NBER WORKING PAPER SERIES

REGIONAL TRANSFERS

Raphael Corbi
Elias Papaioannou
Paolo Surico

Working Paper 20751
http://www.nber.org/papers/w20751

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2014, Revised March 2017

This paper supersedes NBER WP No. 20751 "Federal Transfer Multipliers: Quasi-Experimental Evidence from Brazil". For useful comments, we thank Daron Acemoglu, Josh Angrist, Sascha Becker, Markus Brueckner, Antonio Ciccone, Giancarlo Corsetti, Emmanuel Farhi, Manolis Galenianos, Pierre-Olivier Gourinchas, Sebnem Kalemli-Ozcan, Rick Mishkin, Emi Nakamura, Jonathan Parker, Danny Shoag, Alp Simsek, Jon Steinnson, Guido Tabellini, Ivan Werning, Pierre Yared, Katia Zhuravskaya, Guido Imbens, Carlos Viana de Carvalho and participants at many conferences and seminars. Corbi and Surico gratefully acknowledge financial support from the Newton Advanced Fellowship Scheme (award AF160119) and the European Research Council (Agreements 263429 and 647049). The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Regional Transfers
Raphael Corbi, Elias Papaioannou, and Paolo Surico
NBER Working Paper No. 20751
December 2014, Revised March 2017
JEL No. E32,E62

ABSTRACT

We exploit a series of discontinuities, at several population thresholds, in the allocation mechanism of federal transfers to municipal governments in Brazil to identify the causal effect of municipal spending on local labor markets, using a 'fuzzy' regression discontinuity design. Our estimates imply a cost per job of about 8; 000 US dollars per year, mostly driven by employment in services, and a local income multiplier of around two. A currency union model with nominal rigidities and liquidity constraints implies that the stimulative effects would have been substantially smaller if local government spending was financed by local tax revenues rather than regional transfers.

Raphael Corbi
London Business School, Economics
Regent's Park, Sussex Place
London, NW1 4SA, United Kingdom
rcorbi.phd2008@london.edu

Paolo Surico
London Business School
Regent's Park
NW1 4SA
London (United Kingdom)
psurico@london.edu

Elias Papaioannou
London Business School
Regent's Park
Sussex Place
London NW1 4SA
United Kingdom
papaioannou.elias@gmail.com

1 Introduction

The ongoing political crisis in the Euro-area has brought the design of fiscal policy to the front stage of the public debate, generating renewed interest in policy and academic circles on the role of regional transfers in large currency unions (Farhi and Werning, 2016, Nakamura and Steinsson, 2014). This debate goes back to the early contributions of Robert Mundell (1961, 1973) and Peter Kennen (1971). Besides important theoretical issues, there is limited applied research quantifying the impact of regional transfers on local economies inside a currency union.[1]

In this paper we examine the impact of transfers-driven municipal expenditure on local labor markets in Brazil, where municipal receipts of federal transfers change abruptly at numerous pre-determined population thresholds, allowing for a 'fuzzy' Regression Discontinuity Design (RDD). While municipalities belonging to the same population bracket receive the same amount of transfers in a given year and state from the federal government, municipalities with a few inhabitants above (below) the upper (lower) bound of each bracket receive, on average, 20% more (less). Hence, population fluctuations around the legislated cutoffs provide locally exogenous variation to identify the causal effects of externally-financed municipal government spending on economic activity. Our analysis exploits variation from more than $3,000$ municipalities over the period $1999-2014$ using high-quality microdata covering the bulk of private and municipal public sector employment contracts. The focus on numerous small geographical units over time allows controlling for time-invariant municipal factors, related to geography, history, local cultural and institutional features, and for country-wide and state trends, related to monetary policy, federal fiscal policy, and business cycles. This contrasts favorably with empirical studies on government spending at the national level, where aggregate confounding factors are harder to net out. The focus on regional transfers allows us to draw a distinction between external and internal sources of public finance, a critical issue for policy making (see Ramey (2016) and Chodorow-Reich (2016)). In this regard, we calibrate Farhi and Werning (2016) currency union model with regional trade, nominal rigidities, and liquidity constraints and contrast our fuzzy-RD estimates to the counterfactual that would have emerged if municipal spending was funded by local tax revenues rather than regional transfers, as in our set up.

[1] Chodorow-Reich (2017) summarizes some recent empirical studies that we discuss below.

Results Preview. Our analysis yields five main findings. First, changes in local government expenditure stemming from 'locally' exogenous shifts in federal transfers are associated with a significant boost in local private and public sector employment. A USD $30,000$ increase in municipal spending is associated with an extra job in the local public sector and three extra jobs in the private sector, implying a cost per job of about $7,500-8,000$ USD per year. Second, the effect on wages in muted; pre-existing employees in the public sector experience a modest pay rise, whereas compensation per worker in the private sector is not affected. Third, most of the private sector employment response comes from services, a result in line with theoretical works stressing the stimulative effects of local spending and regional transfers on non-tradeables (e.g., Farhi and Werning, 2016). Fourth, a simple production function mapping of the fuzzy-RD employment effects into income yields local income multipliers in the range of 1.6 to 2.4 (Chodorow-Reich, 2016). Fifth, our counterfactual simulations using a workhorse New-Keynesian currency-union model predict that the estimated multiplier would have been between 0.8 and 1.4 if local government spending was financed instead by local tax revenues. Sixth, the effects of regional transfers are somewhat larger in more developed Southern states and in smaller municipalities.

Related Literature. Our work is related to the recent literature that examines the impact of government spending on local economic outcomes by exploiting cross-sectional variation.[2] Nakamura and Steinsson (2014) interact state-level military procurement and spending with country-level changes in military build-ups to identify the impact of fiscal shocks on state output. Shoag (2013) uses variation in the idiosyncratic component of U.S. states' portfolio of defined-benefit pension plan asset returns as an 'instrument' for local spending. Serrato and Wingender (2016) exploit federal spending reallocations across U.S. counties driven by unanticipated revisions to local population estimates to identify the effects of county-level government spending. These studies report local multipliers over the post-WWII period in the range of 1.4 to 2.6. Clemens and Miran (2012) find however subnational government spending multipliers below one; Fishback and Kachanovskaya (2010) and Fishback and Cullen (2013) also find much lower multipliers for the post-Great Depression spending across U.S. states and for WWII military purchases across U.S. counties, respec-

[2]See Chodorow-Reich (2017) for an overview of geographic cross-sectional multipliers. Ramey (2013, 2016) reviews the broader literature that quantifies the aggregate effects of fiscal policy.

tively.[3] Becker, Egger and von Ehrlich (2010, 2013) examine the medium-run growth effects of EU structural fund grants, documenting positive but quite heterogeneous effects.

We share with these recent studies the geographic cross-sectional approach and the effort to push on causation via exploiting some form of "quasi-random" variation. Our first contribution is to provide evidence on the impact of local fiscal policy in a large emerging market against the backdrop of an empirical literature dominated by estimates for the United States and some other advanced economies, like Italy and Japan (Notable exceptions are the cross-country works of Kraay, 2012, 2014).[4] Moreover, we examine the impact of direct transfers from the federal government to localities rather than swings on local spending from an exogenous shock, like military buildup or higher stock returns. Second, building on advances in labor economics (Angrist and Lavy, 2001; van der Klaauw, 2002; Hahn, Todd and Van der Klaauw, 2001) we apply a new in applied macroeconomics 'fuzzy' regression discontinuity approach to identify the effects of local fiscal policy.[5] In this regard our work connects with empirical works in political economy that examine the effect of federal transfers in Brazil on various political outcomes applying RD methods (Ferraz and Finan, 2010; Brollo, Nannicini, Perotti and Tabellini, 2013; Litschig and Morrison, 2013, Gadenne, 2016). Third, we nest our RD estimates in a canonical currency union model to approximate the impact of municipal spending if it was funded via local taxes rather than outside (federal in our application) transfers. This is important both because it allows quantifying the impact of regional transfers in currency unions against a reasonable counterfactual and because it connects the paper's results to the broader literature on the effects of government spending on aggregate economic activity (Farhi and Werning, 2016; Ramey, 2016).

Structure The paper is organized as follows. In the next section, we present the institutional framework behind the allocation of regional transfers from the federal government to Brazilian municipalities and discuss the main data. In Section 3 we present the fuzzy-RD

[3] As for recent government interventions, Feyrer and Sacerdote (2012) use state variation in the seniority of the U.S. Congressmen as an 'instrument' for local government expenditure. Chodorow-Reich, Feiveson, Liscow and Woolston (2012) exploit pre-crisis variation on Medicare/Medicaid allocations to identify the effects of the 2009 American Recovery and Reinvestment Act (ARRA) on employment.

[4] Acconcia, Corsetti and Simonelli (2014) exploit cuts in public spending triggered by the dismissal of Italian province governments suspected of mafia infiltration. Porcelli and Trezzi (2014) use variation on public reconstruction activity across Italian municipalities after an earthquake. Bruckner and Tuladhar (2014) exploit geographical variation within Japanese prefectures.

[5] See Fuchs-Schundeln and Hassan (2016) for an overview of works exploiting natural experiments in business cycle and growth research.

framework and discuss the identifying assumptions. In Section 4 we examine the impact of federal transfers on employment and wages in the municipal public sector. Section 5 reports the baseline results linking private sector employment and mean wages with regional transfers. First, we present the fuzzy-RD local estimates. Second, we approximate the cost per job and associated employment multipliers for the local economy. Third, we map the employment multiplier into an income multiplier using a simple, intuitive production function framework (Chodorow-Reich, 2017). Fourth, we present counterfactual simulations of the impact of local government expenditure under alternative funding, using a New-Keynesian currency-union model with nominal rigidities and financial constraints (Farhi and Werning, 2006). In Section 6 we examine the effects of local spending on employment and average wages in agriculture, manufacturing, and services. In Section 7 we explore heterogeneity across regions and city size and present various sensitivity checks. Section 8 concludes.

2 Institutional Framework and Data

2.1 The FPM Transfers Scheme

The Federative Republic of Brazil is organized at three levels of government: the federal union, 26 states and 1 federal district, and 5,565 municipalities. The executive and legislative powers are organized independently at all three levels, while the judiciary is organized at the federal and state level. Municipal governments are managed by an elected mayor (Prefeito) and an elected council (Camara dos Vereadores), which are in charge of a significant portion of public goods provision, related to education, health, and small-scale infrastructure.[6] Brazilian municipalities have limited ability to raise taxes, which on average correspond to only 6% of total revenues in our sample of municipalities with less than 50,000 inhabitants. Municipalities are highly dependent on transfers from the states and the federal government. A major role is played by an automatic federal fiscal transfer scheme - the Fundo de Participação dos Municipios (FPM). FPM is the largest program of transfers to municipalities accounting for almost 80% of all types of federal transfers and 31% of municipal revenues. FPM transferred R29.5 billion Brazilian Reais (US14.8 billion in current prices) from the

[6]For size and administrative organization, Brazilian municipalities are akin to U.S. counties.

national government to municipalities in 2006, the middle year of our sample.[7] The pool of resources for the FPM fund amounts to 22.5% of total revenues raised through the federal income tax and the industrial products tax.

The FPM was introduced in 1965 as a constitutional amendment by the military government to distribute resources in an orderly and transparent fashion (and weaken local political elites). The allocation mechanism was shaped by subsequent legislation in 1981 (decree 1881) and was rectified by the Federal Constitution of 1988 (Art. 159 Ib). Since then, there have been no changes.

In each year, FPM funds are allocated to municipalities according to a predetermined mechanism that relies on local population estimates and the state which the municipality belongs to. First, a fixed share of total FPM funds is assigned to each of the 26 states. Second, each municipality is assigned a coefficient depending on pre-specified population brackets. Let FPM_i^k be the federal transfers received by municipality i in state k in a given year. The allocation mechanism is:

$$FPM_i^k = FPM^k \frac{\lambda^i}{\sum_{i \epsilon k} \lambda^i}$$

where FPM^k is the amount of (fixed) resources allocated to state k.[8] λ_i is the FPM coefficient of municipality i based on its population. The fraction $\frac{\lambda^i}{\sum_{i \epsilon k} \lambda^i}$ is simply the share of FPM^k that goes to municipality i in state k in a given year. Figure 1 plots FPM coefficients across the various population brackets. The width of the population brackets is $3,396$ inhabitants for the three first cutoffs ($10,188$, $13,584$, and $16,980$) and it doubles to $6,792$ people for cities larger than $16,981$ residents.

There are two interesting features of the FPM allocation mechanism. First, municipalities in the same bracket (in a given year and state) should get the exact same amount of transfers, independently of the exact number of inhabitants. Second - and most importantly for our identification - federal transfers change discontinuously at the cutoffs. For instance, the population of *Anita Garibaldi*, a municipality in the southern state of *Santa Catarina*, fluctuated between $9,991$ and $10,193$ during $2002 - 2007$. The population increased by only 13

[7] In comparison, Bolsa Familia, the largest conditional cash transfer program in the world targeting low-income households, distributed R$8.2 billion in 2006 prices (US4.1 billion in 2016 prices).

[8] The state shares of FPM transfers (reported in Appendix Table 1) are based on population/output per capita in 1991 and have not been altered ever since. The FPM formula applies to all municipalities with population less than approximately 150 thousand inhabitants that are not state capitals.

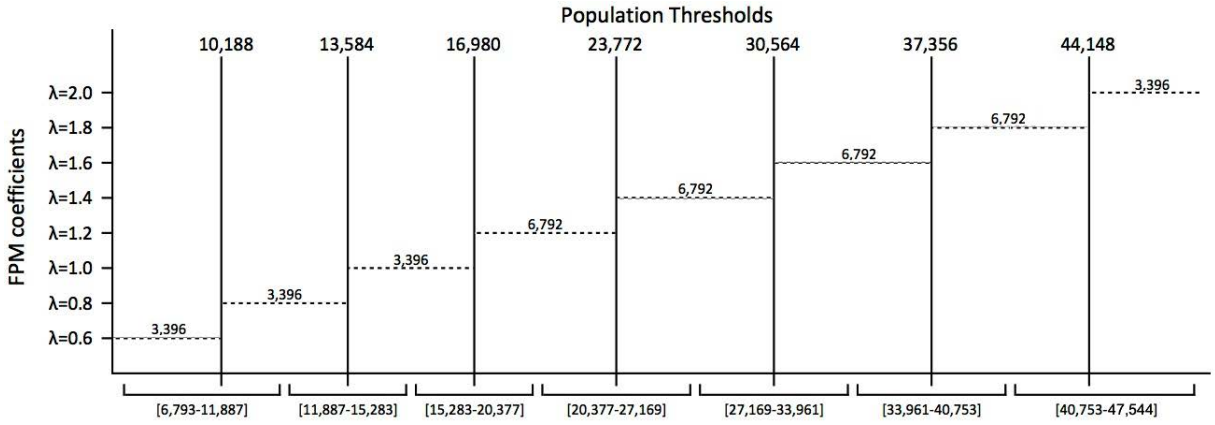


Figure 1: FPM Coefficients and Population Brackets

inhabitants between 2002 and 2003 (from 10,180 to 10,193). As population crossed the first threshold (10,188) the FPM coefficient increased from 0.6 to 0.8 and so did transfers from $R\$1,204,762$ in 2002 to $R\$1,324,306$ in 2003. The population in 2004 fell by 38 inhabitants to 10,155. Since it crossed back the first cutoff, FPM transfers dropped to $R\$1,098,906$. *Nova Trento*, another municipality in the same state of similar size, also experienced a small increase in population from 9,943 to 10,006. As it did not cross the threshold, FPM transfers fell from $R\$1,204,762$ to $R\$1,111,936$, as in 2003 there was a brief recession due to political turmoil caused by the national election that lowered the size of FPM program.[9]

The FPM coefficients are based on yearly population estimates produced by the federal statistical agency, IBGE - Instituto Brasileiro de Geografia e Estatistica (Brazilian Institute of Geography and Statistics) - and supervised by a federal court. IBGE calculates municipal population for non-census years taking into consideration past censuses, regional birth and death rates, migration trends and other features using a publicly known methodology.[10] Figure 2 describes the time-line of the allocation. Population estimates for year $t-1$ are announced by October 31^{st} . On this basis the Federal Budget Court publishes the FPM coefficients for all municipalities. Then local authorities form the budget for fiscal year t. The budget is approved by municipal councils by the end of the year and FPM funds are transferred during year t.

[9]In the Appendix we exemplify the non-linear allocation mechanism of federal transfers discussing four additional examples. All monetary values throughout the paper are in Brazilian Reais (BRL) in constant prices of 1998. At the time of writing that is equivalent to 3.2 BRL or $US\$1$ in current prices.

[10]See IBGE website. http://www.ibge.gov.br/home/estatistica/populacao/estimativa_pop.shtm

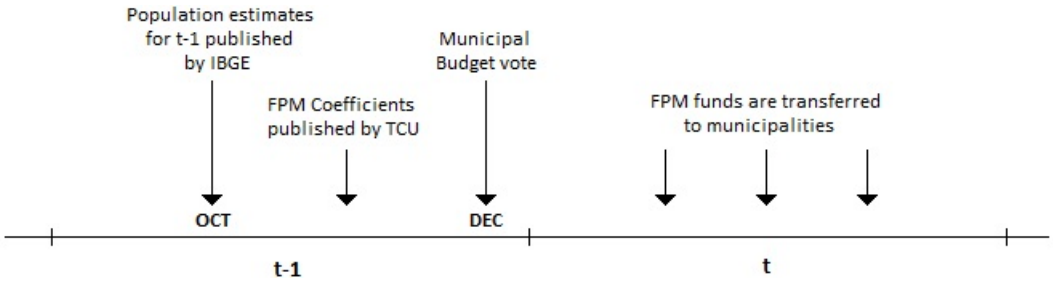


Figure 2: FPM Allocation Timelines

2.2 Grouping municipalities around the discontinuities

As the number of municipalities falls with population (Appendix Table 2) and because reliance on federal transfers is smaller for larger cities, we follow Brollo, Nannicini, Perotti and Tabellini (2013) and focus on cities around the thresholds $1-7$, thereby examining the effect of federal transfers on the local economy for municipalities with a population between $6,793$ and $47,544$. This results into an unbalanced panel of $43,466$ observations, covering $3,279$ municipalities over $1999-2014$. Our sample covers 60% of Brazilian municipalities, accounting for 28% of Brazilian population, which was close to 175 (202) million in 2000 (2014). Since we have numerous discontinuities, each municipality-year observation is assigned to the nearest population cutoff. We construct seven population intervals centered on each discontinuity (Figure 1). The intervals are $[6,793\text{-}11,887]$, $[11,887\text{-}15,283]$, $[15,283\text{-}20,377]$, $[20,377\text{-}27,169]$, $[27,169\text{-}33,961]$, $[33,961\text{-}40,753]$ and $[40,753\text{-}47,544]$. Appendix Table 2 reports the number of observations (municipality-years) grouped by whether they are above or below each of the seven thresholds.

Table 1 illustrates the richness of the experiment. Panel A shows that $1,410$ of the $3,279$ municipalities (43%) did not change population bracket in any given year. $1,087$ municipalities experience only positive jumps (33%), 93 cities experienced movements only to a lower population bracket (3%) and 689 municipalities (21%) experienced at least one positive and one negative jump. As we focus on the neighborhood around the seven cutoffs, in Appendix Table 3 we tabulate similar statistics narrowing the sample in a 4%-population-bandwidth around each cutoff. Around one-third of the municipalities in our 'local' sample fluctuates around the cutoffs without crossing them (705 of $2,305$), while two-thirds move to a higher or lower FPM population interval or both.

Table 1 - Panels B and C report the number of municipalities that remain in the same

population bracket or move across brackets by year and by cutoff, respectively. Almost all movements are either to the immediately higher (+1) or immediately lower (−1) population brackets. The larger number of positive jumps should not come as a surprise, as during the sample period Brazil experienced considerable population growth (1.1% per annum on average). Most of the upward or downward jumps regard cities falling within thresholds $1-4$ (up to $27,169$). There are fewer movements around thresholds 5, 6, and 7; yet the number of jumps in any population bracket relative to the number of observations is roughly constant.

2.3 Data and Summary Statistics

Municipal public finances are retrieved from the FINBRA database and FPM transfers from the National Treasury.[11] Population estimates are provided by the IBGE. Our main source for local labor market outcomes (income and employment) is the *Relação Anual de Informações Sociais* (RAIS), spanning over $1999-2014$.[12] This is an administrative dataset assembled yearly by the Brazilian Ministry of Labor. Effectively, this is a high-quality census of the Brazilian formal labor market that contains detailed contractual information on 26.2 million workers of a universe of 27.6 million in 2000, according to the census, and on all 2.2 million registered firms (De Negri *et al.*, 2001; Saboia and Tolipan, 1985; Amorim *et al*, 2006). We aggregate earnings and employment information at the municipal level separately by private or public sector (local government only), and according to job tenure and sector of the economy. Providing accurate information in RAIS is required for workers to receive payments from government benefit programs and firms face fines for failing to report.[13]

In Table 2 - Panel *A*, we report summary statistics for population, municipal public finance and local expenditure. For income per capita only, we present average values (retrieved from

[11] Municipal public finance and FPM transfers data are available from the Ministry of Finance, at *http://www.tesouro.fazenda.gov.br/pt_PT/contas-anuais*

[12] While data on municipal GDP are available at yearly frequency from IBGE over our sample period (see Corbi, Papaioannou and Surico, 2014), they are not observed but estimated based on past surveys and censuses. This makes the use of municipal GDP as measure of local economic activity unattractive for our purpose for two reasons. First, it does not capture yearly changes in the sectorial structure of local economies, keeping the share of each industry constant across years, which is particularly worrysome in a set up that exploits within-variation. Second, these historical data are also used to calculate the population estimates and would introduce a mechanical link between the running variable (population) and the outcomes.

[13] RAIS covers nearly all formally employed workers with a signed work-card, providing access to benefits and offering legal labor protection rights. It omits interns, in-house workers and other minor employment categories. Self-employed and independent professionals recruiting employees are also included (Dix-Carneiro and Kovak, 2015b). These data have been used by Dix-Carneiro (2014), Helpman, Itskhoki, Muendler and Redding (2017), Krishna *et al.* (2014), Lopes de Melo (2013), and Menezes-Filho and Muendler (2011).

the Census) for the year 2000: these increase with population and amount to an overall average around 1,900 Brazilian Reais (constant 1998 prices).[14] For the same year, income per capita at the national level was BRL 3,600.[15] FPM transfers is the most important source of funds for the municipalities in our sample, accounting for 31% of revenues. Other important sources are state-level transfers and federal transfers (net of FPM), which account for 23% and 14%, respectively. Local taxes revenues account for 6%. Turning to spending, the main categories are Local Administration (16%), Education (33%), Health (22%) and Housing & Urban Infrastructure (9%). There are institutional constraints preventing municipalities for borrowing and overspending, so local governments virtually run balanced budgets.[16]

In Table 2 - Panel B, we record total earnings in the municipal sector for pre-existing and newly-hired employees. 'New-hires' (recruited in current year) account for 16% of total earnings in the municipal sector and 'old-hires' (at least 1 year tenure) account for 84%. Panel B also gives municipal earnings in agriculture, manufacturing, and services. Earnings in agriculture account for 12% of total private sector earnings. Manufacturing and services account each for 44%. Table 2-Panel C and D report the corresponding statistics for employment and average wages.

3 Identification

In this section we first describe the fuzzy regression discontinuity design that allows us to isolate the effect of municipality spending driven by regional transfers on local labor markets outcomes. Then we discuss and present supportive evidence of the identifying assumptions.

[14] While municipal GDP is available at yearly frequency from IBGE (see Corbi, Papaioannou and Surico, 2014), these data are not directly measured but estimated using historical surveys and censi. This is unattractive for our purpose for two main reasons. First, the construction of the municipal GDP estimates assume that the share of each industry in the local economy remains constant across years. This is particularly worrisome in a set up that exploits within-municipality variation. Second, these historical surveys and censis are also used to estimate municipal population, thereby introducing a mechanical link between the running variable (local population) and the potential outcome (local GDP).

[15] This disparity reflects bigger cities' higher income. For example, income per capita Sao Paulo and Rio de Janeiro, which account for almost 20% of the country's population, was around BRL 18,900 in 2013.

[16] More specifically, the median (average) surplus is only 0.1% (0.2%) of municipal GDP.

3.1 Empirical Framework: Fuzzy RD Design

3.1.1 Source of Exogenous Variation

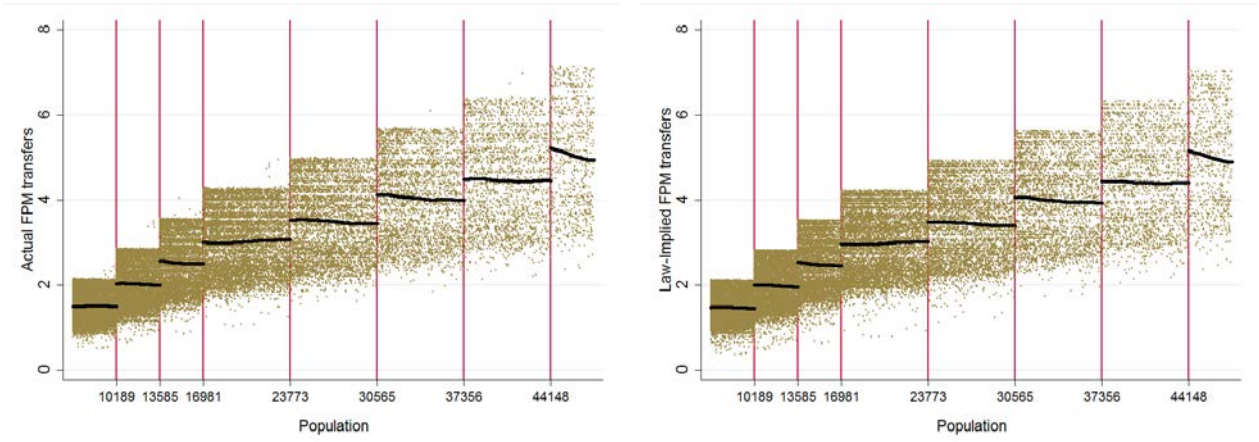
The allocation of FPM transfers to municipal governments is a non-linear function of population. While level and changes in population are likely to depend on local economic conditions and other hard-to-observe factors, federal transfers change abruptly at several pre-determined population thresholds. Hence population movements around the cutoffs can be used as a source of locally exogenous variation to estimate the causal effects of regional transfers on labor market outcomes in the neighborhood of thresholds (Angrist and Pischke, 2008). In Figure 3a, we plot actual FPM transfers against population. The solid (red) vertical lines represent the cutoffs of the FPM allocation mechanism (Figure 1). Small dots represent municipality-year observations. Thick (black) lines denote running-mean smoothing over population bins of 200 inhabitants. There are visible jumps when population crosses the FPM cutoffs. There is also considerable variability, as total FPM funds have grown over time and because of non-negligible differences in FPM funds across states.

