firms
- Period of analysis: 2013-2018
- Small municipalities: 1 to 7 thresholds (Municipalities up to 50,760 inhabitants) or about 3,200 municipalities (56.5% of the total)

Results: Impact of FPM on receipts and expenditures

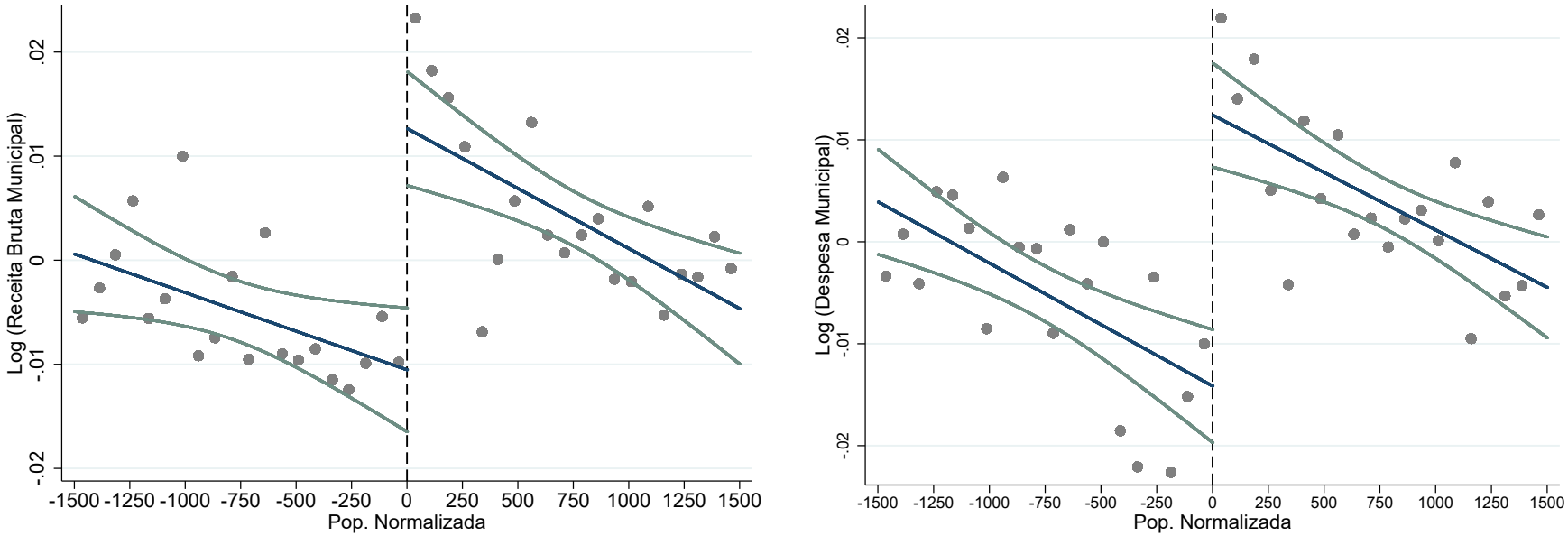

Figure: 4 - FPM impacts on Receipts and Expenditures (1-7 thresholds)

Results: FPM and expenditures on urban services

Table: 4 - The effect of FPM on municipalities' expenditures on urban services and other categories

		Neighborhoods			
	100%	<5%	<3%	<5%	<3%
Urban services	0.431***	0.515**	0.373*	0.633***	0.567***
	(0.159)	(0.205)	(0.202)	(0.213)	(0.205)
Pub. Adm.	0.412***	0.438***	0.491***	0.430***	0.417***
	(0.0745)	(0.0926)	(0.104)	(0.104)	(0.122)
Education	0.162***	0.113**	0.117***	0.143***	0.166***
	(0.0306)	(0.0464)	(0.0423)	(0.0535)	(0.0458)
Health	0.206***	0.246***	0.249***	0.250***	0.231***
	(0.0516)	(0.0552)	(0.0729)	(0.0655)	(0.0819)
Others	0.335***	0.313***	0.212***	0.268***	0.201**
	(0.0689)	(0.0723)	(0.0762)	(0.0738)	(0.0876)
1st order polynomial	No	No	No	Yes	Yes

Results: FPM and urban services

Table: 5 - The effect of FPM on urban services

	Neighborhoods				
	100%	<5%	<3%	<5%	<3%
	(1)	(2)	(3)	(4)	(5)
Street paving	0.0911	0.0518	0.0340	0.0571	0.0343
	(0.0748)	(0.0616)	(0.0704)	(0.0699)	(0.0856)
Garbage collection	0.163***	0.114**	0.110**	0.0387	0.0573
	(0.0418)	(0.0451)	(0.0502)	(0.0458)	(0.0551)
Public transport	0.250	0.275	0.178	0.345*	0.313
	(0.159)	(0.171)	(0.188)	(0.192)	(0.216)
Water supply	0.131***	0.118***	0.111**	0.107*	**0.148****
	(0.0402)	(0.0423)	(0.0487)	(0.0505)	(0.0670)
Sewage network	0.0629	0.231**	0.162	0.166	0.116
	(0.109)	(0.110)	(0.105)	(0.112)	(0.110)
N	18,394	5,185	2,877	5,185	2,877
1st order polynomial	No	No	No	Yes	Yes

Results: Regional heterogeneity may matter...

Figure: 5 - Receipts by regions and sources

Results: Regional heterogeneity may matter...