Federal transfers are not shaped exclusively by the FPM allocation mechanism. This mis-assignment of funds has many causes, from simple misreporting to the fact that throughout the 1990s some municipalities split into two, but (temporarily) kept their former FPM coefficient through court disputes.[17] Figure 3b repeats 3a using this time law-implied FPM transfers instead of actual. Law-implied transfers are the exact amount each municipality would have received if the allocation mechanism was perfectly enforced; hence the sharper jumps at the seven FPM cutoffs.

3.1.2 Empirical Specifications

If actual FPM transfers are the only relevant factor that change discontinuously at the cutoffs, we can estimate the impact of locally exogenous movements of municipalities across population thresholds on labor market outcomes by running variants of the following specifications

[17] In the Appendix we discuss that in detail these small discrepancies.



(a) Actual Transfers

(b) Law-Implied Transfers

Figure 3: Actual and Law-Implied FPM Transfers around the cutoffs

in the neighborhood (h) of the seven cutoffs (c):

$$FS \quad : \quad T_{i,t} = f(P^c_{i,t-1}) + \gamma_{FS}\tilde{T}_{i,t} + \delta_i + \delta_{ct} + \delta_{st} + \varepsilon_{i,t} \tag{1}$$

$$RF \quad : \quad Y_{i,t} = f(P^c_{i,t-1}) + \gamma_{RF}\tilde{T}_{i,t} + \delta_i + \delta_{ct} + \delta_{st} + \varepsilon_{i,t} \tag{2}$$

$$\forall P_{i,t-1} \quad \in \quad [c(1-h), c(1+h)]; \; h\{4\%, 3\%, 2\%)$$

The first-stage (FS) specification associates actual FPM transfers ($T_{i,t}$) with law-implied FPM transfers ($\tilde{T}_{i,t}$). Under perfect assignment, the coefficient on law-implied transfers (γ_{FS}) should be one and the in-sample fit perfect ($R^2 = 1$). The reduced-form (RF) specification links labor market outcomes ($Y_{i,t}$) - total earnings, employment, and average wages - to law-implied transfers.

δ_{st} are state-year dummies that capture aggregate developments (national and state level) such as federal tax proceeds, common monetary policy, and regional business cycles. Their inclusion is necessary to account for upward trends in wages and earnings and for the increase in the total pot of FPM due to the growth of the Brazilian economy. Municipal fixed-effects δ_i account for time-invariant factors determining municipal fiscal policy and economic conditions, related to geography, ecology, culture, local institutional quality, corruption, etc.[18] The municipal constants also account for state-level differences on FPM shares. δ_{ct} are cutoff-

[18]Naritomi, Soares, and Assuncao (2012) show that there are sizeable differences across Brazilian municipalities on institutional quality that are related to the type of colonization and local geographic features.

year constants, accounting for different levels and trends of outcomes and transfers across municipalities of different size.

The RD-polynomial $f(P^c_{i,t-1})$ is defined on normalized population (the 'running' variable) and its inclusion accounts for how far/close municipalities are from the closest FPM cutoff (^{c}) in the previous year ($t-1$). Following Angrist and Lavy (1999), Hahn, Todd and Van der Klaauw (2001), van der Klaauw (2002), and subsequent works in a similar context to ours (e.g., Brollo, Nannicini, Tabellini, and Perotti (2013)), we combine the estimation of the first-stage and the reduced-form specifications in an Instrumental Variable (IV) set-up, which isolates the effects on local labor market conditions of locally exogenous changes in federal transfers, stemming from the enforceability of the law, close to the FPM cutoffs.[19] The fuzzy-RD model reads:

$$IV: Y_{i,t} = f(P^c_{i,t-1}) + \gamma_{IV}\hat{T}_{i,t} + \delta_i + \delta_{ct} + \delta_{st} + \varepsilon_{i,t}$$

$$\forall P_{i,t-1} \in [c(1-h), c(1+h)];\ h\{4\%, 3\%, 2\%)$$

$\hat{T}_{i,t}$ denotes the component or federal transfers implied by FPM's non-linear allocation mechanism) in each year.

We estimate two variants of this specification, which restrict estimation in the neighborhood of the seven cutoffs using three bandwidths (h = 4%, 3% and 2%).[20] First, we estimate simple OLS (reduced-form) and IV (fuzzy-RD) models without including any RD polynomials. This approach is transparent, simple and straightforward to implement (Angrist and Lavy, 1999). However, it may yield imprecise estimates, as the bandwidth narrows, and not account well for differences in population when the bandwidth is wide. Second, we estimate "local regressions" with a "rectangular kernel". These models include cutoff-specific linear RD polynomials on normalized population, allowing for different slopes of the "running variable" for municipalities below and above the discontinuities.[21]

[19] See Angrist *et al.* (2014), Hinnerich and Pettersson-Lidbom (2012, 2014), and Pettersson-Lidbom (2012).

[20] The use of relative size neighborhood as opposed to absolute is due to the fact that the number of municipalities decrease in population size. In order not to lose too many observations as we narrow the sample, we allow neighbourhoods to grow with population as in Litschig and Morrison (2012). For example, consider the first and fourth cutoff (10,188 and 23,772). A 2%-neighbourhood include 1,141 and 801 observations, respectively. If we were to use an absolute neighbourhoods of 200 inhabitants, we would have 1,139 and 360 observations, further decreasing the weight of larger municipalities.

[21] Imbens and Lemieux (2008) write "*from a practical point of view, one may just focus on the simple*

The simplicity of the FPM mechanism and the fact that transfers within a state and year depend only on population estimates render this setup ideal for our purpose.[22] Another attractive feature of the FPM law is the presence of many discontinuities. Thus our results are not subject to the usual critique of RDD estimates that, since the identified effects are local, they may not apply far from the discontinuity. It would seem of some interest to point it out that, unlike earlier contributions exploiting the allocation of federal resources across municipalities in Brazil to study other outcomes, our design makes the identification strategy particularly strong. By exploiting within-municipality variation, we account for unobserved features, something key as in a large and heterogeneous country, municipalities differ across many dimensions.

We report heteroskedasticity-robust standard errors clustered at the micro-region level, which the IBGE defines as "*groups of economically integrated municipalities sharing borders and structure of production*".[23] This approach accounts for residual auto-correlation and spatial spillovers across nearby municipalities with economic links. This adjustment yields more conservative estimates as standard errors are larger as compared to simply clustering at the municipality level or the state level.

3.2 Identifying Assumptions

Our RD design relies on four main identifying assumptions, which we discuss below.

3.2.1 Federal Transfers at the Discontinuities

A *sine qua non* requirement is that FPM transfers change when municipalities cross FPM population thresholds. While fuzzy-RD does not require that the law is perfectly enforced, there has to be some enforcement. This is akin to the 'strong first-stage-fit' assumption in classical two-stage least squares. Figure 4 plots actual FPM transfers averaged over 75

rectangular kernel, but verify the robustness of the results to different choices of bandwidth". Lee and Lemieux (2010) argue that it is "*more transparent to just estimate standard linear regressions (rectangular kernel) with a variety of bandwidths, instead of trying out different kernels corresponding to particular weighted regressions that are more difficult to interpret*". For completeness, however, we also report in the specifications using all observations (both far and close to discontinuities) and conditioning on high-order RD polynomials (as Brollo, Nannicini, Tabellini and Perotti, 2013), obtaining similar results (Appendix Table 16).

[22] Indeed, Eggers, Freier, Grembi and Nannicini (2016) argue that "*population-threshold RDD may be the best available research design for studying the effects of certain policies*".

[23] See IBGE (1990, page 10). Our sample comprises 547 micro-regions with an average of 21 micro-regions per state and 5 municipalities per micro-region.

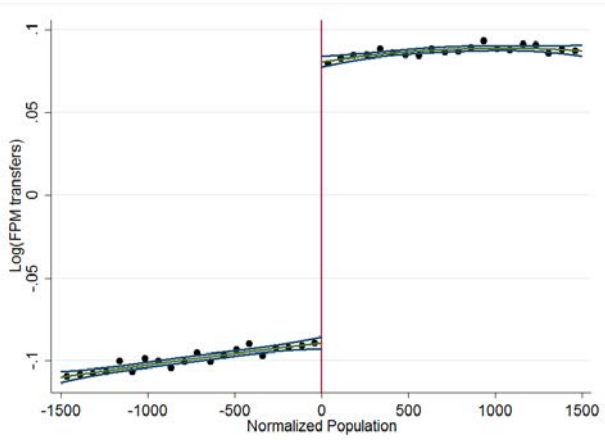


Figure 4: FPM Transfers around the cutoffs

inhabitants bins around the pooled cutoffs. There is clear evidence that the law shaping FPM transfers is enforced, though even with averaged-data there is evidence of mis-assignment.

In Table 3, we assess the link between actual and law-implied transfers. Panel A specifications include state and year dummies to account for the fixed state shares and time variation on the size of the FPM program that changes as the Brazilian economy and federal proceeds grow. We do not include municipality fixed-effects, as we want to examine how well the law shaping FPM allocations is enforced. Besides log specifications, we also report models in levels, exactly as dictated by the law.[24] The estimates in row (1) show that - in line with the allocation mechanism - there is an almost one-to-one relationship between law-implied and actual transfers. The coefficient remains stable as we narrow the bandwidth. The same applies when use the logarithm of actual and law-implied transfers (row (2)). We also estimate least-absolute deviation (median) regressions to account for outliers. The coefficient on law implied-transfers in row (3) is 1 and tightly estimated. The model-fit is not perfect, as the rules are not fully enforced (Figure 3a-3b and Figure 4). The marginal R^2 - once we net out state and year fixed effects - is around $0.83 - 0.92$. Since the specifications that link employment and wages to FPM transfers in Table 3-Panel B include municipality fixed-effects, we report fixed-effect estimates in levels and log levels. The pattern is similar, with the coefficient close to unity.[25]

[24] We thank Josh Angrist for making this clarifications and for advice on the technical aspects of the RDD.

[25] The same applies when we estimate the specifications in first-differences, though these models come with an efficiency loss (Appendix Table 5). The OLS and LAD specifications yield estimates of 1, while the log difference models yield somewhat attenuated elasticities of around 0.94. We also examined the link between

3.2.2 Municipal Government Revenues and Expenditure

A related necessary condition for identification is that municipal revenues and expenditure change abruptly at the cutoffs.

Table 4 - Panel *A* reports level and log-OLS estimates with municipality fixed-effects and LAD estimates without fixed-effects of law-implied FPM transfers on municipal revenues. Columns (2)-(4) estimates are reasonably stable and move closer to 1 as we narrow the bandwidth. When we add the 1^{st}-order RD polynomial in columns (5)-(7), the OLS estimates fall and become somewhat imprecise ($0.6-0.78$). LAD estimates that account for outliers remain in the range of $0.9-1.1$. Log-OLS results are also stable with point estimates not statistically different from the share of FPM in municipal revenues (0.31, Table 2). Figure 5a provides a graphical illustration of these estimates when we pool across all cutoffs. There is an evident jump of municipal revenues for municipalities on the right of the pooled discontinuities.

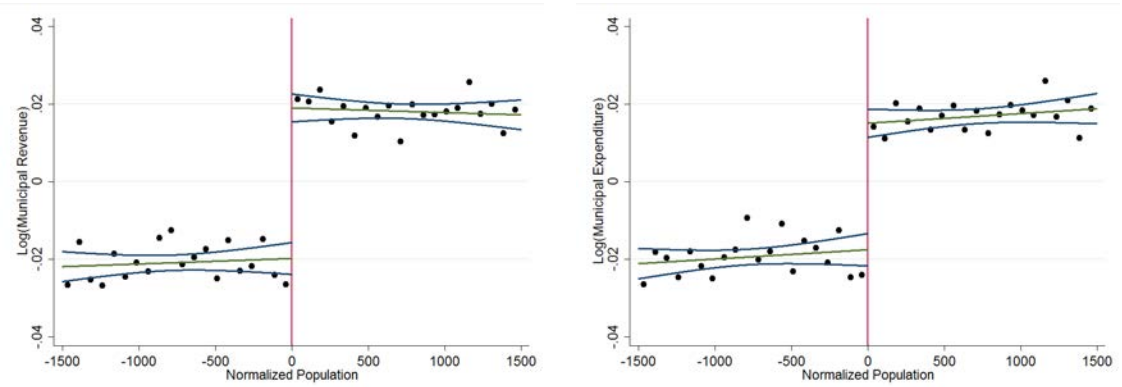
Table 4 - Panel *B* reports corresponding estimates for municipal expenditure. OLS and LAD estimates in columns (2)-(4) are close to 1. While the estimates fall when we add the cutoff-specific constants and linear polynomials, we cannot reject a coefficient of unity. Log-OLS estimates are around 0.30, close to the share of FPM transfers to municipal spending. Figure 5b plots average municipal expenditure below and above the pooled discontinuities. While relatively more noisy than FPM transfers, municipal spending visibly changes discontinuously across the cutoffs.[26]

3.2.3 Other Sources of Municipal Revenues around the FPM Thresholds

Another condition for identification is that, besides FPM transfers, no other relevant for labor markets covariates move abruptly at the FPM thresholds. All factors affecting employment, wages and total earnings should be continuous at the cutoffs (Imbens and Lemieux, 2008; Lee and Lemieux, 2010, 2014). This RD assumption is similar to the "exclusion restriction" in an IV setting requiring that the 'instrument' (law-implied FPM transfers around the cutoffs

actual FPM and law-implied FPM transfers across each of the seven cutoffs. There is a strong link across cutoffs (Appendix Table 6) and geographic regions (Appendix Table 24).

[26] We also examined how these estimates vary across each of the seven cutoffs separately (Appendix Tables 7 and 8): the discontinuities in the the FPM allocation mechanism affect transfers, revenues and expenditure across each cutoff. In Appendix Table 24, we show that the link between FPM/transfers and spending do not differ across broad geographic regions. In Appendix Table 9, we split total municipal spending into current wage, current non-wage, and capital expenditure. All types of expenditure jump when municipalities cross to higher FPM population intervals. In Appendix Table 10, we report estimates distinguishing between the main expenditure categories. All types of expenditure increase/fall, as cities cross FPM cutoffs.



(a) Municipal Revenues

(b) Municipal Expenditure

Figure 5: Municipal Revenues and Expenditure

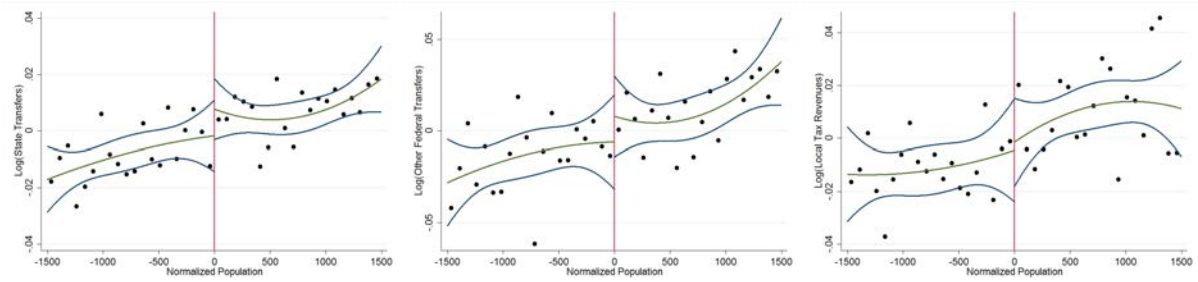
in our application) should affect the outcomes only via determining the endogenous variable (actual FPM transfers and associated municipal spending). While this assumption cannot be directly tested, there are many pieces of supportive evidence.

First, since our identification strategy explores within-municipality variation in transfers and labor market outcomes, concerns related to selection or that cities may differ systematically across geographic, institutional or other features (which apply to cross-sectional approaches) are not particularly severe.[27] Furthermore, Gadenne (2017) shows that municipalities moving to an adjacent FPM population bracket are similar to those that do not cross the cutoffs across many political economy features, such as the political alignment of the mayor and councillors to the federal government, political competition, and mayoral terms.

Second, to the best of our knowledge there is no other federal or state grant scheme that follows a similar to FPM discontinuous allocation mechanism.[28] One may worry that municipal governments gaining extra FPM funds may decide not to spend them. Likewise, municipalities that receive less FPM funds may obtain additional funding from the state or other federal transfer programs. These issues are, however, unlikely in our setting: municipalities run balanced budgets and their expenditure tightly adjusts to their revenues. In Table 5 we test whether FPM transfers correlate with state transfers, non-FPM federal transfers

[27] Brollo, Nannicini, Tabellini and Perotti (2013) provide cross-sectional evidence that municipalities just above and just below FPM thresholds do not differ on many time-invariant characteristics.

[28] After 2004 local councillors pay increases abruptly (by 50%) for municipalities with more than 10,000 inhabitants, a value close to the first threshold of 10,188. Ferraz and Finan (2011) show that the characteristics of councillors differ at this cutoff. We have thus verified that our findings are not sensitive to excluding observations centered on the initial cutoff. See Appendix Table 14.



(a) State Gov Transfer (b) Federal Gov Transfers (non-FPM) (c) Local Tax Revenues

Figure 6: Types of Municipal Revenues around the cutoffs

and local tax revenues close to the seven population cutoffs. Starting with the evolution of state-level government transfers in Panel A, the local regression estimates are small and statistically indistinguishable from zero. These patterns, which apply with OLS in levels and log-levels and LAD, show that state transfers do not vary systematically at the population cutoffs where FPM transfers change sharply. The picture is similar when we study the evolution of non-FPM federal transfers and local tax revenues around the FPM discontinuities in Panels B and C. The local regression estimates are small, change sign, and are all statistically indistinguishable from zero. Figures 6a-6c provide visualization of these patterns. There is no abrupt change at the FPM discontinuities.[29]

3.2.4 Precise Systematic Manipulation

RD design strategies rely on the assumption that if individuals (municipalities) have imprecise control over the running variable (population), this implies that variation in treatment status (i.e., be above or below the FPM cutoffs) will be randomized in a neighborhood of the threshold (Lee and Lemieux, 2010). If there is precise manipulation of population estimates *and* this correlates with the labor market outcome, then the estimates will not identify the causal effect of regional transfers. Although it is impossible to directly test such assumption, we comment here for brevity and report in the appendix three sets of exercises.

First, we examine whether the density of population and population changes are con-

[29]Local tax rates are not used as a stabilisation tool. Increasing local tax rates is politically costly for mayors and local legislatures (Oliveira-Junior, 2014). A federal law has been proposed recently to establish rules forcing municipalities to increase periodically their tax rates so to protect local mayors from public pressure to keep taxes low (Projeto de Lei do Senado (PLS) 46/2016). Smaller municipalities lack technical capacity to efficiently enforce such taxation. A national effort led by the Brazilian Development Bank has been introduced to help small municipalities modernize their tax system management (Gadenne, 2017).

tinuous at the cutoffs. While the Mc Grary density plots uncover some manipulation, it is restricted only to years when population censuses were conducted. So we re-run all specifications excluding census years and find almost identical results. Moreover, we estimate fuzzy-RD specifications focusing solely on municipality-years with either no movement across FPM intervals or falling into lower population intervals. Again the results are similar. We also estimate restrictive specifications that, on top of municipality fixed-effects, add municipality-term-specific mayoral constants so to account even more for unobservables. The results are again similar. Second, we perform a falsification test to check whether lagged 'treatment' variables (actual FPM, revenues and expenditure) vary abruptly at FPM cutoffs. We find that they do not, implying that municipalities narrowly above the FPM thresholds are not more likely to have been above or below the threshold in the previous year. Third, we conduct a placebo test in which all cutoffs are moved by 750 inhabitants, and examine whether the 'treatment' variables jump at the 'fake' discontinuities. In line with our identification strategy, there are no swings at the 'fake' cutoffs.

4 Employment and Wages in the Public Sector

We start our analysis by examining the responses of employment and wages in the municipal public sector to locally exogenous (at the FPM cutoffs) swings in regional transfers. This serves three purposes. First, it provides evidence on the composition of the municipal government expenditure on public sector wages and employment. Second, linking swings of federal transfers to municipalities with their spending patterns is interesting from a political economy standpoint. Third, it provides a benchmark against which, in the next section, we will evaluate the effects of regional transfers on private sector outcomes.

4.1 Baseline Effects

In Table 6, we report RD specifications that associate total municipal earnings, employment and wages to law-implied transfers. Since the 'first-stage' link between actual and law-implied FPM transfers is strong, with estimates statistically indistinguishable from one, we simply report OLS estimates in logs. IV ('fuzzy' RD) estimates are similar and thus we do not report them for brevity. Columns (2)-(4) record local linear regression coefficients that restrict estimation in the neighborhood of the seven discontinuities using progressively smaller

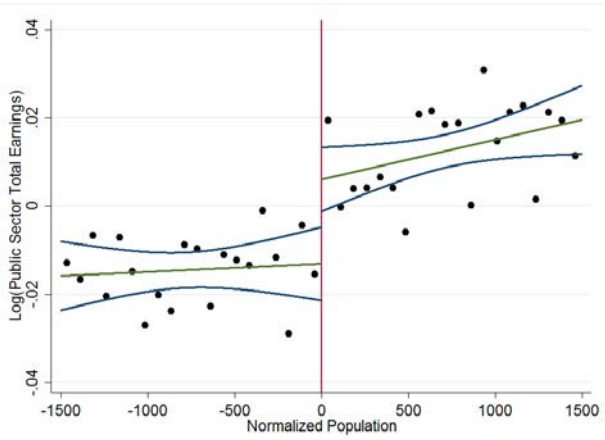


Figure 7: Total Earnings of Public Sector Employees around the cutoffs

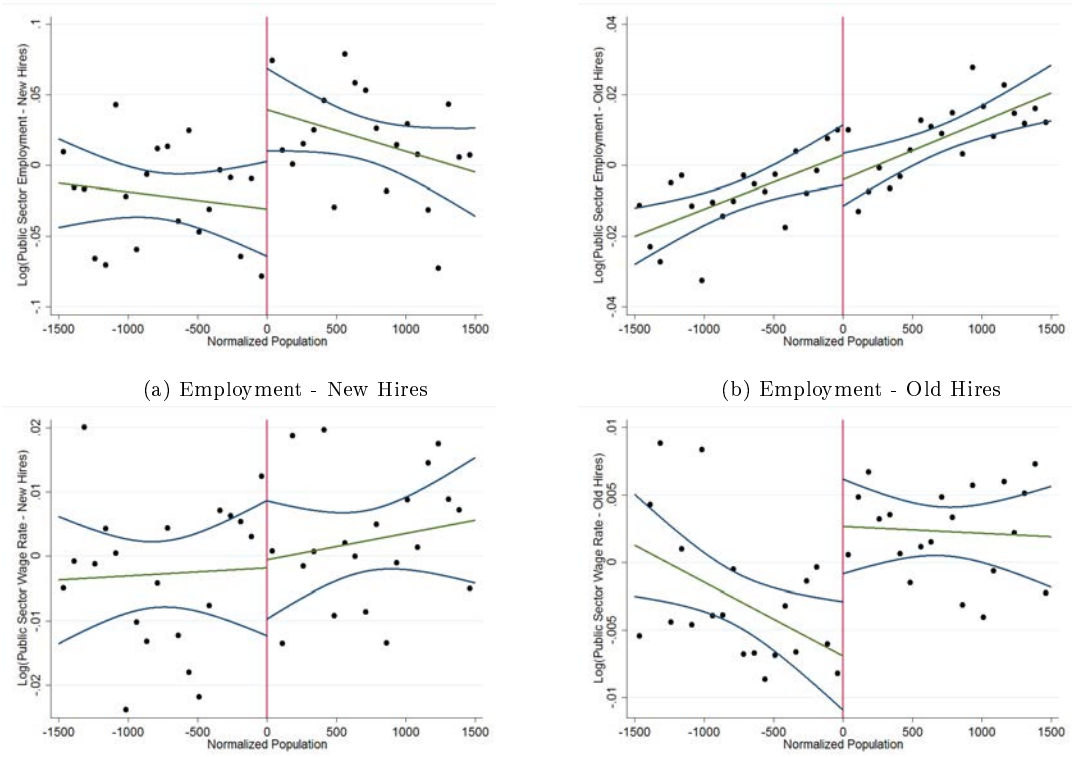
bandwidths (4%, 3% and 2%). Columns (5)-(7) display otherwise identical specifications including linear polynomials on population distance from the discontinuity, allowing for different slopes above and below cutoffs and cutoff-specific constants (rectangular kernel). For comparability, in column (1) we report full sample estimates (i.e. both close and far from the discontinuities).

Let us start with the specifications for total earnings of municipal public sector employees in row (1). The coefficient implies that a one-percentage-point increase in FPM transfers generate an extra $0.21\%-0.26\%$ increase in the total earnings of all municipal employees. The elasticity is stable across the various specifications.[30] Figure 7 gives a graphical illustration of the jump (fall) in the earnings of municipal (public-sector) employees when municipalities move to a higher (lower) FPM cutoff.[31]

We decompose total municipal earnings into employment and average wage per worker to examine whether local authorities recruit more people or whether they raise wages for existing municipal employees in response to changes in federal transfers. Rows (2)-(3) report the estimates. Swings in regional transfers close to the FPM discontinuities affect both municipal employment and the wage rate.

[30]These estimates are close to the ones in row (2) of Appendix Table 9, which reports the coefficient of law-implied FPM transfers on the total municipal wage bill. This is a non-trivial test as total earnings of municipal employees and the total wage bill of municipalities come from completely different datasets (RAIS - Ministry of Labor administrative dataset and FINBRA - Public Finance of Municipalities, respectively).

[31]The pattern is similar, though attenuated, using a model in first-differences (see Appendix Table 11).



(a) Employment - New Hires

(b) Employment - Old Hires

(c) Wage per worker - New Hires

(d) Wage per worker - Old Hires

Figure 8: Public Sector Employment and Wage Rate (New vs Old Hires)

4.2 New-hires *vs* Old-hires

We further explore the relationship between regional transfers and municipal sector employment and wages, distinguishing between 'new-hires' and 'old-hires' recruited in current or previous years. Panel *A* of Table 7 reports estimates focusing on 'old-hires' whereas Panel *B* refers to 'new-hires'. The elasticity of FPM transfers to total earnings is significantly positive for both groups of municipal employees. The increase in total earnings of pre-existing municipal employees, when cities jump to a higher FPM bracket, comes from higher average wages. The jump in total earnings of the newly-hired is reflected on higher employment. Local governments, on average, hire more people (at the same wage rate they hired workers in the previous years) and increase the wage of pre-existing employees when faced with an increase in federal transfers. Figures 8a-8d illustrate these patterns.[32]

[32]Similar results are obtained using an empirical model in first-differences (see Appendix Table 12).

5 Employment and Wages in the Private Sector

We first present the baseline fuzzy-RD estimates of the effects of regional transfers on the private sector. Second, we calculate the cost of a new private sector job. Third, using a simple accounting method we map the employment estimates into a local income multiplier. Fourth, we examine how the multiplier estimates change if local spending was self-financed (e.g. by local tax revenues) using a currency union model.

5.1 Baseline Effects

In Table 8 - Panel A we report 'reduced-form' estimates (equation (3)) linking total labor earnings, employment and average wage per employee with law-implied FPM transfers. Panel B records the corresponding fuzzy-RD estimates, which combine the reduced-form with the corresponding first-stage estimates associating actual with law-implied FPM transfers (Table 3-Panel B, row (2)).

The elasticity between law-implied transfers and total private sector earnings is around 0.15 across the various specifications. Since the first-stage fit is strong and the elasticity of actual and law-implied FPM transfers is close to unity, the fuzzy-RD estimates are similar, ranging from $0.1 - 0.19$. Conditional on unobserved time-invariant municipal factors, Brazil-wide and state-specific trends as well as cutoff-specific time trends, a twenty percent increase in federal transfers (roughly the step in the FPM allocation function, equation (1)) is associated with a $3\% - 4\%$ boost in private-sector labor income. This corresponds to roughly the mean of earnings growth. Figure 9 gives a graphical illustration of this core result. There is an evident jump (fall) in total labor earnings of private sector employees when municipalities move to a higher (lower) FPM population interval.

We then examine whether the impact of regional transfers on the local economy stems from increased private sector hiring (employment) or via higher wages. The estimates in rows (2) and (3) reveal that regional transfers affect mostly employment. The coefficients of log law-implied FPM on log private employment are always significant at standard confidence levels. The FPM private employment elasticity ranges between $0.10 - 0.21$. Figure 10a illustrates the higher level of private employment on the right side of the pooled FPM discontinuities. In contrast, Figure 10b shows no evident change in average wages at the pooled FPM cutoffs. In line with this illustration, the transfers-wages elasticities in row (3) are small ($0.02 - 0.06$)

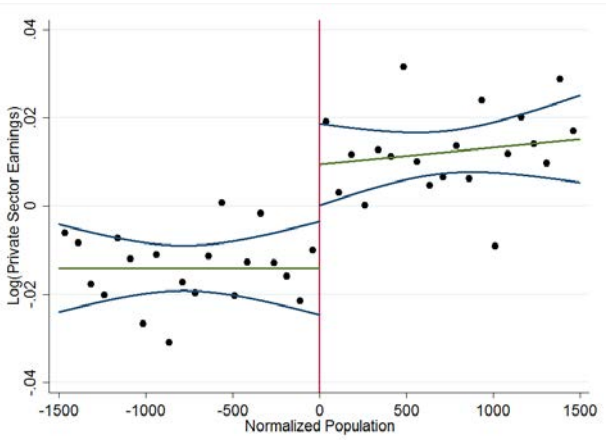
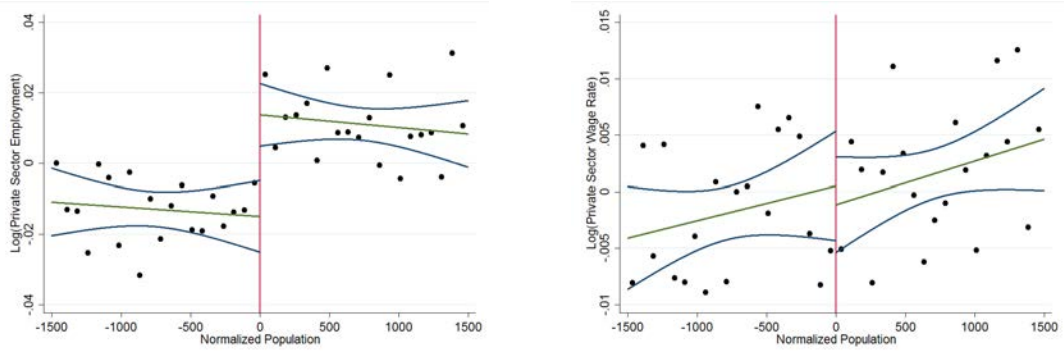


Figure 9: Private Sector Total Labor Earnings around the cutoffs

and typically insignificant.



(a) Employment

(b) Wage per Worker

Figure 10: Total Earnings, Employment and Wage Rate in the Private Sector

5.2 Cost per job

In Table 9 - Panel A we map our findings into estimates of the cost of a job in the private sector (Table 8) and in the public sector (Table 6).[33] Estimating the cost of a job in the private sector and local government allows us to compare our federal transfer estimates for Brazil with studies that have exploited variation in other countries and settings.

In Panel A we report fuzzy-RD coefficients (columns (1) and (3)) and the associated number of jobs created for an increase of BRL 30,000 (at constant 1998 prices) in FPM transfers (columns (2) and (4)). This amount roughly corresponds to 1% of average FPM transfers.

[33]These are calculated using the elasticity formula and are based on the IV fuzzy-RD estimates.

An additional BRL 30,000 of municipal government spending is associated with around one extra public-sector job and three extra private-sector jobs. Given that the elasticities of regional transfers with respect to public and private sector employment are around 0.15, this difference reflects the fact that - in terms of number of employees - the size of the private sector is roughly three times the size of the public sector (see Table 2).

Alternatively, our results can be framed in terms of the average cost of an extra job per year. The third row of Table 9 shows that for the local economy to increase by an additional headcount, FPM transfers need to raise on average by an amount between 6,100 and 8,700 BRL at constant 1998 prices (or by about 8,000 USD at constant 2016 price). The average cost per job implied by our RD estimates across a sample of relatively small Brazilian municipalities is roughly one fourth of the corresponding calculation of about USD 30,000 that Serrato and Wingender (2016) report across US counties (which are comparable in size to Brazilian municipalities).[34] This is consistent with the real wage and productivity gaps between Brazil and the U.S. that can be found in national statistics (as for instance reported by the World Bank Indicators database).

5.3 Local Income Multiplier

Several recent works on the local effects of fiscal policy present their results in terms of local multipliers (Nakamura and Steinsson, 2014; Acconcia *et al.*, 2014; Serrato and Wingender, 2016 and Shoag, 2013). Chodorow-Reich (2017) summarizes this body of research and proposes a simple and intuitive way to convert local employment multipliers to income/output multipliers. Assuming a neoclassical production function linking output (Y_t) to employment (E_t), hours worked (H_t) and productivity (A), without capital adjustment in the short-run [$Y_t = A(H_t E_t)^{1-\xi}$], output and employment multipliers are linked by the following simple expression:

$$\mu_Y = (1-\xi)(1+\chi)\frac{Y}{E}\mu_E. \tag{3}$$

where μ_Y denotes the output/income multiplier and μ_E is the employment multiplier, namely the inverse of the estimated cost of a job reported in Table 9. The parameter χ represents

[34] Focusing on the impacts of the American Recovery and Reinvestment Act (ARRA) of 2009 which was aimed to mitigate the economy from the collapse of economic activity, Chodorow-Reich *et al* (2012) estimate a cost per job in the range of $16,000 - 50,000$ USD, while Dube *et al.* (2012) estimate is close to 25,000 USD and Feyrer and Sacerdote (2012) estimate is closer to 50,000 (though with a wide range). Adelino *et al.* (2012) estimate a cost per job of around 21,000 USD and Shoag (2013) estimates a cost per job of around 35,000 USD. USD. See Chodorow-Reich (2017) for an overview of these works.

the elasticity of hours per worker to total employment and ξ refers to the share of capital in the production function.

Following Chodorow-Reich (2017), we parameterize this expression using Brazilian data to approximate the local income multiplier. More specifically, we set the capital share, ξ, to 1/3 as standard in the literature and also in line with the evidence on Brazil (Bugarin, Ellery-Jr and Gomes, 2004). Following Santos (2016) we set the elasticity of hours to total employment, χ, to 0.12. Finally, income per worker, $\frac{Y}{E}$, takes the value of BRL 21,152, which the average reported in the 2010 Brazilian Census.

In Table 9-Panel B we report the local income multiplier. This ranges between 1.9 and 2.6 across specifications: a BRL 1,000 increase in municipal spending funded by federal transfers is associated with an increase in local output of around BRL 2,200. We also varied the parameters in formula (3), allowing the share of capital, ξ, to go from 0.3 to 0.4 and the hours employment elasticity, χ, from 0 (no adjustment of hours) to 0.5, which is the estimate for the US. The local income multiplier is now centered around 2, ranging between $1.6 - 2.4$ for our preferred specification in column (4). Our estimates are in line with the evidence from other recent studies focusing on developed countries, which report local output multipliers between 1.4 and 2.5 (see for instance Nakamura and Steinsson, 2014; Acconcia *et al.*, 2014; Serrato and Wingender, 2016; Shoag, 2013).

5.4 Insights from a Currency Union Model

We now examine how our empirical findings compare with the predictions of a macroeconomic model of government spending financed by regional transfers in a currency union. We also assess the extent to which the size of the estimated effects depend on the way expenses are paid for, whether via transfers from the central government or via local tax revenues. This is important because as Ramey (2016) notes the constants and time fixed-effects "difference out the effects of the financing" as the FPM program is funded by taxes at the federal level. To this end, we employ the theoretical setup of Farhi and Werning (2016), which provides closed-form solutions to local multipliers under alternative financing rules. This theoretical model, which builds on Gali and Monacelli (2008), Corsetti, Kuester and Muller (2013) and Nakamura and Steinsson (2014), nests neoclassical and Keynesian effects of fiscal policy in a currency union under complete and incomplete markets.[35]

[35] We are grateful to Emmanuel Farhi and Ivan Werning for kindly sharing the codes for their model.

5.4.1 Model and Parameterization

In a nutshell, households with constant-elasticity-of-substitution (love for variety) preferences over differentiated goods derive utility from private consumption, government expenditure, and leisure. Firms compete monopolistically and face a fixed probability of resetting prices in each quarter. Agents can only trade a risk-free bond and their consumption is tilted toward locally produced goods. The local government engages in public spending, which can be financed via taxes either at the local or at the currency union level. The nominal interest rate is fixed, consistent with our empirical specifications where the time-effects absorb, among other things, variation in monetary policy.[36]

In an effort to limit our degrees of freedom, we borrow most parameter values from Farhi and Werning (2016).[37] For steady state values, we set the real interest rate to 8% and the local government spending-output ratio in Brazil to 10%, which correspond to our sample average. The persistence of municipal government spending is set to 0.5, consistent with the estimates of an AR(2) process in our sample. The 'home-bias' parameter (i.e., fraction of non-locally produced consumption goods and services) is equal to 0.4, the fraction of hand-to-mouth consumers amounts to 0.25, and the fraction of firms resetting prices is 0.25 per quarter (consistent with the average duration of individual price spells for CPI goods and services reported by Barros *et al.*, 2009). Since there exists uncertainty around the values of these parameters and because Brazilian municipalities are likely to differ along many hard-to-observed dimensions, in our quantitative analysis we vary the values of each of the following parameters (keeping all other coefficients fixed at their baseline values): (i) the fraction of the consumption basket that is not locally produced ranges between 0.30 and 0.7; (ii) the fraction of "hand-to-mouth" consumers varies from 0 to 0.25; and (iii) the fraction of firms resetting prices goes from 0.1 to 0.9.

5.4.2 Results

In Figure 11, we report the one-year cumulated response of local output to a government spending shock as large as 1% of steady state output. The top, middle and bottom panels

[36] For brevity we do not sketch fully their model. Details can be found in Farhi and Werning (2016), Gali and Monacelli (2008), Corsetti, Kuester and Muller (2013), Nakamura and Steinsson (2014).

[37] In particular, the elasticity of inter-temporal substitution is set to 1, the elasticity of labor supply to 3, the elasticity between local and foreign goods to 1, and the elasticity of varieties to 6. These values are also in line with earlier works (e.g. Nakamura and Steinsson, 2014).

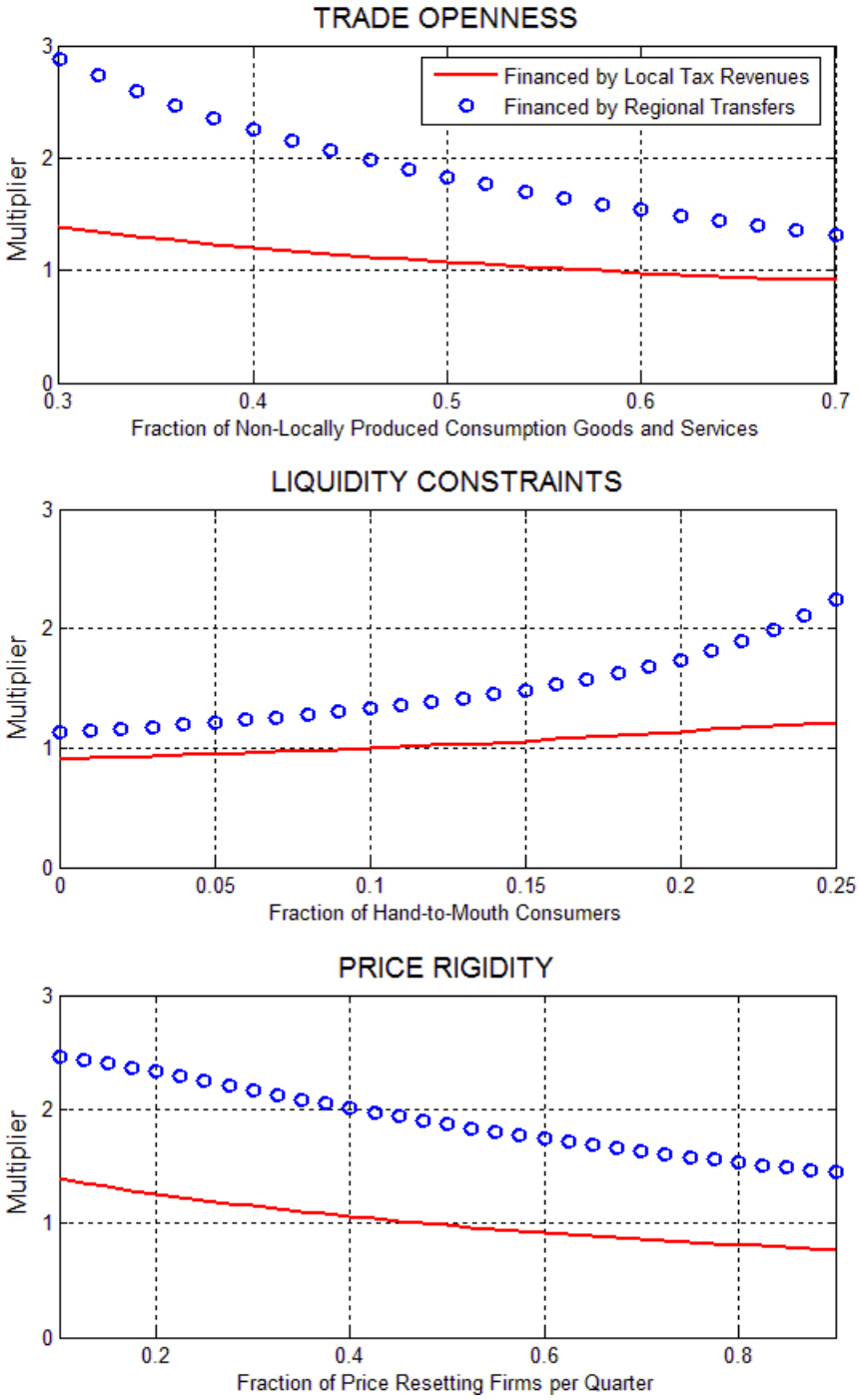


Figure 11: Externally-Financed vs Locally-Financed Multipliers

display the magnitude of the local multipliers as we alter respectively the parameter capturing home bias in consumption, the share of hand-to-mouth consumers and the share of price resetting firms. Each panel presents two lines: the blue-circled lines summarize the effects on local output of municipal government spending financed by regional transfers from currency union-wide tax revenues (as in our estimates); the red lines plot the local output effects of municipal spending if this was financed instead by raising local taxes.[38] Hence, the difference between blue and red lines can be interpreted as the contribution of the source of public finance to the impact of fiscal policy on the local economy.

Several interesting results emerge from Figure 11. First, the effect of government spending on local economic activity varies with key model parameters reflecting features of the Brazilian economy that are hard-to-observe at the municipal level. The impact of public expenditure is stronger for relatively closed economies (top panel), when more agents face liquidity constraints (middle panel) and when prices are less flexible. Second, the externally-financed multiplier ranges between 1.2 and 2.8. Under the baseline parameterization (i.e., when the shares of liquidity-constrained consumers and price resetting firms are around 0.25 and municipalities' openness around 0.4), the local multiplier is close to 2: thus, the model predictions confront well with the fuzzy-RD estimates in Table 9, which refer to the effects on the local economy of externally-financed (via the FPM program of regional transfers) municipal government spending.[39] Third, if local public expenditure was financed instead by local tax revenues, then the multiplier would have been significantly lower, in the range $[0.8, 1.4]$.[40] The model simulations reveal that locally-financed multipliers are between 20% and 50% smaller than externally-financed multipliers. The gap is smaller for municipalities more open to trade and less constrained in their access to financial markets.

[38] The red line may also be interpreted as the locus of national fiscal multipliers for a small open economy operating in a liquidity trap (i.e., with a fixed nominal interest rate) and under a fixed exchange rate regime. As emphasized by Farhi and Werning (2016), the national multiplier in a liquidity trap is likely to be larger under a flexible exchange rate regime as the initial devaluation associated with the fiscal expansion triggers also an expenditure-switching effect.

[39] The intuition behind these large effects on local output come from the fact that government spending is financed externally and therefore Ricardian effects are modest. Furthermore, home-bias in consumption implies that federal transfers yield Keynesian demand effects that are sufficiently large to dominate the (negative) neoclassical wealth effect. Farhi and Werning (2016) show that the neoclassical channel becomes relevant only when the terms-of-trade appreciate considerably.

[40] Interestingly, this range of values is consistent with the estimates of the national (and therefore internally-financed) multiplier surveyed by Ramey (2011a) and reported by Ramey and Zubairy (2017).

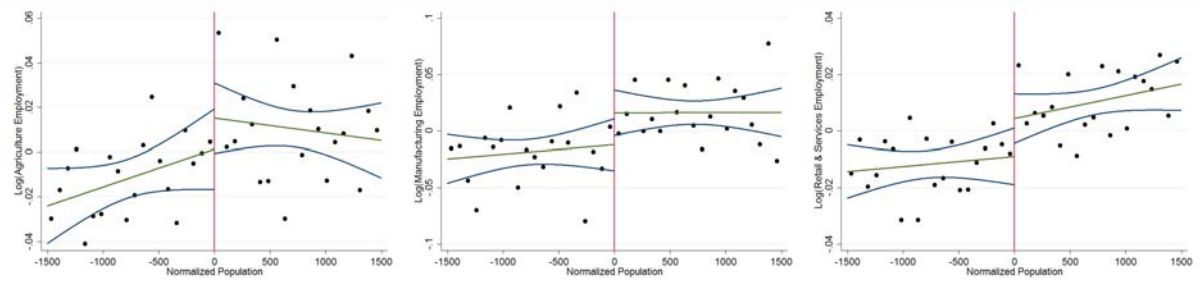
6 Sector Analysis

We now investigate the impact of regional transfers on private sector labor market outcomes across different sectors of the Brazilian economy. Table 10 reports local RD estimates that associate law-implied FPM transfers with total earnings, employment, and average wage per employee in Agriculture, Manufacturing and Services (see Table 2).

The focus of Panel A is on agriculture. The coefficients of log transfers on log total earnings in row (1) are unstable, small, and statistically indistinguishable from zero. Similarly, there is no association between regional transfers and employment or average wages in agriculture (rows (2) and (3)).

In Panel B we report estimates for manufacturing. The elasticities of total earnings in manufacturing with law-implied FPM transfers in row (1) are all positive but statistically insignificant. When we decompose manufacturing earnings to employment and average wages, there is some evidence of a positive effect of transfers on manufacturing employment. The estimates in row (2) are positive, implying potentially sizeable effects (elasticity range $0.09 - 0.27$). However, the estimates are rather inaccurate and statistically indistinguishable from zero. The elasticity of mean manufacturing wages to FPM transfers in row (3) is close to zero, changes sign and never passes standard significance levels. Overall, there seems to be a weak positive link between regional transfers and employment in the manufacturing sector while we detect virtually no effect on wages.

In Panel C we present results for services. There appears to be a strong association between total earnings in services and federal transfers (row (1)). The coefficient is positive and highly significant across all bandwidths, both in the simple local regressions reported in columns (2)-(4) and in the specifications with linear polynomials in columns (5)-(7). The elasticity is tightly estimated, ranging from $0.15 - 0.20$. A twenty percent increase in FPM transfers –roughly the average jump when a municipality moves across FPM cutoffs– is associated with a $3\% - 4\%$ increase in total earnings for the service sector. This is to be compared with an average/median growth in earnings of around 10%. As the specifications in rows (2)-(3) show, this effect is driven by employment. As municipalities move to a higher FPM population interval (and therefore local revenues and municipal spending rise accordingly) private sector employment in services increases considerably. There is a local multiplier effect as an increase (decrease) in local public spending is strongly associated to a hike (fall) in employment. In contrast, the impact of regional transfers on average wages in services is



(a) Agriculture (b) Manufacturing (c) Services

Figure 12: Employment in Agriculture, Manufacturing and Services

small and statistically insignificant.

Figures 12 provide visual evidence of the sector-specific patterns in private employment.[41] Figure 12a shows that employment in agriculture does not change abruptly at the FPM cutoffs. Figure 12b shows some evidence of a jump in manufacturing employment for municipalities moving to a higher FPM population interval. In line with the noisy estimates in Table 10-Panel B, the jump is visible but not sharp. Figure 12c exhibits a clear jump in municipal employment for services.

Overall, the results point out that the effect of FPM transfers on local private sector earnings and employment (Table 9) is driven mostly by services, a result in line with New-Keynesian models that predict strong demand-driven effects of fiscal transfers on nontradables (Farhi and Werning, 2016, 2017). There is little evidence of an impact on wages and employment in agriculture and there is only a weak effect on manufacturing employment.

7 Further Evidence and Sensitivity Analysis

In this section, we explore some potentially interesting dimensions of heterogeneity and discuss some necessary robustness checks that corroborates the inference from our analysis.

7.1 Heterogeneity

There are considerable differences on economic, institutional and financial development between the South and the North of Brazil. Perhaps due to geographic differences, isolation and different colonial history, the southern states are more developed than northern states. We

[41] We report the RD plots for sectoral total earnings and wage per employee in Appendix Figures *A.13*.

thus examine the link between local labor market outcomes and regional transfers separately for municipalities in the southern and the northern states. Table 11 records reduced-form estimates. As the link between law-implied, actual FPM transfers and municipal expenditure is similar in the two sub-samples (Appendix Table 24 - Panel A), heterogeneity in the reduced-form reflects differential effects of local government spending on the local economy. The elasticity of law-implied FPM transfers and total earnings in the private sector (Panel A) is positive and significant for both southern and northern municipalities. The elasticity in the southern municipalities is somewhat larger ($0.16 - 0.24$ compared to $0.01 - 0.16$) and more precisely estimated. The same holds when we examine private employment (Panel B). The estimated coefficient in our preferred specifications at the $3\% - 4\%$ bandwidth imply that in southern cities a 20% increase in federal transfers is associated with $3\% - 3.6\%$ increase in private employment. The elasticities of northern municipalities, however, are lower and less significant. This pattern is consistent with the evidence in Becker, Egger and von Ehrlich. (2013), who show that the effects of regional transfers are larger in European regions with above-average levels of human capital endowment and quality of government. Finally, in Panel C, we show that there is virtually no link between regional transfers and the wage rate in both samples. For a RD-graph visualization of these patterns see Appendix Figure A.14a-A.14b.

Our sample includes smaller and larger municipalities, with non-negligible differences in income per capita (Table 1). We re-estimate the reduced-form specifications allowing the impact of federal transfers to differ for smaller and larger municipalities.[42] Following Brollo, Nannicini, Tabellini and Perotti (2013), we pool all municipalities around cutoffs $1 - 3$ (population range $6,793$ to $20,377$) and municipalities in cutoffs $4 - 7$ ($20,378 - 47,537$). Table 12 reports the results. The estimates on total private sector earnings is significantly higher in smaller municipalities (Panel A). The employment specifications (Panel B) yield a clearer pattern: economically sizeable effect of transfers on private employment in smaller municipalities and substantially weaker (and in most specifications statistically indistinguishable from zero) in larger ones. There is some weak evidence of a positive association between transfers and average wage per employee in larger cities (Panel C).

[42]The first-stage link between law-implied and actual FPM transfers (and municipal spending) is homogeneous across city size (Appendix Table 24 - Panel B).