- Receipts
  - The Northern and Northeastern municipalities' receipts amount to less than 70% of that of Southern municipalities
  - FPM transfers amount to about 27% of receipts in the Northeastern municipalities, but about 18% in the Southern ones
  - On the other hand, local taxes correspond to only 7% of receipts in the Northeastern municipalities, but about 17% in the Southern ones

Results: Effects of FPM by regions

Table: 6 - The impact of FPM on the Municipalities' Expenditures - Brazilian regions

		Neighborhoods			
	100%	<5%	<3%	<5%	<3%
	(1)	(2)	(3)	(4)	(5)
			Total Expenditure		
Northeast	0.292***	0.300***	0.226***	0.295***	0.214***
	(0.0455)	(0.0526)	(0.0614)	(0.0559)	(0.0616)
Southeast	0.220***	0.219***	0.297***	0.276***	0.332***
	(0.0451)	(0.0593)	(0.0644)	(0.0618)	(0.0663)
South	0.331***	0.279***	0.255***	0.291***	0.254***
	(0.0488)	(0.0517)	(0.0570)	(0.0536)	(0.0556)
			Urban services		
Northeast	0.218	0.369	0.242	0.522	0.448
	(0.270)	(0.343)	(0.362)	(0.316)	(0.345)
Southeast	0.0790	-0.00889	0.110	0.172	0.207
	(0.227)	(0.258)	(0.281)	(0.277)	(0.317)
South	0.522	1.114**	1.000***	1.424**	1.391***
	(0.341)	(0.442)	(0.361)	(0.560)	(0.456)
1st order polynomial	No	No	No	Yes	Yes

Results: Effects of FPM on urban services by regions

Table: The Impact of FPM on Municipalities' Urban Services - **Southeast**

			Neighborhoods		
	100%	<5%	<3%	<5%	<3%
	(1)	(2)	(3)	(4)	(5)
			Southeast		
Street paving	0.307***	0.235**	0.265**	0.124	0.180
	(0.110)	(0.0940)	(0.112)	(0.104)	(0.113)
Garbage collection	0.141	0.152*	0.196**	0.0743	0.138
	(0.0894)	(0.0785)	(0.0913)	(0.0782)	(0.0881)
Public transport	-0.130	0.164	0.206	0.242	0.102
	(0.341)	(0.380)	(0.429)	(0.375)	(0.405)
Water supply	0.161*	0.180**	0.218**	0.0808	0.143*
	(0.0907)	(0.0786)	(0.0867)	(0.0778)	(0.0842)
Sewage network	0.259**	0.204	0.301***	0.140	0.288**
	(0.130)	(0.133)	(0.107)	(0.146)	(0.117)
1st order polynomial	No	No	No	Yes	Yes

Results: Effects of FPM on urban services by regions

Table: The Impact of FPM on Municipalities' Urban Services - **Northeast**

	Neighborhoods				
	100%	<5%	<3%	<5%	<3%
	(1)	(2)	(3)	(4)	(5)
Street paving	-0.00271	-0.0146	-0.0301	-0.0661	-0.121
	(0.0477)	(0.0620)	(0.0783)	(0.0776)	(0.101)
Garbage collection	0.130**	0.0762	0.0743	-0.0333	-0.0135
	(0.0574)	(0.0710)	(0.0720)	(0.0739)	(0.0833)
Public transport	0.139	0.210	0.285	0.174	0.443
	(0.126)	(0.150)	(0.199)	(0.207)	(0.281)
Water supply	0.0529	0.0670	0.0757	0.00574	0.0225
	(0.0450)	(0.0504)	(0.0587)	(0.0565)	(0.0666)
Sewage network	0.0930	0.167	0.00109	0.239*	0.0607
	(0.139)	(0.139)	(0.146)	(0.141)	(0.167)
1st order polynomial	No	No	No	Yes	Yes

Results: Effects of FPM on urban services by regions

Table: The Impact of FPM on Municipalities' Urban Services - **South**

		Neighborhoods			
	100%	<5%	<3%	<5%	<3%
	(1)	(2)	(3)	(4)	(5)
Street paving	0.282	0.161	-0.0750	0.0786	0.0219
	(0.194)	(0.195)	(0.223)	(0.213)	(0.270)
Garbage collection	0.439***	0.363***	0.291**	0.264**	0.300**
	(0.107)	(0.127)	(0.145)	(0.121)	(0.138)
Public transport	0.678	0.612	0.678	0.747	1.156*
	(0.555)	(0.558)	(0.550)	(0.650)	(0.663)
Water supply	0.454***	0.403***	0.300**	0.284**	0.284**
	(0.111)	(0.127)	(0.142)	(0.123)	(0.138)
Sewage network	0.265	0.496	0.220	0.335	0.178
	(0.421)	(0.456)	(0.403)	(0.405)	(0.362)
1st order polynomial	No	No	No	Yes	Yes

Concluding remarks

- In general, we observed only a limited impact of FPM on the provision of urban services in Brazilian small municipalities, specifically associated with the water supply
- Regional heterogeneity matters: this result is explained by the effects of the FPM in the municipalities of the southern region
  - The highest per capita revenues
  - The least dependent on FPM resources
  - The highest revenue and weight of local taxes
- This suggests at least two explanations (not mutually exclusive)
  - Limited revenue in the poorest municipalities, exacerbated by mandatory minimum expenditure on education and health
  - Greater local tax dependency and less social inequality in the South: more social control and less corruption and inefficiency