7.2 Robustness Checks

We perturbe the baseline empirical model across various dimensions to examine the robustness of the estimates. For brevity, we discuss and report these results in the Supplementary Appendix and just summarize them below.

First, we estimate first-differences specifications. Changes in law-implied FPM transfers are significantly correlated with increases in municipal employment new-hires and average wages of old-hires. Changes in regional transfers close to the FPM cutoffs boost private employment, especially in services.

Second, we drop observations around the first cutoff (10, 188) as it is close to the discontinuity in the pay of local politicians (10, 000) after 2004 (Ferraz and Finan, 2011). This does not affect any of our results (Appendix Table 14).

Third, we drop census years (2001, 2008 and 2011) as there is evidence of manipulation of population in those years. Even though manipulation does not invalidate the RDD[43], the estimates are similar to the baseline results, though a bit noisier (Appendix Table 15) .

Fourth, we drop observations of municipalities 'moving up' to a higher FPM population bracket and explored the link between transfers and earnings/employment in municipalities that either stay in the same bracket or 'move down'. By doing so, we minimize concerns that manipulation (to get transfers) is related to the outcomes. Both public and private sector employment respond to the fall in regional transfers (Appendix Table 16). The private employment effect comes mainly from the service sector (Appendix Table 21).

Fifth, to control for mayor's ability, we replaced municipal with mayor-specific fixed-effects.[44] Although the estimates are less accurate, the coefficients are quite similar, revealing a boost of private employment in response to increased FPM transfers (Appendix Table 17), mostly driven by services (Appendix Table 22).

Sixth, we estimate RD specifications with higher-order polynomials in population. The reduced-form and IV elasticity between total earnings in the private sector (and especially private employment) and FPM transfers are highly significant and, if anything, are larger than the local regression estimates (Appendix Table 18).

[43]Lee and Lemieux (2014) write: "*If individuals - even while having some influence - are unable to precisely manipulate the assignment variable, a consequence of this is that the variation in treatment near the threshold is randomized as though from a randomized experiment.*"

[44]Gadenne (2017) shows that mayor's characteristics, political orientation and connectedness to the federal government are similar at the two sides of the FPM cutoffs. So in practice this is not a major concern.

Seventh, we examine whether there are regional spillovers, augmenting the baseline specification with outcome aggregated at the regional (meso-region) level. There is little evidence of spillover effects (Appendix Table 19).[45]

Eighth, we investigate whether the increase in federal transfers has delayed effects. While there is some inertia, the bulk of transfers' impact on public and private sector employment occurs within the year (Appendix Table 20).

8 Conclusions

We study the labor market effects of regional transfers in a large currency union, Brazil, applying a 'fuzzy-RD' design that exploits for identification the highly non-linear allocation mechanism of funds from the federal government to municipalities. Federal transfers, municipal public revenues and spending change abruptly at various pre-determined population cutoffs, according to yearly population estimates provided by the independent federal statistical agency and court of auditors.

The fuzzy-RD estimates appear clear-cut. As municipalities cross the pre-assigned population cutoffs shaping federal transfers, there is a significant boost in private sector income and employment. For every 30,000 USD increase in municipal government receipts from the federal government, the local economy witnesses an extra job in the public sector and three extra jobs in the private sector. Existing workers in the public sector also experience a pay rise. As for the private sector, the effect on wages is mild and insignificant. The sizeable impact of federal transfers on private employment stems from the service sector and, to a lesser extent, in manufacturing. We also find that the stimulative effects of local government spending funded by regional transfers from the federal government are somewhat stronger in the southern states and in relatively smaller municipalities.

To offer insights on the transmission of fiscal policy and the role of regional transfers in a currency-union, we employ a New-Keynesian open-economy model with incomplete markets, financial frictions and nominal rigidities. We show that the model can replicate our estimates of the local effects of fiscal policy on economic activity. We also use the model to predict the impact of municipal spending if this was financed by local taxes rather than external

[45] A meso-region is a subdivision of states defined by the IBGE (Brazilian Institute of Geography and Statistics) which congregates a few municipalities in a given geographical area with economic and social similarities. They do not constitute any sort of political or economic entities.

transfers. In this case, local multipliers are considerably smaller, suggesting that regional transfers could be a useful stabilization tool in a currency union.

References

[1] Acconcia, Antonio, Giancarlo Corsetti and Saverio Simonelli. (2014). "Mafia and Public Spending: Evidence on the Fiscal Multiplier from a Quasi-experiment", *American Economic Review, 104(7)*, pp. 2185-2209.

[2] Amorim, Bruno M. F., Andre L. Souza, Luciana M. S. Servo, Paulo Furtado, Eduardo Pontual Ribeiro (2006) "Base de Dados: Apresentação e Opções Metodologicas", in *Criação, Destruição e Realocação de Empregos no Brasil*, Carlos Henrique Corseuil and Luciana M.S. Servo, IPEA, BrasÃlia.

[3] Angrist, Joshua and Victor Lavy. (1999). "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement", *Quarterly Journal of Economics*, *114* (2), pp. 533-575.

[4] Barros, Rebecca, Bonomo, Marco, Carvalho, Carlos and Matos, Silvia. (2009). "Price Setting in a Variable Macroeconomic Environment: Evidence from Brazilian CPI", mimeo.

[5] Becker, Sasha, Peter Egger and Maximilian von Ehrlich. (2013). "Absorptive Capacity and the Growth and Investment Effects of Regional Transfers: A Regression Discontinuity Design with Heterogeneous Treatment Effects", *American Economic Journal: Economic Policy 5* (4), pp. 29–77.

[6] Becker, Sasha, Peter Egger and Maximilian von Ehrlich. (2010). "Going NUTS: The effect of EU Structural Funds on Regional Performance", *Journal of Public Economics 94* (2), pp. 578–590.

[7] Brito, Fausto and Jose Alberto Carvalho. (2006). "As migracoes internas no Brasil: as novidades sugeridas pelos censos demograficos de 1991 e 2000 e pela PNADS recentes". Anais do XV Encontro Nacional de Estudos Populacionais, ABEP, Caxambu, MG.

[8] Brollo, Fernanda; Tommaso Nannicini; Roberto Perotti, and Guido Tabellini. (2013). "The Political Resource Curse", *American Economic Review*, *103*(5), pp. 1759-96.

[9] Brueckner, Markus. and Anita Tuladhar. (2013). "Local Government Spending Multipliers and Financial Distress: Evidence from Japanese Prefectures", *Economic Journal*, Volume 124, Issue 581, pp. 1279-1316.

[10] Clemens, Jeffrey and Stephen Miran. (2012). "Fiscal Policy Multipliers on Subnational Government Spending." *American Economic Journal: Economic Policy*, 4(2): 46-68.

[11] Chodorow-Reich, Gabriel; Laura Feiveson, Zachary Liscow, and William Gui Woolston. (2012). "Does State Fiscal Relief During Recessions Increase Employment? Evidence from the American Recovery and Reinvestment Act", *American Economic Journal: Economic Policy*, *4* (1), pp. 118-145.

[12] Chodorow-Reich, Gabriel. (2017). "Geographic Cross-Sectional Fiscal Multipliers: What Have We Learned?" *Harvard University* mimeo.

[13] Corbi, Raphael, Elias Papaioannou, and Paolo Surico. (2014) "Federal Transfer Multipliers: Quasi-Experimental Evidence from Brazil", *NBER working paper*, 20751.

[14] Corsetti, Giancarlo, Keith Kuester and Gernot Muller. (2013). "Floats, Pegs and the Transmission of Fiscal policy." In *Fiscal Policy and Macroeconomic Performance*, ed. C espedes Luis Felipe and Jordi Gali , Central Bank of Chile series on Central Banking, Analysis and Economic Policy, Volume 17.

[15] De Negri, João Alberto, Paulo Furtado de Castro, Natalia Ribeiro de Souza, and Jorge Saba Arbache, "Mercado Formal de Trabalho: Comparação entre os Microdados da RAIS e da PNAD", *IPEA Texto Para Discussão*, 2001, (840).

[16] Dix-Carneiro, Rafael, (2014) "Trade Liberalization and Labor Market Dynamics," *Econometrica*, 82 (3).

[17] Dix-Carneiro, Rafael and Kovak, Brian, (2015) "Trade Liberalization and Regional Dynamics" *NBER* working paper

[18] Eggers, Andrew, Ronny Freier, Veronica Grembi, and Tommaso Nannicini (2017) "Regression Discontinuity Designs Based on Population Thresholds: Pitfalls and Solutions". *The American Journal of Political Science*, forthcoming.

[19] Ellery-Jr, Roberto, Bugarin, Mirta N.S. and Gomes, Vitor (2005) "Long-run Implications of the Brazilian Capital Stock and Income Estimates", *Brazilian Review of Econometrics* v.25, no.1, pp. 67-88 May 2005

[20] Farhi, Emmanuel, and Ivan Werning. (2016). "Fiscal Multipliers: Liquidity Traps and Currency Unions," *Handbook of Macroeconomics*, Volume 2, Pages 2417-2492.

[21] Farhi, Emmanuel, and Ivan Werning. (2017). "Fiscal Unions," mimeo, Harvard University and M.I.T.

[22] Ferraz, Claudio and Frederico Finan. (2008). "Exposing Corrupt Politicians: The Effect of Brazil's Publicly Released Audits on Electoral Outcomes", *Quarterly Journal of Economics 123*(2), pp. 703- 745.

[23] Ferraz, Claudio and Frederico Finan. (2011a). "Motivating Politicians: The impacts of Monetary Incentives on Quality and Performance", mimeo, PUC-Rio and Berkeley.

[24] Ferraz, Claudio and Frederico Finan. (2011b). "Electoral Accountability and Corruption in Local Governments: Evidence from Audit Reports", *American Economic Review, 101*(6), pp. 1274-1311.

[25] Feyrer, James and Bruce Sacerdote. (2012). "Did the Stimulus Stimulate? The Effects of the American Recovery and Reinvestment Act", mimeo, Dartmouth College.

[26] Filho, Joaquim and Mark Horridge. (2010). "Climate Change Impacts on Agriculture and Internal Migrations in Brazil", mimeo, ESALQ/USP and Monash University.

[27] Fishback, Price and Joseph Cullen. (2013). "Second World War spending and local economic activity in US counties: 1939–58," *Economic History Review* 66(4), pp. 975–992.

[28] Fishback, Price and Valentina Kachanovskaya,.(2010). "In Search of the Multiplier for Federal Spending in the States During the Great Depression," NBER WP 16561.

[29] Fuchs-Schuendeln, N. and Hassan, T.A. (2016). "Natural Experiments in Macroeconomics" in *Handbook of Macroeconomics* Volume 2, Pages 923-1012

[30] Gadenne, Lucie. (2017). "Tax Me, But Spend Wisely: Sources of Public Finance and Government Accountability" *American Economic Journal*, Vol. 9, pp. 274-314

[31] Gali, Jordi, and Tomasso Monacelli. (2008). "Optimal and Monetary and Fiscal Policy in a Currency Union," *Journal of International Economics*, *76*(1), pp. 116-132.

[32] Gelman, Andrew and Guido Imbens (2014). "Why High-order Polynomials Should not be Used in Regression Discontinuity Designs", NBER WP 20405.

[33] Hahn, Jinyong; Petra Todd, P. and Wilbert Van der Klaauw. (2001). "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design", *Econometrica*, *69*(1), pp. 201-209.

[34] Helpman, Elhanan, Oleg Itskhoki, Marc-Andreas Muendler, and Steven J. Redding, (2017) "Trade and Inequality: From Theory to Estimation," *Review of Economic Studies*, 2017, 84(1): 357-405

[35] IBGE. (1990). "Divisao Regional Do Brasil em Mesorregioes and Microrregioes Geograficas", *Volume 1.*

[36] Imbens, Guido W., and Thomas Lemieux. (2008). "Regression Discontinuity Designs: A Guide to Practice", *Journal of Econometrics 142*(3), pp. 615-635.

[37] Kenen, Peter, (1969). "The Theory of Optimum Currency Areas: An Eclectic View", in R.A. Mundell and A.K. Swoboda, eds., *Monetary Problems of the International Economy*, Chicago University Press.

[38] Kraay, Aart. (2012). "How Large is the Government Spending Multiplier?" *Quarterly Journal of Economics, 127*(2): pp. 829-887.

[39] Kraay, Aart. (2014). "Government Spending Multipliers in Developing Countries: Evidence from Lending by Official Creditors", *American Economic Journal: Macroeconomics*, *6*(4), pp. 170-208.

[40] Lee, David S., and Thomas Lemieux. (2010). "Regression Discontinuities Designs in Economics," *Journal of Economic Literature*, *48*(2), pp. 281–355.

[41] Lee, David S., and Thomas Lemieux. (2014). "Regression Discontinuities Designs in the Social Sciences," in *Economics Regression Analysis and Causal Inference*, Henning Best and Christof Wolf, Sage, 2014.

[42] Litschig, Stephan. (2012). "Are Rules-based Government Programs Shielded from Special-interest Politics? Evidence from Revenue-sharing Transfers in Brazil, *Journal of Public Economics*, *96*(11–12), pp. 1047-1060.

[43] Litschig, Stephan and Kevin M. Morrison. (2013). "The Impact of Intergovernmental Transfers on Education Outcomes and Poverty Reduction", *American Economic Journal: Applied Economics*, *5*(4): pp. 206-40.

[44] Gori-Maia, Alexandrei, and Menezes, Esther. (2014). "Economic growth, labor and productivity in Brazil and the United States: a comparative analysis."*Revista de Economia Politica*, 34(2), 212-229

[45] McCrary, Justin. 2008. "Manipulation of the running variable in the regression discontinuity design: A density test."*Journal of Econometrics* 142(2):698-714.

[46] Menezes-Filho, Naercio and Marc-Andreas Muendler, (2011). "Labor Reallocation in Response to Trade Reform,"*NBER* WP, (17372)

[47] Monasterio, Leonardo (2013). "O FPM e a Estranha Distribuicao da Populacao dos Pequenos Municipios Brasileiros", Discussion Papers 1818, Instituto de Pesquisa Economica Aplicada - IPEA.

[48] Mundell, Robert (1961). "A Theory of Optimum Currency Areas", *American Economic Review*, *51* (4), pp.657?665.

[49] Mundell, Robert (1973). "The Economics of Common Currencies", in H.G. Johnson and A.K. Swoboda, eds., *Uncommon Arguments for Common Currencies*, Allen and Unwin.

[50] Nakamura, Emi and Jon Steinsson. (2014). "Fiscal Stimulus in a Monetary Union: Evidence from U.S. Regions," *American Economic Review*, *104*(3), pp. 753-792.

[51] Oliveira-Junior, Luiz Antonio de (2014) "Potencial de arrecadacao do IPTU: analise nacional e do municipio de Santo Andre"*Fundacao Getulio Vargas*, mimeo.

[52] Pettersson-Lidbom, Per. (2012). "Does the Size of the Legislature Affect the Size of Government: Evidence from Two Natural Experiments," *Journal of Public Economics*, *96*(1), pp 269–278.

[53] Porcelli, Francesco and Riccardo Trezzi. (2014). "Reconstruction Multipliers", Finance and Economics Discussion Paper 2014-79. Divisions of Research & Statistics and Monetary Affairs Federal Reserve Board, Washington, D.C

[54] Ramey, Valerie. (2011a). "Can Government Purchases Stimulate the Economy?", *Journal of Economic Literature*, *49*(2), pp. 673–85.

[55] Ramey, Valerie. (2011b). "Identifying Government Spending Shocks: It's All in the Timing", *Quarterly Journal of Economics*, *126*(1), pp. 1-50.

[56] Ramey, (2016). "Macroeconomic Shocks and Their Propagation,"in the *Handbook of Macroeconomics*, eds. John B. Taylor and Harald Uhlig, Amsterdam: Elsevier, 2016. Vol. 2, 71-162.

[57] Ramey, Valerie and Zubairy, Sarah (2017). "Government Spending Multipliers in Good Times and in Bad: Evidence from U.S. Historical Data", forthcoming in the *Journal of Political Economy*

[58] Saboia, João L. M. and Ricardo M. L. Tolipan, "A relação anual de informações sociais (RAIS) e o mercado formal de trabalho no Brasil: uma nota,"*Pesquisa e Planejamento Economico*, 1985, 15 (2), 447-456.

[59] Santos, Fernando Siqueira (2015) "Okun Law And Labor Productivity In Brazil", Proceedings of the 43rd *Brazilian Economics Meeting*], number 232

[60] Serrato, Juan Carlos Suarez, and Philippe Wingender. (2014). "Estimating Local Fiscal Multipliers", mimeo, University of California, Berkeley.

[61] Shoag, Daniel. (2013). "The Impact of Government Spending Shocks: Evidence on the Multiplier from State Pension Plan Returns," mimeo, Harvard University.

[62] Van der Klaauw, Wilbert. (2002). "Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach," *International Economic Review* 43, pp. 1249-1287.

[63] Van der Klaauw, Wilbert. (2008). "Regression-Discontinuity Analysis: A Survey of Recent Developments in Economics," *Review of Labor Economics and Industrial Relations*, *22*(2), pp. 219–245.

A Supplementary Appendix

The Appendix is split into six parts. In Section 1, we report summary statistics and descriptive evidence. In Section 2, we discuss two pair of municipalities as illustration of the mechanics of the FPM allocation mechanism. Additional tests of the identification strategy are recorded in Section 3. In Section 4, we describe in detail the construction of the law-implied FPM Transfer measure. In Section 5, we report tests regarding systematic manipulation while the last Section presents and discusses various sensitivity checks.

A.1 Summary Statistics

In Appendix Table 1, we report some key characteristics of Brazilian states. The table gives the fixed state shares (percentages) of the FPM program (based on population and income per capita in 1991), the number of municipalities per state in our sample and the average municipal population.

In Appendix Table 2, we provide descriptives on the distribution of Brazilian municipalities around each FPM population cutoff. Summary statistics for the sample that covers municipalities with a population between $6,793$ and $47,537$ inhabitants are recorded in Panel A. In Panel B, we report the summary statistics for the restricted sample in the neighborhood of 4% -inhabitants bandwidth around each of the seven FPM discontinuities. This is the sample we use in the RDD estimates.

In Appendix Table 3, we summarize sample characteristics in the neighborhood of the discontinuities using a 4%-inhabitants bandwidth (the Table "mirrors" Table 1). Panel A reports the number of municipalities that move to lower and higher FPM brackets ('treatment' group) and the number of municipalities that do not change population bracket ('control' group). Approximately 31% (705 out of $2,305$) of the municipalities in the local sample consists of cities whose population fluctuates around the cutoffs without crossing any FPM threshold. Nearly 49% of the sample ($1,140$ cities) move (only) to a higher FPM bracket during the period $2000-2014$; and about 6% of municipalities move to a lower FPM bracket. The remaining 14% (327 municipalities) move to a higher FPM interval in some year(s) but to a lower FPM interval in some other year(s). In Appendix Table 3 - Panel B and C, we report the number of municipalities that remain in the same population bracket or move across brackets by year and by cutoff, respectively, focusing again on the 'local' sample.

Summary statistics of the main variables in the local sample that we use in our RD specifications are in Appendix Table 4. No discernible pattern emerges relative to the descriptive statistics in the full sample (both close and far from the FPM population cutoffs) in Table 2.

A.2 Examples of the FPM Allocation Mechanism

To illustrate the discontinuous nature of the FPM allocation mechanism, we discuss two sets of examples where FPM transfers change from one year to the next, as municipalities cross the pre-determined population cutoffs depicted in Figure 1. Differences in FPM transfers for a given municipality over two consecutive years are driven by two (possibly opposing) forces: (i) the move, if any, to a higher or lower population FPM interval, (ii) the growth of the national economy which, when positive (as in the case of Brazil over our sample period), translates into higher fiscal revenues at the federal level and thus a larger total pot of money available for the FPM program (which is independent of municipal population estimates).

Consider two pairs of municipalities in the state of *Minas Gerais*[46] over the years 2010 and 2011 displayed in Figure A.1. The first pair consists of Bela Vista and Centralina. These municipalities experienced a slight drop in population over that period. On the one hand, Bela Vista population went from $10,333$ to $10,004$ inhabitants. The small decline was nevertheless sufficient to cross the FPM population cutoff of $10,188$ residents and to have its FPM coefficient λ reduced from 0.8 to 0.6. Accordingly, FPM transfers fell from $R\$2,328,037$ in 2010 to $R\$2,014,811$ in 2011. The drop was smaller than 20% (which is the drop in the FPM coefficient) because during 2010-2011 the total FPM pot of funds increased considerably as Brazil growth was close to 4%. On the other hand, the population of Centralina fell from $10,557$ to $10,266$ inhabitants, but the municipality remained in the same population bracket over the same period. Although its FPM coefficient was unchanged ($\lambda = 0.8$), Centralina witnessed an increase in federal transfers from $R\$2,328,037$ to $R\$2,686,415$ due to a larger pot of FPM funds at the national level. Note also that the two cities received the exact same amount from the FPM program in 2011, exactly as the law dictates.

The second pair of cities in *Minas Gerais*, Caetanopolis and Pedralva, experienced a slight increase in population. On the one hand, the population of Pedralva went up by 116 inhabitants, from $11,351$ to $11,467$. This population change was not large enough to move

[46] *Minas Gerais* is the largest state in number of municipalities (853) and the second largest in population (20 million inhabitants). It neighbors 6 different states, including Sao Paulo and Rio de Janeiro.

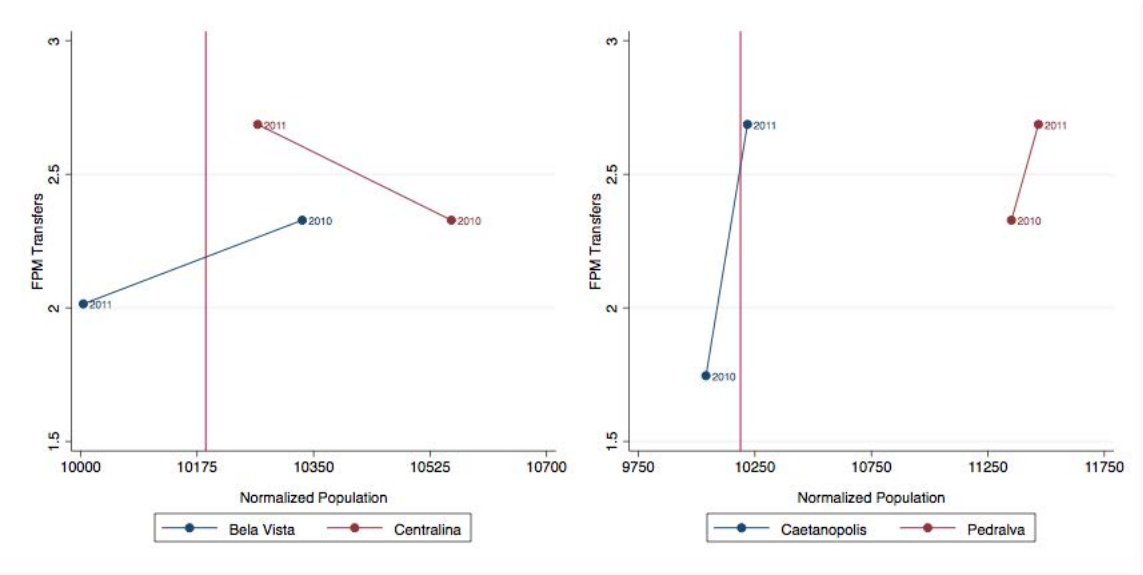


Figure A.1: Example of the FPM allocation mechanism

the city to a higher population bracket. As such, the increase in FPM transfers was moderate - from $R\$2,328,037$ to $R\$2,686,415$, simply reflecting the overall raise in the total pot of funds at the national level. On the other hand, Caetanopolis population increased only by 178 inhabitants from 10,040 to 10,218, which was enough to move Caetonopolis to a higher FPM population bracket (λ increased from 0.8 to 1.0). Accordingly, FPM transfers increased considerably from $R\$1,746,027$ to $R\$2,686,415$, reflecting both the higher FPM coefficient and the increase in the total proceeds of the FPM program at the federal level.

As discussed in Section 3, a necessary condition for identification is that not only federal transfers but also municipal expenditure change abruptly at the FPM cutoffs. Figure A.2 mirrors Figure A.1 but with expenditure instead of transfers. On the one hand, municipal spending from 2010 to 2011 increases in both Bela Vista and Centralina as the Brazilian economy was growing and the FPM program expanded. Centralina increased spending relatively less than Bela Vista, as it received less from the FPM program. Similarly, municipal spending raised in both Caetanopolis and Pedralva over that period. But the public spending hike in Caetanopolis was sharper as this municipality benefited also from an increase in federal transfers.

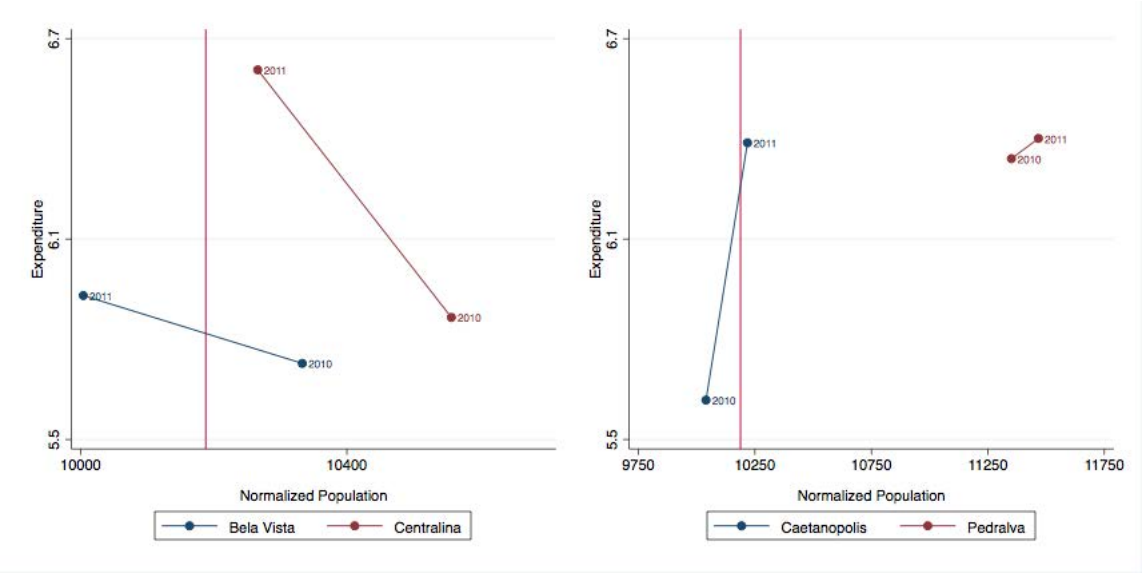


Figure A.2: Expenditure and FPM allocation mechanism

A.3 Identifying Assumptions

In this section we provide further evidence on the validity of the identifying assumptions behind the fuzzy-RD empirical design.

A.3.1 Federal Transfers

In Appendix Table 5, we report estimates associating actual and law-implied FPM transfers in log-differences (columns (1)-(3)), OLS-differences (columns (4)-(6)) and least-absolute deviation (LAD)-differences (columns (7)-(9)). While taking first-differences comes at an efficiency loss, these models further account for outliers and unobserved characteristics. Changes in actual transfers closely match changes in law-implied transfers. OLS and LAD estimates are very close to unity; and log-differences are only slightly attenuated (0.94). In these specifications, we do not include any RD polynomial and we just progressively narrow the bandwidth. The results are similar if we add RD polynomials in both years or simply control for changes in population.

In Appendix Table 6, we examine the relationship between actual and law-implied transfers by cutoff. The first two rows report coefficients pooling thresholds 1-3 and 4-7 (as Brollo, Nannicini, Perotti, and Tabellini, 2013). The following seven rows reports estimates for each cutoff separately. All estimates are close to unity, suggesting that the FPM allocation mech-

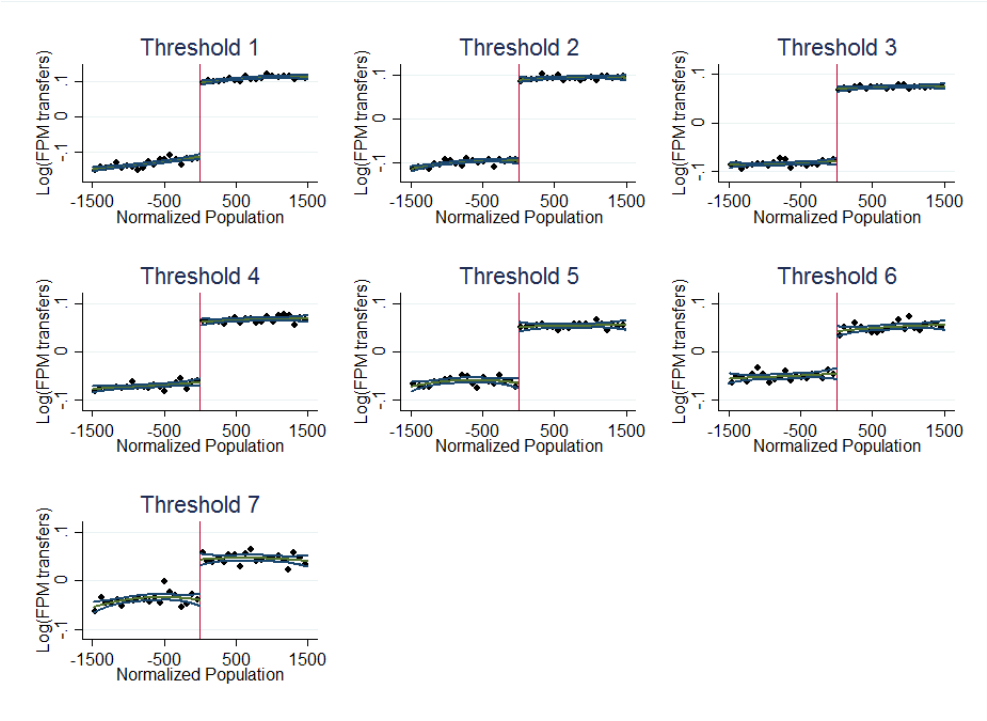
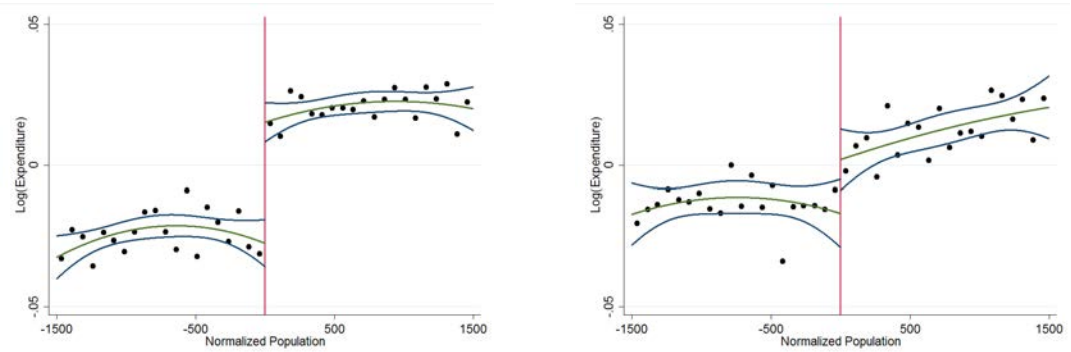


Figure A.3: FPM Transfer around each threshold

anism is on average enforced. Appendix Figure A.3 provides visual evidence of the jumps of federal transfers at FPM cutoffs.

A.3.2 Municipal Revenues

In Appendix Table 7, we examine the relationship between municipal revenues and law-implied transfers by cutoff. The first two rows report coefficients from specifications that pool thresholds $1-3$ and $4-7$. Appendix Figure A.4 provides visual illustrations of these patterns. Rows (3)-(9) give cutoff-specific estimates. For brevity, we just report logarithmic specifications. All variables are in logs, so the coefficients should be close to the share of FPM transfers over revenues and expenditure for the relevant sample (reported on the right in each table). The estimates on law-implied FPM transfers are positive and highly significant. The estimates are close to the corresponding shares across all cutoffs, though the estimates for cutoffs 6 and 7 are somewhat noisy, as the number of observations around these thresholds is small (see Appendix Table 2).



(a) Threshold 1-3

(b) Threshold 4-7

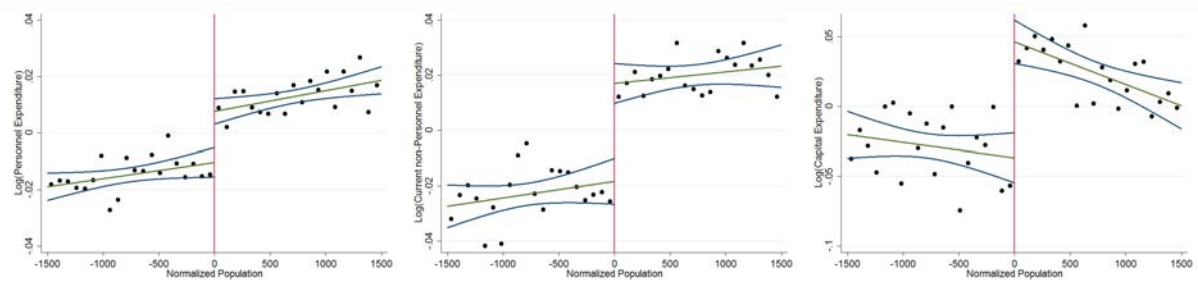
Figure A.4: Municipal Expenditure around thresholds 1-3 and 4-7

A.3.3 Municipal Expenditure

In Appendix Table 8, log municipal spending is associated with log law-implied FPM transfers by cutoff. In the first two rows, we pool thresholds $1-3$ and $4-7$, while the other rows report cutoff-specific estimates. The elasticities are positive and highly significant. The estimates loose significance only in the narrow bandwidth (2%) of large cities (cutoffs 6-7), which are only a few in our sample. Overall the cutoff-specific estimates show that as municipalities move to higher (lower) population FPM intervals, local government expenditure increases considerably across both small and large cities.

In Appendix Table 9, we examine the pervasiveness of municipal spending, as municipalities move across FPM cutoffs. The table reports estimates of how law-implied transfers affect current expenditure (net of wages), wage bill, and capital expenditure. All main types of municipal expenditure move as cities cross the FPM population cutoffs shaping regional transfers from the federal government. Figure A.5 provides visual illustrations of this pattern.

Similarly, the focus of Appendix Table 10 is on the main categories of municipal spending, namely public administration, education, health, housing & urbanism, and others. All coefficients are positive and highly significant, suggesting that the increase in municipal expenditure triggered by a "locally" (close to the FPM cutoffs) exogenous increase in transfers is spread across all budget categories



(a) Current (wage) (b) Current (non-wage) (c) Capital

Figure A.5: Types of Municipal Expenditure around the cutoffs

A.4 Mis-assignment and Law-Implied FPM Transfers

Actual FPM Transfers do not always exactly correspond to what they should be based of the FPM allocation rule. This explains why the association between actual and law-implied FPM transfers simply based on the allocation formula does not yield a perfect in-sample fit (Table 3). Yet, mis-assignment is not systematic as the estimated coefficients linking actual and law-implied FPM transfers is one and tightly estimated (Tables $3-4$, Appendix Table 6). There are many reasons behind the imperfect enforcement of the FPM allocation mechanism.

In the 1990s some municipalities split into two, but temporarily managed to keep their former FPM coefficient through court disputes. In an effort to correct for such distortions, the federal government (through a Complementary Law LC 91/97) mandated that all municipalities should be framed in the correct population brackets with their relevant coefficients by 2008. To prevent immediate disruption to the public finances of the municipalities involved, the law established a transition period to the new regime, so that in the period $1999-2007$ some municipalities still received FPM transfers which were not consistent with their population estimate.

Law LC 91/97 determined that FPM transfers for these municipalities should be calculated using a modified FPM coefficient ($\tilde{\lambda}_t$), which equals a weighted average of their coefficient in 1997 (λ_{97}) and their "correct" coefficient in year t (λ_t). The weight α_t given to the "correct" FPM coefficient (λ_t) would start at $\alpha_{99} = 0.2$ and increase by 0.1 per year until 2008 when the correction would be complete. Such correction affects $1,503$ municipalities.[47]

Hence the law-implied FPM Transfer $\widehat{FPM}^{k}_{i,t}$ for municipality i in state k and year t is calculated by:

[47] We have re-estimated all specifications dropping these muicipalities altogether finding similar results.

$$\widehat{FPM}_{i,t}^{k} = FPM_t^k \frac{\tilde{\lambda}_t^i}{\sum_{i \epsilon k} \tilde{\lambda}_t^i} \tag{4}$$

$$\text{where } \tilde{\lambda}_t^i = \alpha_t \lambda_t^i + (1 - \alpha_t)\lambda_{97}^i$$

$$\text{and } \alpha_t = \begin{cases} 0.2 + (t - 1999) * 0.1 & \text{if } t < 2008 \\ 1 & \text{if } t \geq 2008 \end{cases}$$

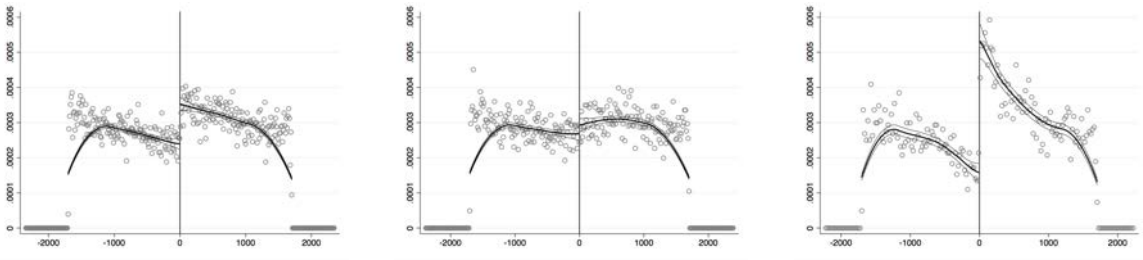
A.5 Systematic Manipulation

We provide here three set of results to support the identification assumption, which require that the local variation in the assignment to treatment is as-good-as random in the neighborhood of the cutoffs (Lee and Lemieux, 2010).

A.5.1 Population Density Test

We begin by testing whether the density of population estimates is continuous at the cutoffs. Figure A.6a presents the McCrary (2008) density test for all years in our sample ($1999 - 2014$). Figures A.6b and A.6c split the sample into (a) census years (2001, 2008, 2011) and (b) non-census years while Figure A.7 reports visualizations for each year. A clear pattern emerges: manipulative sorting behavior seems to be present in census years but there is no such evidence in non-Census years. It would seem that municipal authorities seek to attract new residents (or simply changing the numbers) just in time for the official counting (Monasterio, 2013). In contrast, little manipulation seems to happen during non-census years. This is consistent with the fact that population estimates in these years are calculated by IBGE (an independent federal institute) using a publicly known methodology that incorporates data from past censuses, administrative records from migration, births and deaths. [Below we show that the results are unaffected by using data only from non-census years].

Motivated by the use of within-municipality variation for identification (see Gadenne, 2017), we consider whether the probability of crossing a FPM cutoff is different from the probability of crossing any other population cutoff by plotting changes in population between years t and $t-1$ as a function of distance to the cutoff at time $t-1$. This is akin to a manipulation test on population changes instead of levels. Figure A.8 provides supporting



(a) All years (b) Census years (c) Non-census years

Figure A.6: McCrary Density Test - Census and non-Census years

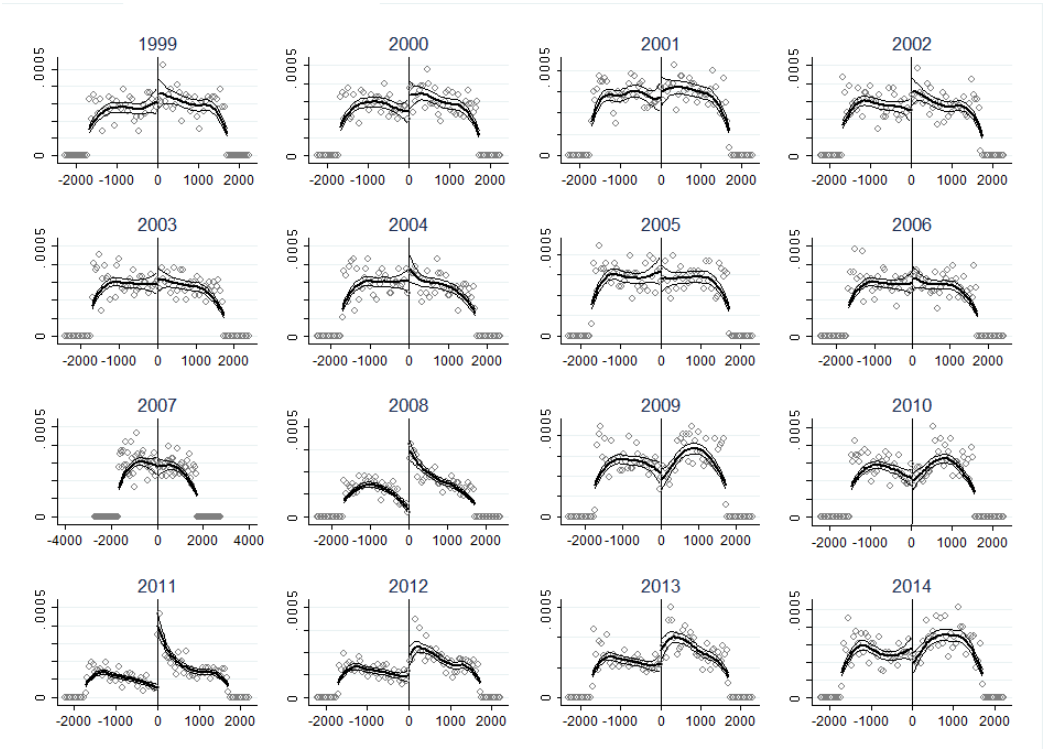


Figure A.7: McCrary Density test for each year

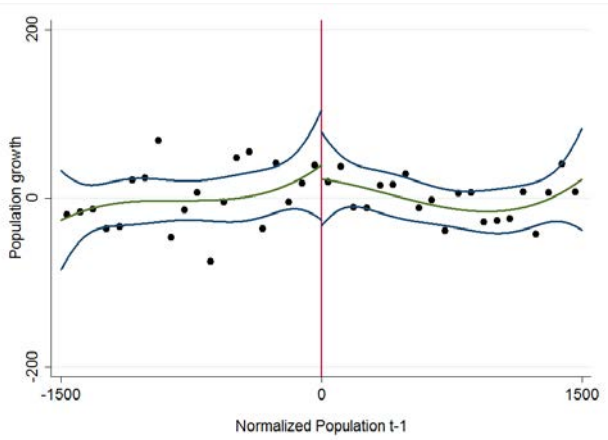


Figure A.8: Population change as a function of population in t-1

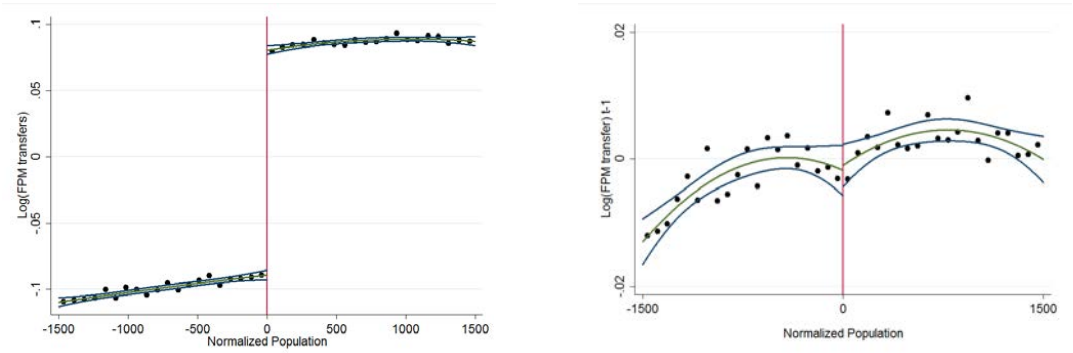
visual evidence. Changes in population are quite similar at the two sides of the pooled FPM cutoffs. Municipalities that eventually cross FPM cutoffs and receive a higher FPM coefficient do not experience on average higher population growth than municipalities that do not cross the population cutoffs. This test further supports our identification design that exploits within-municipality variation on FPM, expenditure, and local economy outcomes.

A.5.2 Falsification Tests

To further evaluate the validity of our analysis, we performed complementary tests following the suggestions in Eggers, Freier, Grembi and Nannicini (2016). First, we undertake a falsification test in which lagged 'treatment' variables are viewed as outcomes in an RDD analysis. Figure A.9a replicates our identification hypothesis, namely that current FPM transfers respond strongly to the allocation mechanism discontinuity as defined by FPM law. Figure A.9b mirrors that but with lagged FPM. Consistent with the view that that municipalities narrowly above the threshold are not more likely to have been above the threshold in the previous year, lagged FPM does not vary abruptly at the cutoff. Figure A.10 and A.11 repeat the exercise for lagged municipal revenues and expenditure. The patterns are similar: there is no jump of revenues and expenditure at the FPM thresholds when one uses lagged values.

A.5.3 Placebo Tests

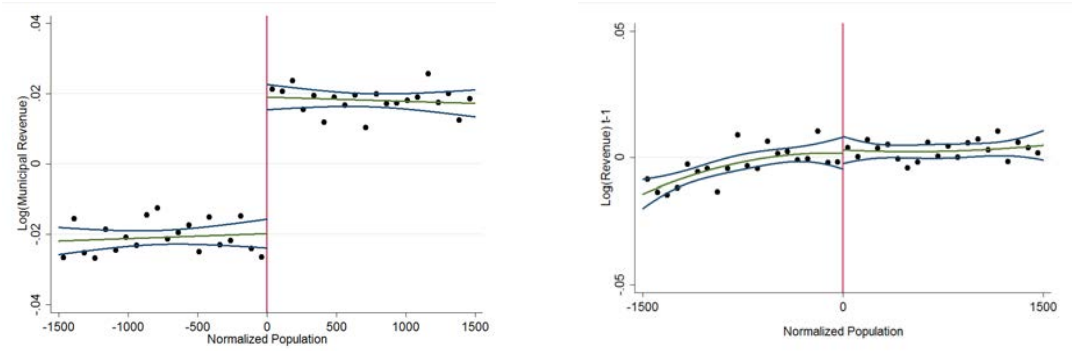
We also conducted placebo tests in which all cutoffs are artificially and counterfactually moved to the right (and left) of the population distribution by 750 inhabitants (and also 500



(a) Current FPM

(b) Lagged FPM

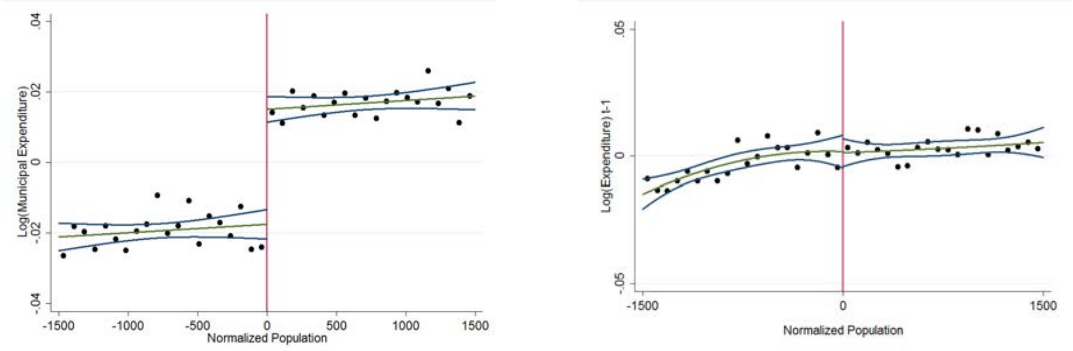
Figure A.9: Current and Lagged FPM Transfers around thresholds



(a) Current Revenues

(b) Lagged Revenues

Figure A.10: Current and Lagged Municipal Revenues around thresholds



(a) Current Expenditure

(b) Lagged Expenditure

Figure A.11: Current and Lagged Municipal Expenditure around thresholds

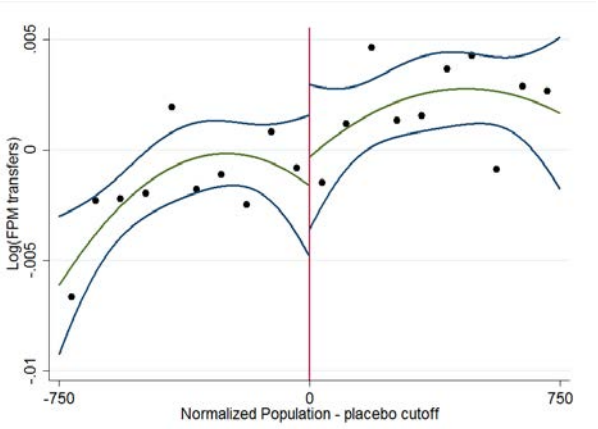


Figure A.12: Standard Placebo Test

and 1000). This is shown in Figure A.12 where we artificially move the FPM cutoffs to the right by 750 inhabitants. FPM Transfers do not jump at the 'fake' discontinuities.

A.6 Sensitivity Analysis

In this section we report results and discuss various perturbations and checks that assess the robustness of our estimates.

Public Sector Labor Market. First, we estimate first-difference specifications to further account for unobserved characteristics. In Appendix Table 11, we report estimates that link local public sector labor market outcomes with law-implied FPM transfers. Columns (1)-(3) report log-difference specifications; columns (4)-(6) refer to OLS difference specifications, while columns (7)-(9) report LAD-differences models. Point estimates from log-differences specifications are around 0.1 and 0.07 for earnings and employment, respectively. These are somewhat smaller than the baseline specification estimates (in log levels reported in Table 6). OLS difference specifications yield positive but imprecise estimates. Yet, when we run "median" regressions to account for extreme values the estimates become significant.

In Appendix Table 12, we report similar estimates separating the effect for 'old-hires', i.e. those who have been hired over one year earlier, and 'new-hires'. A similar pattern to Table 7 albeit more noisy emerges. Estimates from log-differences specification corroborate the view that earnings for both old and new-hires are positively affected by transfers. Most of the aggregate effect seems to come from an increase in average wage of the old-hires and

an increase in the number of new-hires.

Private Sector Labor Market. In Appendix Table 13, we record first-differences specifications for private sector earnings, employment, and average wages. The results are clear-cut and much in line with the baseline estimates (Table 8). Locally exogenous changes in federal transfers significantly affect local private sector earnings and employment. Point estimates from log-differences specifications are around 0.10-0.15, slightly smaller than the ones from our baseline specification (in log levels). OLS and LAD first-difference specifications yield a similar pattern. Increases in regional transfers close to the FPM discontinuities are associated with increases in total private labor income, stemming almost exclusively from a boost in private employment. A benefit of these (non-log) first-differences specifications is that they are easily interpretable. For instance, the OLS estimates imply $2.1 - 2.7$ extra private sector jobs for a $US\$30,000$ increase in spending, comparable to our baseline estimate of $2.5 - 3$ in Table 9. LAD estimates imply somewhat smaller effects.

Excluding Observations around the first threshold. Our empirical strategy assumes that no feature other than federal transfers change abruptly at the FPM discontinuities. As detailed in Section 2, this is the case in our sample of relatively small Brazilian municipalities, with one exception: a 2000 Constitutional amendment –which was enforced in 2005– placed caps on the salaries of local council members and made these caps change discontinuously at some population cutoffs. While most of these population cutoffs for salary cups are only relevant for large cities (not included in our sample), the first cutoff of the FPM transfer allocation mechanism $(10,188)$ is close to the first discontinuity on the salary cap $(10,000)$. Hence we re-estimate our main specifications excluding observations of municipalities around the first cutoff.[48] The results are reported in Appendix Table 14. Although there is strong link between federal transfers and private sector employment in small cities centered around cutoff 1, the coefficients on law-implied transfers resemble closely our first-stage and reduced-form estimates.

Excluding Observations from Census Years. A key identifying assumption is that local authorities should not be in a position to precisely manipulate population estimates so as

[48] Ferraz and Finan (2011) show that higher wages of local politicians triggered by the 2005 change are associated with increased political competition, legislative productivity and public goods provision.

to receive more FPM transfers. Since there is some cross-sectional evidence of manipulation in Census years, we repeated estimation excluding census years (2001, 2008 and 2011). In Appendix Table 15, we report the RD estimates excluding Census years, which comes at a non-negligible efficiency loss as the total number of observations in the sample drops by some 25%. The elasticity of actual and law-implied FPM transfers is still 1. Municipal expenditure also respond to law-implied FPM transfers: the elasticity is around 0.31, similar to the share of FPM transfers to municipal expenditure (Panel A). The estimates on earnings and employment in the public sector (Panel B) are quite similar to the baseline estimates (Table 6). In Panel C, we record the RD estimates for the private sector. The elasticity of earnings with respect to law-implied FPM transfers is around $0.08 - 0.16$, similar to the baseline estimate. The elasticity for private employment is around 0.10, somewhat attenuated and less precisely estimates than the baseline estimate (of 0.15).

Excluding Observations of Municipalities that 'move up' a Population Bracket. In a further sensitivity analysis, we run specifications dropping municipalities that 'move up' into a higher population bracket. In so doing, we restrict our focus exclusively to variation across municipalities that either stay in the same bracket or 'move down' a bracket. This is of particular interest as the notion of potential systematic manipulation is a concern about ('artificial' or at least induced) *increases* in population, as a municipal government that tried to play down its number of inhabitants would receive less federal transfers. In Appendix Table 17, we report estimates that are very similar to the baseline estimates of spending, public/private sector earnings and employment. In addition, Appendix Table 21 confirms that the bulk of the effect comes from employment in the service sector.

Controlling for mayor-specific fixed effects. We address a concern regarding mayors' characteristics such as ability and political connectedness which, if correlated to labor market outcomes, can be potentially problematic for our empirical strategy. Controlling for municipality fixed-effects in this case is unlikely to solve the issue as mayors' terms typically last four years. We proceed to re-estimate our baseline results replacing municipal fixed-effects with mayor-specific fixed-effects in each municipality. This is equivalent to municipality fixed-effects interacted with mayor-term dummies. Appendix Table 18 reports estimates that are very similar to the baseline results of spending and public sector earnings and employment.

Estimates on private sector employment remain positive but become less precisely estimated. In Appendix Table 22, we show a positive and statistically significant effect on employment in the service sector.

Global Regression Discontinuity High-Order Control Function Approach. Some previous works in political economy that exploit the non-linear allocation of federal transfers to Brazilian municipalities apply a regression discontinuity approach that uses all observations, both close and far from the cutoffs. Brollo, Nannicini, Tabellini, and Perotti (2013) condition on high-order polynomials of population estimates to control for the continuous part of the allocation mechanism. While this approach is sensitive to the polynomial order and tends to make inference challenging (Gelman and Imbens, 2014), Appendix Table 16 reports the 'global control function' RD estimates with law-implied FPM transfers and municipal expenditure expressed in logs (Panel A), public sector (Panel B) and private sector (Panel C) labor outcomes. The link between outcomes and law-implied FPM transfers is present when we use observations both close and relatively further away from the seven discontinuities. The estimates tend to be significant and fairly larger than our baseline specifications.

Regional Spillovers. In keeping with other studies on 'local' fiscal multipliers such as Serrato and Wingender (2014), Acconcia, Corsetti, and Simonelli (2014) and Shoag (2012), we examined whether there are regional spillover effects of federal transfers in nearby municipalities. To this end, we augment the baseline specifications with dependent variables aggregated at the regional level (meso-region) net of own-municipality outcomes.[49] The idea is to investigate whether an exogenous change in FPM transfers in a given municipality affects expenditure and labor market outcomes in neighboring cities. The estimates in Appendix Table 19 reveal that spillover effects are statistically indistinguishable from zero. Spillovers may also arise because of labor relocation and migration. Since we do not have data on inter-municipality migration, directly tackling this issue is challenging. Yet, socio-demographic analyses of the Brazilian labor market reveal that the migration trends from small rural areas to large cities that were evident in the 1980s and 1990s slowed down considerably during the 2000s (Brito and Carvalho, 2006; Filho and Horridge, 2010). Furthermore, as our sample

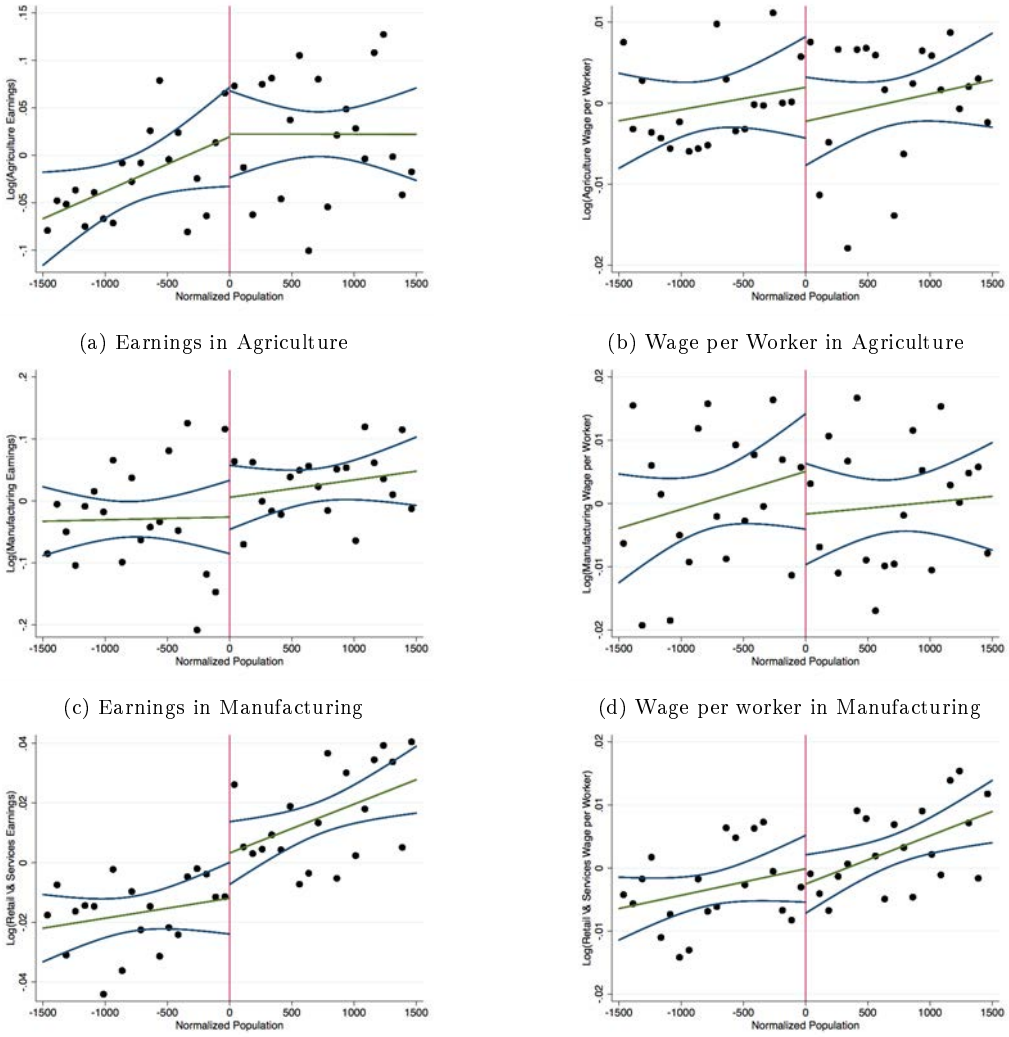
[49] A meso-region is a subdivision of states defined by the IBGE (Brazilian Institute of Geography and Statistics) which congregates a few municipalities in a given geographical area with economic and social similarities. They do not constitute any sort of political or economic entities.

consists of small municipalities (less than 50,000 inhabitants), significant migration between such small cities seems unlikely, especially at annual frequency. Finally, the estimates in this section are also consistent with the view that exogenous shock to local spending do not significantly cause labor reallocation from nearby municipalities.

Delayed Effects. We investigate whether increases in transfers may have a delayed effect on labor market outcomes. In Appendix Table 20, we record coefficients of law-implied transfers at year t on outcomes at year $t+1$. All estimates are positive but insignificant. This is in line with the view that the most of the effect is contemporaneous.

Sector-specific Analysis. We have also examined whether the effect of FPM transfers affect differently the three main sectors of the local economies. As before we estimate specifications in first-differences. Appendix Table 23 reports the log-difference specifications in columns (1)-(3), as well as OLS and LAD difference specifications in (4)-(9). Changes in federal transfers and municipal government spending are significantly correlated with changes in private sector employment and earnings. The magnitudes and significance are very similar to our baseline model estimates in levels reported in Table 10. This pattern is also robust to excluding municipalities that 'move up' a population bracket and including mayor-specific fixed-effects (Appendix Table 21 and 22).

Geography and Size. In Appendix Table 24 - Panel A, we show the link between law-implied and actual FPM transfers (and municipal expenditure) is similar across geographic regions (north and south). The same is true across smaller (Thresholds 1-3) and larger (Threhsolds 4-7) as evidenced by Panel B. We present visual evidence regarding the heterogeneity of the effect of transfers according to geography and size as discussed in section 6 on the main text. Point estimates from Tables 10 and 11 show that federal transfers have a larger and more significant effect on private sector earnings and employment in small municipalities, mainly in the southern areas. Appendix Figures A.14a-A.14b corroborate those findings showing that average earnings and employment change abruptly once southern municipalities cross a threshold, while the jump is less sharp for northern regions. An even more striking pattern is revealed by Appendix Figures A.14c-A.14d in which the effect seems to be concentrated in smaller cities.



(a) Earnings in Agriculture

(b) Wage per Worker in Agriculture

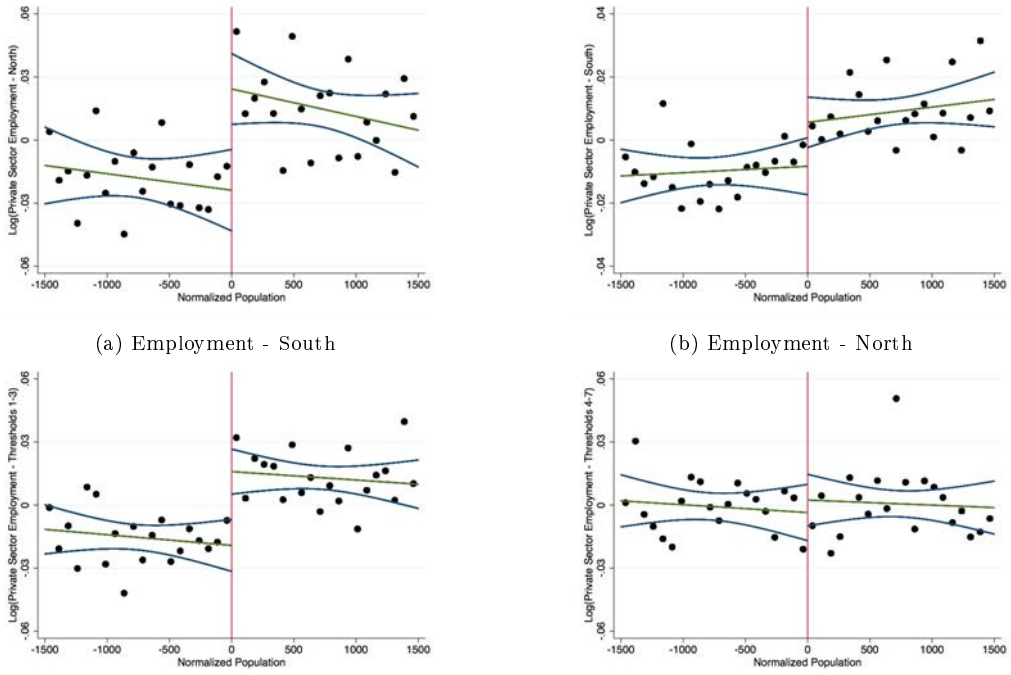
(c) Earnings in Manufacturing

(d) Wage per worker in Manufacturing

(e) Earnings in Services

(f) Wage per Worker in Services

Figure A.13: Private Sector Earnings and Wage per Worker in each sub-sector



(a) Employment - South

(b) Employment - North

(c) Employment - Thresholds 1-3

(d) Employment - Thresholds 4-7

Figure A.14: Private Sector Employment by Geography and Size

Table 1 - Descriptive Evidence

Panel A: Distribution of Municipalities; "Control" and "Treatment" Groups

	No Movement	Bracket	Total
No Movement	1410	1087	2497
›ves to Lower Bracket	93	689	782
Total	1503	1776	3279

Panel B: Municipality Moves to a Higher or Lower Population Bracket by Year

	Movements to a Lower (-) and Higher (+) Population Bracket					
Years	-2	-1	no change	+1	+2	Total
1999	0	33	1,921	90	0	2,044
2000	0	32	2,438	103	0	2,573
2001	0	26	2,528	79	0	2,633
2002	21	202	1,997	455	28	2,703
2003	1	26	2,657	83	1	2,768
2004	0	17	2,536	91	0	2,644
2005	1	37	2,417	194	0	2,649
2006	0	18	2,729	111	0	2,858
2007	0	12	2,752	82	0	2,846
2008	25	281	2,229	315	15	2,865
2009	0	2	2,701	225	0	2,928
2010	0	6	2,851	78	0	2,935
2011	3	139	2,431	256	6	2,835
2012	0	21	2,662	30	0	2,713
2013	0	18	2,749	50	1	2,818
2014	1	5	2,387	261	0	2,654
Total	52	875	39,985	2,503	51	43,466

Panel C: Municipality Moves to a Higher or Lower Population Bracket by Bracket

	Movements to a Lower (-) and Higher (+) Population Bracket					
Brackets	-2	-1	no change	+1	+2	Total
6,793–10,188	0	0	9,813	478	11	10,302
10,189–13,584	0	210	7,614	486	19	8,329
13,585–16,980	9	197	5,477	462	6	6,151
16,981–23,772	22	175	7,823	396	3	8,419
23,773–30,564	1	139	4,305	298	6	4,749
30,565–37,356	6	73	2,683	215	6	2,983
37,357–44,148	8	40	1,732	168	0	1,948
44,149–47,537	6	41	538	0	0	585
Total	52	875	39,985	2,503	51	43.466

Panel A reports the number of municipalities that move across FPM population brackets and the number of municipalities that stay in the same FPM population bracket across the sample period 1999-2014. Panel B and C reports the number of municipalities that stay in the same FPM population bracket and the number of municipalities that move to a higher or lower FPM population bracket per year and per bracket, respectively.

Table 2 - Summary Statistics

Panel A: Population and Public Finance

	Population growth		Sources of Revenue (% of Total)				Income p.c.	Main Categories of Expenditures (% of Total)			
Population Bracket	mean	s.d.	FPM	Local taxes	State	Federal	in 2000	Administration	Education	Health	Housing
6,793–10,188	0,01	0,05	0,33	0,05	0,25	0,13	1850,50	0,17	0,31	0,22	0,09
10,189–13,584	0,01	0,05	0,33	0,05	0,22	0,13	1831,25	0,17	0,33	0,22	0,09
13,585–16,980	0,01	0,05	0,33	0,05	0,22	0,13	1813,63	0,16	0,34	0,23	0,10
16,981–23,772	0,01	0,05	0,31	0,06	0,22	0,14	1878,15	0,16	0,34	0,22	0,09
23,773–30,564	0,01	0,04	0,28	0,07	0,22	0,15	2016,49	0,16	0,35	0,22	0,10
30,565–37,356	0,01	0,05	0,26	0,08	0,23	0,14	2113,95	0,15	0,34	0,23	0,10
37,357–44,148	0,01	0,05	0,24	0,09	0,23	0,15	2134,62	0,15	0,34	0,23	0,10
44,149–47,537	0,01	0,03	0,24	0,09	0,22	0,15	2272,26	0,15	0,34	0,24	0,10
Total	0,011	0,051	0,31	0,06	0,23	0,14	1901,40	0,16	0,33	0,22	0,09

Panel B: Total Earnings per sector in BRL thousands

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	1289	757	258	299	645	1377	1431	3174	1081	1496
10,189–13,584	1719	956	338	384	905	2072	1899	3907	1626	2363
13,585–16,980	2201	1308	423	470	936	2102	2710	6388	2358	3040
16,981–23,772	2923	1721	571	657	1327	2673	4088	7777	3583	4351
23,773–30,564	3839	2451	749	968	1494	2887	5647	10135	5657	7397
30,565–37,356	4864	2687	936	999	2266	4242	8267	13254	8899	9804
37,357–44,148	5596	3085	1024	1039	2634	4938	11412	15707	11599	12129
44,149–47,537	6420	3420	1152	1241	2793	5358	13471	19230	14426	16549
Total	3606	2048	681	757	1625	3206	6116	9947	6154	7141

Panel C: Employment per sector

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	245	106	48	53	141	244	238	444	203	242
10,189–13,584	324	132	61	67	191	342	324	587	308	401
13,585–16,980	403	159	76	84	202	334	431	765	437	511
16,981–23,772	520	208	99	106	287	474	635	1039	658	701
23,773–30,564	657	267	129	152	330	502	856	1300	1041	1197
30,565–37,356	801	297	157	162	434	661	1179	1630	1568	1478
37,357–44,148	894	310	175	176	536	772	1609	1880	2045	1742
44,149–47,537	1008	341	196	200	577	832	1934	2209	2526	2253
Total	607	228	118	125	337	520	901	1232	1098	1066

Panel D: Yearly Wage per worker in BRL

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	5216	1869	5407	2443	3825	1296	5746	3896	4970	1645
10,189–13,584	5279	1959	5538	2626	3815	1380	5537	3422	5002	1565
13,585–16,980	5366	2051	5579	2594	3763	1375	5438	3212	5081	1565
16,981–23,772	5548	2154	5756	2681	3859	1556	5683	3418	5133	1548
23,773–30,564	5698	2360	5785	2731	3868	1469	5931	3607	5007	1355
30,565–37,356	5962	2299	6021	2717	4214	1828	6119	3520	5166	1359
37,357–44,148	6103	2431	5925	2529	4117	1766	6370	4246	5137	1343
44,149–47,537	6257	2298	6041	2560	4022	1301	6007	2915	5077	1143
Total	5679	2178	5757	2610	3935	1496	5854	3530	5072	1440

The table gives summary statistics for the main variables employed in the empirical analysis. The sample includes 43,466 yearly observations covering 3,279 Brazilian municipalities over the period 1999-2014. Panel A reports the mean and standard deviation of three sets of variables per population bracket: municipal population growth, sources of municipal revenue as a share of total, income per capita according to the 2000 census and types of expenditure. Sources of municipal revenue include FPM transfers, local tax revenue which include ISS (service tax) and IPTU (property tax), state-level government transfers and federal-level government transfers (net of FPM) to municipalities. Panel B-D report summary statistics on municipal public and private sector labor markets outcomes, by employee tenure (old or new hires) and by sub-sector (Agriculture, Manufacturing and Services), respectively. Panel B-D on reports total earnings, total employment and wage per worker, respectively.

Table 3 - Actual and Law-Implied FPM Transfers

OLS, Fixed-Effect and LAD (Median) Estimates

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	PANEL A: Estimates without Fixed-Effects						
Actual FPM	1.010***	1.003***	1.001***	0.995***	1.010***	1.009***	1.008***
OLS estimates	(0,003)	(0,005)	(0,005)	(0,005)	(0,007)	(0,007)	(0,009)
within (marginal) R2	0,93	0,92	0,92	0,91	0,86	0,86	0,83
Log Actual FPM	1.012***	0.980***	0.973***	0.966***	0.990***	0.981***	0.976***
OLS estimates	(0,003)	(0,007)	(0,007)	(0,007)	(0,010)	(0,009)	(0,011)
within (marginal) R2	0,92	0,89	0,89	0,88	0,84	0,83	0,83
Actual FPM	1.010***	1.003***	1.001***	0.995***	1.007***	1.007***	1.007***
LAD estimates	(0,003)	(0,005)	(0,005)	(0,005)	(0,001)	(0,001)	(0,001)
	PANEL B: Fixed-Effect Estimates						
Actual FPM	1.025***	1.015***	1.012***	1.002***	1.018***	1.016***	1.012***
OLS estimates	(0,004)	(0,006)	(0,005)	(0,007)	(0,007)	(0,008)	(0,010)
within (marginal) R2	0,993	0,992	0,993	0,993	0,992	0,993	0,993
Log Actual FPM	1.020***	0.979***	0.976***	0.965***	0.981***	0.975***	0.966***
OLS estimates	(0,006)	(0,008)	(0,007)	(0,008)	(0,009)	(0,009)	(0,011)
within (marginal) R2	0,99	0,989	0,989	0,99	0,989	0,989	0,99
Observations	43466	11349	8471	5663	11349	8471	5663
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual municipal FPM transfers to law-implied FPM Transfers. The table reports estimates from 5 specifications. Panel A reports estimates without fixed-effects. Row (1) reports OLS coefficient estimates when both the dependent and the independent variable are expressed in levels (no transformation). Row (2) reports OLS coefficient estimates when both actual FPM transfers (the dependent variable) and law-implied transfers (the independent variable) are expressed in logs. Row (3) reports least-absolute-deviation (median) estimates associating actual FPM transfers with law-implied FPM transfers in levels. PANEL B - rows (4) and (5) repeat specifications in (1) and (2) with fixed-effects. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). The table also reports the within (marginal) R2. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 4 - Municipal Revenue and Expenditure around the FPM Cutoffs

OLS Fixed-Effect and LAD (Median) Estimates

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A - Municipal Revenue					
Level-OLS with FE	2.599***	1.548***	1.271***	1.197***	0.781***	0.597**	0.694***
	(0,147)	(0,156)	(0,177)	(0,185)	(0,289)	(0,293)	(0,239)
Log-OLS with FE	0.499***	0.381***	0.345***	0.355***	0.370***	0.354***	0.365***
	(0,015)	(0,016)	(0,018)	(0,022)	(0,021)	(0,023)	(0,027)
LAD (median)	2.297***	1.212***	1.160***	0.949***	0.897***	1.015***	0.917***
	(0,079)	(0,127)	(0,133)	(0,179)	(0,199)	(0,208)	(0,317)
		PANEL B - Municipal Expenditure					
Level-OLS with FE	2.327***	1.358***	1.081***	0.918***	0.708***	0.536***	0.567***
	(0,129)	(0,129)	(0,141)	(0,161)	(0,190)	(0,206)	(0,207)
Log-OLS with FE	0.469***	0.338***	0.304***	0.299***	0.319***	0.308***	0.308***
	(0,015)	(0,017)	(0,018)	(0,023)	(0,022)	(0,024)	(0,029)
LAD (median)	2.254***	1.089***	0.910***	0.907***	0.637***	0.727***	0.809***
	(0,074)	(0,131)	(0,141)	(0,166)	(0,173)	(0,220)	(0,269)
Observations	43460	11347	8470	5662	11347	8470	5662
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating municipal public finance variables to law-implied FPM Transfers. Panel A reports estimates for municipal revenues as the dependent variable and Panel B for municipal expenditure. Row (1) in each panel reports OLS coefficient estimates when both the dependent and the independent variable are expressed in levels (no transformation). Row (2) reports OLS coefficient estimates when both variables are expressed in logs. Row (3) reports least-absolute-deviation (median) estimates. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 5 - Other Sources of Municipal Revenue around the FPM Cutoffs

OLS Fixed-Effect and LAD (Median) Estimates

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: State-level government transfers					
Level-OLS with FE	0.396***	0,059	0,005	-0,004	-0,077	-0,093	-0,005
	(0,075)	(0,066)	(0,074)	(0,076)	(0,079)	(0,084)	(0,102)
Log-OLS with FE	0.198***	0.077**	0,055	0,006	0,051	0,033	0,029
	(0,031)	(0,033)	(0,037)	(0,047)	(0,039)	(0,044)	(0,055)
LAD (median)	0.199***	0,020	-0,015	-0,079	-0,114	-0,105	-0,084
	(0,036)	(0,049)	(0,062)	(0,067)	(0,100)	(0,108)	(0,118)
		PANEL B: Federal-level government transfers (net of FPM)					
Level-OLS with FE	0.215***	-0,008	-0,067	-0,013	-0,301	-0,358	-0,124
	(0,056)	(0,086)	(0,110)	(0,090)	(0,184)	(0,191)	(0,161)
Log-OLS with FE	0.257***	0,063	0,043	0,020	0,031	0,013	-0,006
	(0,048)	(0,074)	(0,086)	(0,089)	(0,090)	(0,104)	(0,116)
LAD (median)	0.242***	0.0606***	0,026	0,013	0,008	0,012	0,017
	(0,015)	(0,023)	(0,028)	(0,034)	(0,035)	(0,040)	(0,054)
		PANEL C: Local tax revenues					
Level-OLS with FE	0.294***	0.145***	0.103**	0,064	0,008	-0,021	-0,043
	(0,041)	(0,047)	(0,048)	(0,064)	(0,053)	(0,050)	(0,077)
Log-OLS with FE	0.212***	0.104*	0,087	0,042	0.134**	0,081	0,093
	(0,045)	(0,054)	(0,058)	(0,065)	(0,067)	(0,069)	(0,083)
LAD (median)	0.0959***	0,014	-0,005	-0,032	-0,030	-0,025	-0,028
	(0,016)	(0,023)	(0,024)	(0,026)	(0,037)	(0,040)	(0,042)
Observations	43460	11347	8470	5662	11347	8470	5662
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating other sources of municipal revenue (apart from FPM transfers) to law-implied FPM Transfers. Panel A reports estimates for state-level government transfers as the dependent variable, Panel B reports estimates for federal-level government transfers (net of FPM) and Panel C reports estimates for revenues from local taxes which includes ISS (service tax) and IPTU (property tax). Row (1) in each panel reports OLS coefficient estimates when both the dependent and the independent variable are expressed in levels (no transformation). Row (2) reports OLS coefficient estimates when both variables are expressed in logs. Row (3) reports least-absolute-deviation (median) estimates. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 6 - Earnings, Employment and Average Wage in the Public Sector

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log (Total Earnings)	0.394***	0.233***	0.226***	0.217***	0.261***	0.210***	0.258***
	(0,031)	(0,033)	(0,034)	(0,043)	(0,040)	(0,045)	(0,057)
log (Employment)	0.336***	0.155***	0.147***	0.121***	0.174***	0.114***	0.150***
	(0,028)	(0,030)	(0,033)	(0,040)	(0,038)	(0,043)	(0,052)
log (Wage per Worker)	0.047***	0.050***	0.036*	0,024	0.0532**	0.0549**	0.0544**
	(0,015)	(0,017)	(0,019)	(0,022)	(0,022)	(0,023)	(0,027)
Observations	43441	11344	8467	5661	11344	8467	5661
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating municipal public sector labor market outcomes to law-implied FPM Transfers. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 7 - Earnings, Employment and Average Wage in the Public Sector according to Tenure

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: Old Hires from previous years					
log (Total Earnings)	0.370***	0.191***	0.170***	0.169***	0.184***	0.166***	0.198***
	(0,034)	(0,033)	(0,036)	(0,045)	(0,041)	(0,047)	(0,058)
log (Employment)	0.305***	0.085***	0.064*	0,033	0,0608	0,0351	0,0454
	(0,032)	(0,032)	(0,038)	(0,045)	(0,039)	(0,047)	(0,056)
log (Wage per Worker)	0.050***	0.063***	0.049**	0.050**	0.075***	0.074***	0.087***
	(0,016)	(0,018)	(0,020)	(0,022)	(0,022)	(0,024)	(0,027)
		PANEL B: New Hires in current year					
log (Total Earnings)	0.502***	0.486***	0.670***	0.647***	0.628***	0.592***	0.703***
	(0,084)	(0,135)	(0,159)	(0,192)	(0,165)	(0,197)	(0,246)
log (Employment)	0.430***	0.401***	0.525***	0.427**	0.495***	0.431**	0.515**
	(0,075)	(0,125)	(0,151)	(0,185)	(0,155)	(0,190)	(0,238)
log (Wage per Worker)	0.0447*	0,00249	-0,0232	-0,0424	0,0184	-0,0311	-0,0533
	(0,025)	(0,042)	(0,052)	(0,059)	(0,058)	(0,066)	(0,075)
Observations	42773	11123	8287	5522	11123	8287	5522
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating municipal public sector labor market outcomes to law-implied FPM Transfers according to job tenure. Panel A focus on Old Hires (current employees hired in previous years) and Panel B focus on New Hires (hired in current year). Rows (1)-(3) in each panel reports fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 8 - FPM Transfers and Private Sector Labor Market Outcomes
Earnings, Employment and Average Wage

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Panel A: Reduced-Form Estimates					
log (Total Earnings)	0.339***	0.154***	0.144***	0.101*	0.190***	0.177***	0.184**
	(0,042)	(0,044)	(0,049)	(0,059)	(0,053)	(0,060)	(0,074)
log (Employment)	0.286***	0.168***	0.139***	0.093*	0.211***	0.163***	0.152**
	(0,044)	(0,045)	(0,047)	(0,055)	(0,055)	(0,060)	(0,069)
log (Average Wage)	0.057***	0,022	0.053**	0,0274	0,019	0.057*	0.059*
	(0,019)	(0,022)	(0,024)	(0,028)	(0,027)	(0,032)	(0,033)
		Panel B: Fuzzy RD (IV) Estimates					
log (Total Earnings)	0.332***	0.158***	0.148***	0.104*	0.193***	0.182***	0.191***
	(0,041)	(0,044)	(0,048)	(0,059)	(0,053)	(0,060)	(0,073)
log (Employment)	0.280***	0.172***	0.143***	0.097*	0.215***	0.167***	0.158**
	(0,043)	(0,045)	(0,047)	(0,054)	(0,055)	(0,060)	(0,068)
log (Average Wage)	0.056***	0,0224	0.054**	0,0284	0,019	0.059*	0.061*
	(0,019)	(0,022)	(0,024)	(0,027)	(0,027)	(0,032)	(0,033)
Observations	43425	11328	8451	5645	11328	8451	5645
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating municipal private sector labor market outcomes to actual/law-implied FPM Transfers. Panel A exhibits reduced-form estimates with law-implied FPM transfers as the main regressor. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. Panel B reports fuzzy RD (IV) estimates with actual FPM transfers instrumented by law-implied transfers. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 9 - Federal Transfer Employment Multiplier
Cost of a job in the Public and Private Sector (4% and 3% local samples)

	no polynomial				1st-order polynomial			
	IV-Fuzzy RD coefficient		Jobs Created per BRL 30,000		IV-Fuzzy RD coefficient		Jobs Created per BRL 30,000	
bandwidth	<4%	<3%	<4%	<3%	<4%	<3%	<4%	<3%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PANEL A: Public vs Private Sector								
Public-Sector	0,155	0,147	0,99	0,94	0,174	0,114	1,11	0,73
	(0,030)	(0,033)	(0,192)	(0,211)	(0,038)	(0,043)	(0,240)	(0,276)
Private-Sector	0,172	0,143	3,01	2,51	0,215	0,167	3,77	2,93
	(0,045)	(0,047)	(0,286)	(0,824)	(0,055)	(0,060)	(0,348)	(1,044)
PANEL B: Cost of a Job and Income Multiplier								
Cost of a Job in BRL_{1998}			7495	8712			6151	8211
Output Multiplier			2,12	1,83			2,59	1,94

Panel A reports IV-Fuzzy RD coefficients of the impact of actual FPM trasfers instrumented by law-implied transfers on employment in the public and private sector. Columns (1)-(2) and (5)-(6) report local estimate in the neighborhood of 4% and 3%, respectively, without and with a rectangular kernel on normalized population. Columns (3)-(4) and (7)-(8) report the equivalent number of jobs created by a transfer of 30,000 Brazilian Reais in 1998 prices (equivalent to USD in 2016 prices) using the standard elasticity formula. Panel B calculates the corresponding estimated cost of a job for the different specifications and the associated implied output multiplier. The mapping from emplyment estimated to output multiplier is described in section 5.2. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 10 - Reduced-form Estimates by Type of Activity
Earnings, Employment and Average Wage in Agriculture, Manufacturing and Retail & Services

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Agriculture			
log (Total Earnings)	0.744***	0,181	0,086	0,018	0,237	0,015	-0,309
	(0,185)	(0,232)	(0,239)	(0,289)	(0,307)	(0,298)	(0,380)
log (Employment)	0.374***	0.147*	0,072	0,030	0,141	0,059	-0,094
	(0,069)	(0,085)	(0,088)	(0,100)	(0,105)	(0,108)	(0,131)
log (Average Wage)	-0,003	-0.0540**	-0,030	-0,044	-0,026	0,000	-0,002
	(0,019)	(0,026)	(0,023)	(0,029)	(0,034)	(0,028)	(0,033)
				Manufacturing			
log (Total Earnings)	0.544***	0,268	0,482	0,086	0,420	0,580	0,104
	(0,189)	(0,283)	(0,312)	(0,397)	(0,343)	(0,389)	(0,471)
log (Employment)	0.336***	0,149	0,182	0,091	0.272**	0,250	0,191
	(0,085)	(0,105)	(0,126)	(0,150)	(0,126)	(0,155)	(0,192)
log (Average Wage)	0,041	0,009	0,018	-0,016	-0,037	-0,019	-0,009
	(0,028)	(0,040)	(0,044)	(0,052)	(0,052)	(0,054)	(0,060)
				Retail & Services			
log (Total Earnings)	0.513***	0.173***	0.150***	0.149**	0.163***	0.162***	0.207***
	(0,065)	(0,047)	(0,050)	(0,058)	(0,057)	(0,062)	(0,072)
log (Employment)	0.320***	0.143***	0.116**	0.124**	0.132**	0.120**	0.176**
	(0,047)	(0,044)	(0,046)	(0,055)	(0,054)	(0,060)	(0,070)
log (Average Wage)	0.105***	0,027	0,028	-0,006	0,024	0,032	0,011
	(0,020)	(0,023)	(0,025)	(0,027)	(0,026)	(0,029)	(0,033)
Observations	43425	11328	8451	5645	11328	8451	5645
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating municipal private sector labor market outcomes to law-implied FPM Transfers according to the type of activity. Panel A-C report estimates on Agriculture, Manufacturing and Services. Rows (1)-(3) in each panel reports fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 11 - Heterogeneity Analysis across Geographic Regions
Earnings, Employment and Average Wage in the Private Sector

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				PANEL A: Total Earnings			
South	0.297***	0.174***	0.160***	0.162***	0.207***	0.191***	0.239***
	(0,050)	(0,050)	(0,056)	(0,061)	(0,060)	(0,067)	(0,072)
North	0.388***	0.129*	0,123	0,013	0.166**	0.157*	0,0991
	(0,067)	(0,077)	(0,086)	(0,106)	(0,082)	(0,093)	(0,119)
				PANEL B: Employment			
South	0.278***	0.179***	0.147***	0.136**	0.220***	0.170***	0.191***
	(0,048)	(0,045)	(0,048)	(0,053)	(0,054)	(0,057)	(0,063)
North	0.295***	0.154*	0,129	0,032	0.198**	0,153	0,093
	(0,075)	(0,085)	(0,090)	(0.102)	(0,092)	(0.101)	(0.116)
				PANEL C: Wage per Worker			
South	0,019	0,014	0.0387*	0,026	0,011	0,044	0.0563**
	(0,018)	(0,019)	(0,021)	(0,022)	(0,023)	(0,028)	(0,027)
North	0.101***	0,033	0,071	0,029	0,030	0,077	0,063
	(0,037)	(0,044)	(0,047)	(0,055)	(0,048)	(0,054)	(0.0597)
Observations	43425	11328	8451	5645	11328	8451	5645
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression heterogeneity estimates associating municipal private sector labor market outcomes to law-implied FPM Transfers according to geography. Panel A-C report estimates on Total Earnings, Employment and Wage per Worker. Rows (1) and (2) in each panel reports fixed-effect OLS coefficient estimates for municipalities in the South and North. Appendix Table 1 reports how each state has been classified as South or North. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Table 12 - Heterogeneity Analysis across Municipality Size
Earnings, Employment and Average Wage in the Private Sector

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: Total Earnings					
Thresholds 1-3	0.172***	0.172***	0.157***	0,105	0.191***	0.177***	0.177**
	(0,051)	(0,051)	(0,057)	(0,070)	(0,055)	(0,061)	(0,075)
Thresholds 4-7	0,094	0,094	0,099	0,083	0,161	0,174	0.336**
	(0,082)	(0,082)	(0,089)	(0,099)	(0,104)	(0,123)	(0,140)
		PANEL B: Employment					
Thresholds 1-3	0.308***	0.207***	0.167***	0.116*	0.218***	0.168***	0.153**
	(0,046)	(0,052)	(0,056)	(0,064)	(0,056)	(0,061)	(0,070)
Thresholds 4-7	0.177**	0,034	0,043	0,008	0,074	0,049	0,137
	(0,072)	(0,071)	(0,074)	(0,091)	(0,094)	(0,111)	(0,128)
		PANEL C: Wage per Worker					
Thresholds 1-3	0.0540***	0,004	0,044	0,021	0,014	0.0542*	0,054
	(0,021)	(0,026)	(0,030)	(0,033)	(0,028)	(0,033)	(0,034)
Thresholds 4-7	0.0700**	0.0831**	0.0822*	0,052	0.115**	0.120**	0.169***
	(0,031)	(0,036)	(0,042)	(0,042)	(0,051)	(0,058)	(0,064)
Observations	43425	11328	8451	5645	11328	8451	5645
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression heterogeneity estimates associating municipal private sector labor market outcomes to law-implied FPM Transfers according to municipal population size. Panel A-C report estimates on Total Earnings, Employment and Wage per Worker. Rows (1) and (2) in each panel reports fixed-effect OLS coefficient estimates for municipalities around thresholds 1-3 (6,793-20,376 inhabitants) and thresholds 4-7 (6,793-47,537 inhabitants). Appendix Table 2 reports local sample sizes for each threshold bracket for a 4%-bandwidth. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 1 - Descriptive Statistics

State Name	FPM State Coefficient	Macro Region	IBGE-defined regions	Number of Municipalities	Number of Observations	Mean Municipal Population
Espírito Santo	1,76	South	Southeast	64	964	18438
Minas Gerais	14.185	South	Southeast	449	6,203	16367
Rio de Janeiro	2.738	South	Southeast	59	794	21100
São Paulo	14.262	South	Southeast	327	4,528	19779
Paraná	7.286	South	South	227	3,232	16655
Rio Grande do Sul	7.301	South	South	187	2,619	17192
Santa Catarina	4,2	South	South	144	1,984	15991
Goiás	3.732	South	Center-West	113	1,485	17310
Mato Grosso do Sul	1,5	South	Center-West	58	856	18235
Mato Grosso	1.895	South	Center-West	84	1,101	16923
Alagoas	2.088	North	Northeast	83	1,086	19508
Bahia	9,27	North	Northeast	367	4,944	19004
Ceará	4.586	North	Northeast	153	1,965	21829
Maranhão	3.972	North	Northeast	169	1,700	20921
Paraíba	3.194	North	Northeast	115	1,530	15296
Pernambuco	4.795	North	Northeast	152	2,138	20757
Piauí	2.402	North	Northeast	90	1,097	16318
Rio Grande do Norte	2.432	North	Northeast	90	1,176	14784
Sergipe	1.334	North	Northeast	51	751	17728
Acre	0,263	North	North	17	180	18150
Amazonas	1.245	North	North	56	653	21901
Amapá	0,139	North	North	9	94	15450
Pará	3.295	North	North	116	1,181	24457
Rondônia	0,746	North	North	40	534	18660
Roraima	0,085	North	North	13	109	13456
Tocantins	1.296	North	North	46	562	13910

The table reports the number of municipalities and municipality-years (observations) per state in our 1999-2014 sample. Macro Regions are a classification defined by the authors. State FPM share is the predetermined share of the FPM funds each state receives every year.

Appendix Table 2 - Distribution of Municipalities around Each Discontinuity

Panel A: Full Sample

Population Intervals	threshold 1 6793-11886		threshold 2 11887-15282		threshold 3 15283-20376		threshold 4 20377-27168		threshold 5 27169-33960		threshold 6 33961-40752		threshold 7 40753-47537	
year	below	above	below	above	below	above	below	above	below	above	below	above	below	above
1999	489	236	162	172	129	236	149	133	89	79	51	52	34	33
2000	619	291	204	219	147	299	191	171	111	106	65	58	49	43
2001	626	289	218	216	160	309	205	164	119	102	70	66	51	38
2002	639	289	230	219	165	320	183	191	127	107	74	60	61	38
2003	670	287	248	213	169	329	191	184	140	99	75	62	59	42
2004	634	262	234	214	162	306	204	162	141	103	64	60	61	37
2005	636	256	231	206	157	310	210	147	147	112	66	68	64	39
2006	690	273	238	233	162	335	227	171	150	114	81	72	66	46
2007	690	261	231	232	171	324	234	166	153	111	90	66	65	52
2008	629	360	198	262	159	347	212	196	120	126	75	89	38	54
2009	668	332	220	250	173	347	223	197	118	125	86	80	59	50
2010	677	317	229	251	175	342	226	201	117	132	84	69	62	53
2011	597	402	178	252	145	351	208	198	103	140	73	85	49	54
2012	585	372	173	242	139	329	212	175	105	130	74	69	57	51
2013	617	369	196	243	146	337	231	190	100	133	77	76	57	46
2014	564	323	201	220	150	305	220	194	105	124	79	69	56	44
Total	10,030	4,919	3,391	3,644	2,509	5,126	3,326	2,840	1,945	1,843	1,184	1,101	888	720

Appendix Table 2 - Distribution of Municipalities around Each Discontinuity (cont.)

Panel B: Restricted Sample in the Neighborhood of the FPM Cutoffs (<4%)

Population Intervals	threshold 1 9780-10596		threshold 2 13041-14127		threshold 3 15283-20376		threshold 4 22821-24723		threshold 5 29341-31787		threshold 6 35862-38850		threshold 7 42382-45914	
year	below	above	below	above	below	above	below	above	below	above	below	above	below	above
1999	55	69	54	61	43	52	38	47	23	37	18	19	14	17
2000	60	82	55	75	59	76	47	56	35	46	27	27	23	17
2001	58	80	75	64	56	74	53	54	41	43	27	32	26	14
2002	53	90	78	80	61	71	39	66	40	47	35	28	26	18
2003	61	91	86	73	67	70	40	62	53	36	39	33	28	22
2004	64	75	68	72	70	68	55	61	49	33	36	33	28	16
2005	67	62	68	62	65	64	48	48	40	44	19	33	28	20
2006	61	64	73	83	61	77	49	48	43	40	30	32	31	24
2007	71	56	70	82	65	67	53	47	49	37	41	27	31	29
2008	26	144	47	115	47	96	37	73	40	63	29	43	19	36
2009	55	49	60	60	72	57	54	49	43	42	34	27	28	18
2010	56	47	61	55	62	50	45	61	37	45	37	24	22	21
2011	31	158	46	111	49	100	33	77	21	70	22	41	21	30
2012	41	129	52	92	50	89	54	58	22	62	27	36	25	26
2013	46	129	57	91	49	82	67	54	23	63	30	34	26	23
2014	49	63	53	62	57	59	60	57	41	35	37	29	25	30
Total	854	1,388	1,003	1,238	933	1,152	772	918	600	743	488	498	401	361

Panel A gives the count of observations per year (municipalities-year) in our sample below and above each of the seven FPM population thresholds (10188, 13584, 16980, 23772, 30564, 37356 and 44148) for the full sample. Panel B restricts the sample within a 4%-neighbourhood of the closest threshold.

Appendix Table 3 - Descriptive Evidence
Restricted Sample in the Neighborhood of the FPM Cutoffs (<4%)

Panel A: Distribution of Municipalities; "Control" and "Treatment" Groups

	No Movement	Bracket	Total
No Movement	705	1,140	1,845
›ves to Lower Bracket	133	327	460
Total	838	1,467	2,305

Panel B: Municipality Moves to a Higher or Lower Population Bracket by Year

	Movements to a Lower (-) and Higher (+) Population Bracket					
Years	-2	-1	no change	+1	+2	Total
1999	0	32	428	87	0	2,044
2000	0	30	555	100	0	2,573
2001	0	22	601	74	0	2,633
2002	7	95	419	197	14	2,703
2003	0	25	656	79	1	2,768
2004	0	14	627	87	0	2,644
2005	1	29	491	147	0	2,649
2006	0	16	595	105	0	2,858
2007	0	11	636	78	0	2,846
2008	8	104	495	196	12	2,865
2009	0	2	442	204	0	2,928
2010	0	6	540	77	0	2,935
2011	2	78	533	193	4	2,835
2012	0	20	713	30	0	2,713
2013	0	17	710	47	0	2,818
2014	1	2	432	222	0	2,654
Total	19	503	8,873	1,923	31	11,349

Panel C: Municipality Moves to a Higher or Lower Population Bracket by Bracket

	Movements to a Lower (-) and Higher (+) Population Bracket					
Years	-2	-1	no change	+1	+2	Total
6,793–10,188	0	0	732	328	8	1,068
10,189–13,584	0	123	1,940	382	10	2,455
13,585–16,980	2	113	1,678	339	2	2,134
16,981–23,772	10	100	1,497	297	1	1,905
23,773–30,564	0	73	1,175	244	5	1,497
30,565–37,356	4	43	958	178	5	1,188
37,357–44,148	1	29	697	155	0	882
44,149–47,537	2	22	196	0	0	220
Total	19	503	8,873	1,923	31	11,349

This Table mirrors Table 1 for a restricted sample within a 4%-neighbourhood of the closest threshold. Panel A reports the number of municipalities that move across FPM population brackets and the number of municipalities that stay in the same FPM population bracket across the sample period 1999-2014. Panel B and C reports the number of municipalities that stay in the same FPM population bracket and the number of municipalities that move to a higher or lower FPM population bracket per year and per bracket, respectively.

Appendix Table 4 - Summary Statistics
Restricted Sample in the Neighborhood of the FPM Cutoffs (<4%)

Panel A: Population and Public Finance

	Population growth		Sources of Revenue (% of Total)				Income p.c.	Main Categories of Expenditures (% of Total)			
Population Bracket	mean	s.d.	FPM	Local taxes	State	Federal	in 2000	Public Admin	Education	Health	Housing
6,793–10,188	0,010	0,052	0,31	0,06	0,24	0,14	3724	0,16	0,32	0,22	0,09
10,189–13,584	0,012	0,053	0,33	0,05	0,23	0,13	3632	0,16	0,33	0,22	0,09
13,585–16,980	0,014	0,049	0,33	0,05	0,22	0,13	3726	0,16	0,34	0,22	0,09
16,981–23,772	0,011	0,046	0,31	0,06	0,22	0,14	3738	0,16	0,34	0,22	0,09
23,773–30,564	0,012	0,042	0,28	0,07	0,23	0,14	3862	0,16	0,34	0,22	0,10
30,565–37,356	0,012	0,042	0,26	0,08	0,23	0,14	4283	0,15	0,34	0,23	0,10
37,357–44,148	0,014	0,040	0,24	0,08	0,23	0,15	4573	0,15	0,34	0,23	0,10
44,149–47,537	0,015	0,037	0,24	0,09	0,22	0,15	4568	0,15	0,35	0,24	0,10
Total	0,012	0,047	0,30	0,06	0,22	0,14	3815	0,16	0,34	0,22	0,09

Panel B: Earnings per sector in BRL thousands

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Retail & Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	1423	903	283	381	679	1675	1638	3746	1255	1550
10,189–13,584	1710	1008	340	391	829	1896	1927	4085	1604	2259
13,585–16,980	2159	1260	418	479	894	1945	2531	6608	2292	3149
16,981–23,772	2859	1730	581	634	1220	2124	3563	6957	3415	4209
23,773–30,564	3771	2401	676	755	1459	2439	5545	9747	5633	7138
30,565–37,356	4690	2672	917	1005	2240	4360	8389	14200	8417	9697
37,357–44,148	5559	3093	1040	1020	2755	5634	11900	16100	11400	11600
44,149–47,537	6496	3576	1133	1132	2832	6234	13600	20000	13800	18000
Total	3034	2408	584	7312	1350	3083	4649	10180	4463	7496

Panel C: Employment per sector

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	277	125	52	59	151	301	270	507	244	297
10,189–13,584	321	142	61	67	181	318	331	618	310	409
13,585–16,980	398	152	75	79	196	337	407	754	429	540
16,981–23,772	509	213	102	106	279	408	572	962	639	704
23,773–30,564	650	266	120	130	327	442	839	1289	1050	1226
30,565–37,356	783	298	155	163	428	659	1205	1717	1496	1455
37,357–44,148	887	321	179	169	552	843	1695	1989	2029	1715
44,149–47,537	1023	352	195	193	576	928	1964	2328	2372	2238
Total	526	305	102	121	286	500	705	1271	813	1170

Panel D: Yearly Wage per worker in BRL

	Public Sector				Private Sector					
	Old Hires		New Hires		Agriculture		Manufacturing		Retail & Services	
Population Bracket	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
6,793–10,188	5104	1832	5423	2513	3681	1304	5948	5729	4984	1736
10,189–13,584	5291	1918	5548	2583	3765	1324	5580	3438	4973	1576
13,585–16,980	5340	2061	5489	2474	3752	1341	5357	3040	5059	1578
16,981–23,772	5500	2104	5700	2543	3752	1684	5681	3190	5110	1506
23,773–30,564	5670	2314	5665	2693	3874	1560	5861	3292	5002	1349
30,565–37,356	5905	2258	5937	2552	4227	1955	5947	3300	5088	1298
37,357–44,148	6092	2393	5927	2507	4101	1691	6253	3533	5124	1397
44,149–47,537	6266	2414	5968	2583	4037	1343	6138	3337	5080	1173
Total	5535	2143	5657	2561	3870	1544	5736	3529	5045	1495

This table mirrors table 1 for a restricted sample within a 4%-neighbourhood of the closest threshold. Summary statistics for the main variables employed in the empirical analysis are reported. The sample includes 11,349 yearly observations covering 2,305 Brazilian municipalities over the period 1999-2014. Panel A reports the mean and standard deviation of three sets of variables per population bracket: municipal population growth, sources of municipal revenue as a share of total, income per capita according to the 2000 census and types of expenditure. Sources of municipal revenue include FPM transfers, local tax revenue which include ISS (service tax) and IPTU (property tax), state-level government transfers and federal-level government transfers (net of FPM) to municipalities. Panel B-D report summary statistics on municipal public and private sector labor markets outcomes, by employee tenure (old or new hires) and by sub-sector (Agriculture, Manufacturing and Services), respectively. Panel B-D on reports total earnings, total employment and wage per worker, respectively.

Appendix Table 5 - Actual and Law-Implied FPM Transfers

Specification in Differences - OLS and LAD local estimates

	log-differences			OLS-differences			LAD-differences		
bandwidth	<4%	<3%	<2%	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Law-Implied FPM	0.937***	0.944***	0.937***	0.984***	0.989***	0.985***	1.011***	1.013***	1.012**
	(0,008)	(0,009)	(0,012)	(0,007)	(0,008)	(0,011)	(0,001)	(0,002)	(0,004)
Observations	7089	4756	2650	7089	4756	2650	7089	4756	2650
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression estimates associating differences in actual municipal FPM transfers to differences in law-implied FPM Transfers. Columns (1)-(3) report OLS coefficient estimates when both actual FPM transfers (the dependent variable) and law-implied transfers (the independent variable) are expressed in simple differences (no transformation). Columns (4)-(6) report least-absolute-deviation (median) estimates of simple differences. Columns (7)-(9) report OLS coefficient estimates when both variables are expressed in logs. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Specifications restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 6 - Actual and Law-Implied FPM Transfers

Cutoff-Specific Local Estimates

	full sample	log-level specifications					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
thresholds 1-3	1.010***	0.975***	0.968***	0.961***	0.989***	0.980***	0.975***
	(0,003)	(0,007)	(0,007)	(0,008)	(0,009)	(0,009)	(0,011)
thresholds 4-7	1.021***	0.996***	0.993***	0.982***	1.021***	1.014***	1.007***
	(0,006)	(0,009)	(0,008)	(0,010)	(0,014)	(0,014)	(0,016)
threshold 1	1.015***	0.971***	0.964***	0.965***	0.983***	0.974***	0.975***
	(0,004)	(0,011)	(0,011)	(0,011)	(0,012)	(0,012)	(0,013)
threshold 2	0.999***	0.978***	0.969***	0.954***	0.993***	0.982***	0.967***
	(0,005)	(0,008)	(0,008)	(0,010)	(0,010)	(0,010)	(0,013)
threshold 3	1.006***	0.980***	0.976***	0.964***	0.999***	0.992***	0.982***
	(0,005)	(0,008)	(0,009)	(0,011)	(0,011)	(0,012)	(0,015)
threshold 4	1.021***	0.997***	0.992***	0.984***	1.020***	1.012***	1.005***
	(0,006)	(0,009)	(0,009)	(0,012)	(0,014)	(0,013)	(0,016)
threshold 5	1.023***	1.013***	1.011***	1.000***	1.039***	1.033***	1.024***
	(0,009)	(0,013)	(0,015)	(0,017)	(0,017)	(0,019)	(0,022)
threshold 6	1.011***	0.983***	0.983***	0.973***	1.014***	1.009***	1.000***
	(0,012)	(0,018)	(0,012)	(0,015)	(0,022)	(0,017)	(0,020)
threshold 7	1.013***	0.983***	0.974***	0.945***	1.018***	1.004***	0.979***
	(0,012)	(0,016)	(0,017)	(0,022)	(0,021)	(0,023)	(0,029)
Observations	43466	11349	8471	5663	11349	8471	5663
Municipality Fixed-Effect	No	No	No	No	No	No	No
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports cutoff-specific regression estimates associating actual FPM transfers to law-implied FPM Transfers. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Rows (1) and (2) report estimates specific to observations pooled around Thresholds 1-3 and 44-7, respectively. Rows (3)-(9) report coefficients associated to each of the seven threholds in our sample. Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). The table also reports the within (marginal) R2. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 7 - Municipal Revenue around the FPM Cutoffs

Cutoff-Specific Local Estimates

	full sample	log-level specifications						
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%	FPM /
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Revenue
thresholds 1-3	0.503***	0.395***	0.368***	0.385***	0.376***	0.359***	0.373***	0,33
	(0,016)	(0,019)	(0,022)	(0,024)	(0,021)	(0,024)	(0,027)	
thresholds 4-7	0.476***	0.331***	0.265***	0.240***	0.266***	0.234***	0.195***	0,27
	(0,030)	(0,031)	(0,034)	(0,044)	(0,048)	(0,052)	(0,060)	
threshold 1	0.516***	0.380***	0.342***	0.376***	0.367***	0.337***	0.363***	0,33
	(0,022)	(0,027)	(0,030)	(0,042)	(0,028)	(0,031)	(0,043)	
threshold 2	0.472***	0.388***	0.373***	0.375***	0.366***	0.365***	0.352***	0,33
	(0,026)	(0,027)	(0,030)	(0,040)	(0,029)	(0,032)	(0,042)	
threshold 3	0.513***	0.435***	0.412***	0.419***	0.401***	0.399***	0.384***	0,32
	(0,031)	(0,047)	(0,058)	(0,070)	(0,051)	(0,062)	(0,073)	
threshold 4	0.491***	0.369***	0.287***	0.308***	0.313***	0.266***	0.254***	0,29
	(0,034)	(0,041)	(0,048)	(0,059)	(0,052)	(0,056)	(0,067)	
threshold 5	0.436***	0.276***	0.246***	0.219***	0.202***	0.216***	0.142*	0,26
	(0,047)	(0,062)	(0,061)	(0,075)	(0,074)	(0,078)	(0,086)	
threshold 6	0.473***	0.309***	0.231***	0,0254	0.209**	0.190*	-0,0841	0,24
	(0,053)	(0,070)	(0,079)	(0,100)	(0,098)	(0,105)	(0,119)	
threshold 7	0.477***	0.358***	0.285***	0.283**	0.241**	0.237*	0,147	0,23
	(0,083)	(0,091)	(0,109)	(0,134)	(0,118)	(0,127)	(0,152)	
Observations	43466	11349	8471	5663	11349	8471	5663	
Municipality Fixed-Effec	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
First order polynomial	No	No	No	No	Yes	Yes	Yes	

The table reports cutoff-specific regression estimates associating Municipal Revenue to law-implied FPM Transfers. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Rows (1) and (2) report estimates specific to observations pooled around Thresholds 1-3 and 44-7, respectively. Rows (3)-(9) report coefficients associated to each of the seven threholds in our sample. Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). The table also reports the within (marginal) R2. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 8 - Municipal Expenditure around the FPM Cutoffs

Cutoff-Specific Local Estimates

	full sample	log-level specifications						
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%	FPM /
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Expend.
thresholds 1-3	0.471***	0.346***	0.322***	0.324***	0.324***	0.313***	0.314***	0,33
	(0,015)	(0,019)	(0,021)	(0,025)	(0,022)	(0,024)	(0,029)	
thresholds 4-7	0.459***	0.312***	0.238***	0.204***	0.238***	0.202***	0.169**	0,27
	(0,030)	(0,033)	(0,035)	(0,045)	(0,048)	(0,055)	(0,068)	
threshold 1	0.487***	0.340***	0.313***	0.346***	0.323***	0.304***	0.329***	0,33
	(0,021)	(0,031)	(0,036)	(0,043)	(0,032)	(0,037)	(0,044)	
threshold 2	0.435***	0.351***	0.349***	0.310***	0.323***	0.334***	0.281***	0,33
	(0,026)	(0,028)	(0,030)	(0,040)	(0,030)	(0,033)	(0,042)	
threshold 3	0.479***	0.353***	0.303***	0.302***	0.310***	0.279***	0.256***	0,32
	(0,030)	(0,036)	(0,040)	(0,047)	(0,040)	(0,044)	(0,053)	
threshold 4	0.474***	0.353***	0.272***	0.299***	0.282***	0.232***	0.229***	0,29
	(0,035)	(0,045)	(0,053)	(0,063)	(0,054)	(0,061)	(0,076)	
threshold 5	0.417***	0.240***	0.202***	0.169**	0.146**	0.147*	0,0731	0,27
	(0,047)	(0,062)	(0,062)	(0,081)	(0,072)	(0,079)	(0,096)	
threshold 6	0.477***	0.291***	0.196**	-0,0327	0.165*	0,12	-0,174	0,25
	(0,053)	(0,076)	(0,085)	(0,120)	(0,097)	(0,109)	(0,145)	
threshold 7	0.411***	0.345***	0.230**	0,164	0.201*	0,142	-0,0092	0,24
	(0,088)	(0,097)	(0,115)	(0,126)	(0,119)	(0,132)	(0,154)	
Observations	43466	11349	8471	5663	11349	8471	5663	
Municipality Fixed-Effec	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
First order polynomial	No	No	No	No	Yes	Yes	Yes	

The table reports cutoff-specific regression estimates associating Municipal Expenditure to law-implied FPM Transfers. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Rows (1) and (2) report estimates specific to observations pooled around Thresholds 1-3 and 44-7, respectively. Rows (3)-(9) report coefficients associated to each of the seven threholds in our sample. Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). The table also reports the within (marginal) R2. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 9 - Current *vs* Capital Expenditure around the FPM Cutoffs

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log (Current Expenditure) (net of wage bill)	0.573***	0.374***	0.351***	0.381***	0.354***	0.365***	0.389***
	(0,022)	(0,035)	(0,041)	(0,048)	(0,045)	(0,051)	(0,067)
log (Wage Bill)	0.388***	0.245***	0.205***	0.166***	0.219***	0.182***	0.149***
	(0,017)	(0,023)	(0,022)	(0,025)	(0,029)	(0,027)	(0,032)
log (Capital Expenditure)	0.458***	0.562***	0.512***	0.530***	0.557***	0.553***	0.563***
	(0,053)	(0,071)	(0,081)	(0,096)	(0,086)	(0,101)	(0,121)
Observations	43436	11342	8465	5659	11342	8465	5659
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating types of Municipal Expenditure to law-implied FPM Transfers. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on Current Expenditure (net of wages), Wage Bill and Capital Expenditure. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 10 - Main Categories of Municipal Expenditure around the FPM Cutoffs

	full sample	local estimates						
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%	% of total
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Expenditure
log (Public Admin)	0.538***	0.424***	0.389***	0.336***	0.397***	0.328***	0.303***	16,2%
	(0,035)	(0,045)	(0,052)	(0,063)	(0,057)	(0,066)	(0,085)	
log (Education)	0.428***	0.271***	0.240***	0.206***	0.245***	0.231***	0.208***	33,2%
	(0,020)	(0,023)	(0,024)	(0,029)	(0,031)	(0,031)	(0,036)	
log (Health)	0.394***	0.272***	0.229***	0.184***	0.220***	0.227***	0.175***	22,4%
	(0,029)	(0,040)	(0,044)	(0,050)	(0,049)	(0,055)	(0,063)	
log (Housing & Urbanism)	0.541***	0.303***	0.330***	0.508***	0.412***	0.628***	0.712***	9,3%
	(0,071)	(0,100)	(0,121)	(0,150)	(0,129)	(0,149)	(0.186	
log (Other)	0.580***	0.465***	0.403***	0.439***	0.437***	0.440***	0.475***	19,2%
	(0,040)	(0,045)	(0,051)	(0,061)	(0,058)	(0,064)	(0,077)	
Observations	43269	11289	8425	5636	11289	8425	5636	
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
First order polynomial	No	No	No	No	Yes	Yes	Yes	

The table reports regression estimates associating categories of Municipal Expenditure to law-implied FPM Transfers. Rows (1)-(5) reports fixed-effect OLS coefficient estimates of municipal public spending on Public Administration, Education, Health, Housing & Urbanism and Others. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 11 - Earnings, Employment and Average Wage in the Public Sector

Specification in Differences - OLS and LAD local estimates

	log-differences			OLS-differences			LAD-differences		
bandwidth	<4%	<3%	<2%	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total Earnings	0.111***	0.0972**	0.112**	0,043	0,047	0,062	0.088**	0.111**	0,080
	(0,032)	(0,038)	(0,045)	(0,052)	(0,060)	(0,072)	(0,038)	(0,046)	(0,054)
Employment	0.0886***	0.0736**	0,062	0,005	0,004	-0,001	0.013***	0.011**	0,012
	(0,027)	(0,032)	(0,039)	(0,008)	(0,009)	(0,011)	(0,005)	(0,005)	(0,008)
Average Wage	(0,022)	(0,012)	(0,005)	0.0652**	0.0584*	0.0730*	0.061*	0.077**	0.110*
	(0,016)	(0,018)	(0,022)	(0,031)	(0,035)	(0,043)	(0,032)	(0,037)	(0,063)
Observations	6908	4620	2554	6908	4620	2554	6908	4620	2554
Municipality FE	No	No	No	No	No	No	No	No	No
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression estimates associating differences in Public Sector Labor Market outcomes to differences in law-implied FPM Transfers. Rows (1)-(3) report fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. Columns (1)-(3) report OLS coefficient estimates when both variables are expressed in simple differences (no transformation). Columns (4)-(6) report OLS coefficient estimates when both the dependent the independent variable are expressed in logs. Columns (7)-(9) report least-absolute-deviation (median) estimates of simple differences. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Specifications restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 12 - Earnings, Employment and Wage in the Public Sector according to Tenure

Specification in Differences - OLS and LAD local estimates

	log-differences			OLS-differences			LAD-differences		
bandwidth	<4%	<3%	<2%	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PANEL A: Old Hires from previous years									
Total Earnings	0.0630*	0,050	0.103**	0.072*	0,086	0,055	0.070**	0.066**	0.077*
	(0,038)	(0,041)	(0,048)	(0,043)	(0,053)	(0,064)	(0,028)	(0,033)	(0,046)
Employment	0,008	-0,011	-0,011	0,004	0,005	-0,005	0.008**	0,006	0,000
	(0,031)	(0,034)	(0,041)	(0,006)	(0,007)	(0,009)	(0,004)	(0,005)	(0,008)
Average Wage	0.0260*	0,021	0.0380*	0.062**	0.057*	0.115**	0,056	0,069	0.109*
	(0,015)	(0,018)	(0,023)	(0,031)	(0,035)	(0,046)	(0,038)	(0,045)	(0,063)
PANEL B: New Hires in current year									
Total Earnings	0.578***	0.494**	0,367	-0,024	-0,038	0,010	0,025	0,016	0,004
	(0,194)	(0,227)	(0,268)	(0,041)	(0,054)	(0,064)	(0,030)	(0,041)	(0,055)
Employment	0.496***	0.468**	0.452*	0,001	0,000	0,008	0,004	0,002	0,002
	(0,187)	(0,224)	(0,274)	(0,007)	(0,009)	(0,011)	(0,005)	(0,007)	(0,010)
Average Wage	-0,004	-0,077	-0,132	0,130	-0,055	-0,040	0,140	0,075	0,075
	(0,059)	(0,071)	(0,080)	(0,150)	(0,187)	(0,202)	(0,137)	(0,155)	(0,259)
Observations	6908	4620	2554	6908	4620	2554	6908	4620	2554
Municipality FE	No	No	No	No	No	No	No	No	No
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression estimates associating differences in Public Sector Labor Market outcomes according to tenure to differences in law-implied FPM Transfers. Rows (1)-(3) in Panel A report fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker for `Old Hires'. Panel B reports corresponding estimates for `New Hires'. Columns (1)-(3) report OLS coefficient estimates when both variables are expressed in simple differences (no transformation). Columns (4)-(6) report OLS coefficient estimates when both the dependent the independent variable are expressed in logs. Columns (7)-(9) report least-absolute-deviation (median) estimates of simple differences. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Specifications restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 13 - Earnings, Employment and Average Wage in the Private Sector

Specification in Differences - OLS and LAD local estimates

	log-differences			OLS-differences			LAD-differences		
bandwidth	<4%	<3%	<2%	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total Earnings	0.129***	0.112**	0.154**	0.500***	0.419**	0.577***	0.168***	0.148***	0.229**
	(0,035)	(0,046)	(0,060)	(0,128)	(0,169)	(0,200)	(0,044)	(0,056)	(0,100)
Employment	0.110***	0.097***	0.125***	0.068***	0.061***	0.087***	0.026***	0.021*	0.031**
	(0,030)	(0,035)	(0,043)	(0,016)	(0,021)	(0,025)	(0,008)	(0,011)	(0,014)
Average Wage	0,021	0,015	0,035	0,049	0,021	0,051	0,022	0,026	0,035
	(0,018)	(0,022)	(0,024)	(0,034)	(0,040)	(0,043)	(0,017)	(0,019)	(0,025)
Observations	6908	4620	2554	6908	4620	2554	6908	4620	2554
Municipality FE	No	No	No	No	No	No	No	No	No
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression estimates associating differences in private sector labor market outcomes to differences in law-implied FPM transfers. Rows (1)-(3) report fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. Columns (1)-(3) report OLS coefficient estimates when both variables are expressed in simple differences (no transformation). Columns (4)-(6) report OLS coefficient estimates when both the dependent the independent variable are expressed in logs. Columns (7)-(9) report least-absolute-deviation (median) estimates of simple differences. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Specifications restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 14 - Baselines Estimates excluding observations around Threshold 1
FPM Transfers, Expenditure and Labor Market Outcomes

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: FPM Transfers and Expenditure					
log (FPM Transfers)	1.006***	0.989***	0.988***	0.971***	0.993***	0.990***	0.975***
	(0,006)	(0,007)	(0,008)	(0,010)	(0,009)	(0,010)	(0,013)
log (Expenditure)	0.447***	0.339***	0.294***	0.281***	0.309***	0.292***	0.281***
	(0,018)	(0,020)	(0,021)	(0,026)	(0,026)	(0,028)	(0,035)
		PANEL B: Public Sector					
log (Total Earnings)	0.403***	0.265***	0.259***	0.284***	0.318***	0.244***	0.384***
	(0,041)	(0,045)	(0,047)	(0,058)	(0,057)	(0,064)	(0,080)
log (Employment)	0.343***	0.181***	0.152***	0.130***	0.217***	0.0938*	0.179***
	(0,035)	(0,039)	(0,040)	(0,048)	(0,049)	(0,054)	(0,068)
log (Wage per Worker)	0.0444**	0.0458**	0.0489**	0,047	0.0524*	0.0875***	0.117***
	(0,021)	(0,020)	(0,023)	(0,029)	(0,027)	(0,029)	(0,033)
		PANEL C: Private Sector					
log (Total Earnings)	0.293***	0.105**	0.112*	0,020	0.133**	0.143**	0,112
	(0,050)	(0,050)	(0,058)	(0,072)	(0,066)	(0,072)	(0,101)
log (Employment)	0.245***	0.114**	0.109**	0,054	0.153**	0.131*	0,130
	(0,053)	(0,050)	(0,053)	(0,066)	(0,065)	(0,069)	(0,091)
log (Wage per Worker)	0.0572**	0,022	0,036	-0,009	0,017	0,044	0,021
	(0,024)	(0,025)	(0,027)	(0,038)	(0,033)	(0,039)	(0,048)
Observations	28517	9107	6783	4522	9107	6783	4522
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual FPM transfers, expenditure and labor market outcomes to law-implied FPM Transfers. The sample is restricted by dropping observations around thresholds 1. Panel A reports fixed-effect OLS coefficient estimates on actual FPM transfers and Expenditure. Panel B and C report estimates on Public (Private) Sector Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 15 - Baselines Estimates excluding observations in census years
FPM Transfers, Expenditure and Labor Market Outcomes

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: FPM Transfers and Expenditure					
log (FPM Transfers)	1.044***	1.002***	0.998***	0.989***	0.996***	0.993***	0.987***
	(0,006)	(0,008)	(0,008)	(0,009)	(0,010)	(0,010)	(0,012)
log (Expenditure)	0.478***	0.349***	0.316***	0.309***	0.311***	0.303***	0.291***
	(0,015)	(0,019)	(0,022)	(0,026)	(0,025)	(0,030)	(0,035)
		PANEL B: Public Sector					
log (Total Earnings)	0.406***	0.233***	0.242***	0.236***	0.260***	0.210***	0.273***
	(0,032)	(0,037)	(0,039)	(0,045)	(0,046)	(0,053)	(0,062)
log (Employment)	0.339***	0.156***	0.174***	0.174***	0.178***	0.131***	0.204***
	(0,029)	(0,035)	(0,037)	(0,042)	(0,042)	(0,047)	(0,056)
log (Wage per Worker)	0.0566***	0.0464**	0,029	0,010	0.0474**	0,038	0,026
	(0,016)	(0,019)	(0,021)	(0,025)	(0,024)	(0,027)	(0,031)
		PANEL C: Private Sector					
log (Total Earnings)	0.351***	0.140***	0.128**	0,081	0.180***	0.153**	0.157*
	(0,044)	(0,052)	(0,057)	(0,069)	(0,064)	(0,070)	(0,084)
log (Employment)	0.291***	0.137**	0.101*	0,064	0.183***	0,107	0,106
	(0,045)	(0,054)	(0,056)	(0,064)	(0,065)	(0,070)	(0,077)
log (Wage per Worker)	0.0618***	0,035	0.0687**	0,044	0,030	0.0776**	0.0801**
	(0,019)	(0,024)	(0,027)	(0,032)	(0,030)	(0,036)	(0,040)
Observations	35133	9027	6705	4441	9027	6705	4441
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual FPM transfers, expenditure and labor market outcomes to law-implied FPM Transfers. The sample is restricted by dropping observations on population census years (2001, 2007 and 2011). Panel A reports fixed-effect OLS coefficient estimates on actual FPM transfers and Expenditure. Panel B and C report estimates on Public (Private) Sector Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 16 - Estimates excluding observations with positive changes in population brackets
FPM Transfers, Expenditure and Labor Market Outcomes

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: FPM Transfers and Expenditure					
log (FPM Transfers)	1.024***	0.978***	0.976***	0.955***	0.981***	0.975***	0.958***
	(0.00651)	(0.00971)	(0.0101)	(0.0135)	(0.0121)	(0.0132)	(0.0163)
log (Expenditure)	0.490***	0.380***	0.347***	0.316***	0.363***	0.346***	0.318***
	(0.0159)	(0.0200)	(0.0234)	(0.0342)	(0.0265)	(0.0318)	(0.0445)
		PANEL B: Public Sector					
log (Total Earnings)	0.428***	0.288***	0.293***	0.280***	0.326***	0.303***	0.303***
	(0.0342)	(0.0428)	(0.0452)	(0.0610)	(0.0527)	(0.0583)	(0.0796)
log (Employment)	0.367***	0.195***	0.184***	0.147***	0.213***	0.166***	0.176***
	(0.0314)	(0.0393)	(0.0433)	(0.0539)	(0.0492)	(0.0550)	(0.0668)
log (Wage per Worker)	0.0505***	0.0572**	0.0588**	0,041	0.0722**	0.0842***	0,067
	(0.0170)	(0.0234)	(0.0269)	(0.0354)	(0.0291)	(0.0320)	(0.0411)
		PANEL C: Private Sector					
log (Total Earnings)	0.357***	0.164***	0.142**	0,099	0.197***	0.150*	0.198*
	(0.0453)	(0.0544)	(0.0610)	(0.0857)	(0.0701)	(0.0768)	(0.103)
log (Employment)	0.300***	0.182***	0.135**	0,086	0.244***	0.158**	0.173*
	(0.0473)	(0.0545)	(0.0604)	(0.0763)	(0.0723)	(0.0800)	(0.0945)
log (Wage per Worker)	0.0602***	0,019	0.0631*	0,050	0,001	0,050	0.0754*
	(0.0208)	(0.0289)	(0.0334)	(0.0394)	(0.0357)	(0.0443)	(0.0457)
Observations	40912	9395	6725	4256	9395	6725	4256
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual FPM transfers, expenditure and labor market outcomes to law-implied FPM Transfers. The sample is restricted by dropping observations of municipalities with positive changes in population brackets from one year to the next. Panel A reports fixed-effect OLS coefficient estimates on actual FPM transfers and Expenditure. Panel B and C report estimates on Public (Private) Sector Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 17 - Baselines Estimates with mayor-specific fixed-effects
FPM Transfers, Expenditure and Labor Market Outcomes

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: FPM Transfers and Expenditure					
log (FPM Transfers)	0.915***	0.955***	0.967***	0.957***	0.954***	0.960***	0.954***
	(0,008)	(0,011)	(0,013)	(0,018)	(0,013)	(0,015)	(0,023)
log (Expenditure)	0.304***	0.271***	0.260***	0.271***	0.259***	0.261***	0.256***
	(0,015)	(0,026)	(0,032)	(0,044)	(0,032)	(0,037)	(0,048)
		PANEL B: Public Sector					
log (Total Earnings)	0.176***	0,177	0.185***	0.232***	0.149**	0.154**	0.213*
	(0,031)	(0,060)	(0,062)	(0,082)	(0,063)	(0,072)	(0,110)
log (Employment)	0.130***	0.115**	0.143***	0.154***	0,086	0,085	0,107
	(0,028)	(0,045)	(0,053)	(0,066)	(0,059)	(0,066)	(0,089)
log (Wage per Worker)	0.0302**	0,025	-0,001	0,007	0,017	0,015	0,023
	(0,013)	(0,022)	(0,029)	(0,033)	(0,027)	(0,033)	(0,051)
		PANEL C: Private Sector					
log (Total Earnings)	0.117***	0.108*	0,123	0.190*	0,116	0,158	0.250*
	(0,037)	(0,062)	(0,080)	(0,099)	(0,076)	(0,098)	(0,134)
log (Employment)	0.0842**	0,090	0,084	0,133	0,095	0,095	0,185
	(0,036)	(0,056)	(0,071)	(0,099)	(0,070)	(0,090)	(0,129)
log (Wage per Worker)	0.0358**	0,023	0,041	0,057	0,026	0,065	0,063
	(0,017)	(0,031)	(0,037)	(0,052)	(0,035)	(0,042)	(0,062)
Observations	43466	11349	8471	5663	11349	8471	5663
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual FPM transfers, expenditure and labor market outcomes to law-implied FPM Transfers. Panel A reports fixed-effect OLS coefficient estimates on actual FPM transfers and Expenditure. Panel B and C report estimates on Public (Private) Sector Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include mayor-specific, state-year and cutoff-year fixed-effects (constants not reported). Mayor-specific fixed effects are equivalent to municipality fixed-effects interacted with mayor term dummies. Mayor terms in our sample consist of the following 4-year periods: 1997-2000, 2001-2004, 2005-2008, 2009-2012 and 2013-2016. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 18 - Global RD Full Sample Estimates with higher-order polynomials
FPM Transfers, Expenditure and Labor Market Outcomes

	Global RD estimates - polynomials of nth-order					
bandwidth	-	1st	2nd	3rd	4th	5th
dep.var.	(2)	(3)	(4)	(5)	(6)	(7)
	PANEL A: FPM Transfers and Expenditure					
log (FPM Transfers)	1.020***	1.048***	1.100***	1.151***	1.182***	1.204***
	(0,006)	(0,007)	(0,009)	(0,011)	(0,012)	(0,012)
log (Expenditure)	0.469***	0.418***	0.456***	0.498***	0.537***	0.561***
	(0,015)	(0,018)	(0,022)	(0,026)	(0,028)	(0,030)
	PANEL B: Public Sector					
log (Total Earnings)	0.394***	0.311***	0.360***	0.385***	0.425***	0.465***
	(0,031)	(0,038)	(0,046)	(0,054)	(0,060)	(0,064)
log (Employment)	0.336***	0.244***	0.292***	0.337***	0.380***	0.429***
	(0,028)	(0,035)	(0,042)	(0,050)	(0,055)	(0,059)
log (Wage per Worker)	0.0470***	0.0511***	0.0485**	0,029	0,030	0,026
	(0,015)	(0,016)	(0,021)	(0,025)	(0,027)	(0,029)
	PANEL C: Private Sector					
log (Total Earnings)	0.339***	0.244***	0.291***	0.301***	0.329***	0.331***
	(0,042)	(0,047)	(0,056)	(0,065)	(0,071)	(0,076)
log (Employment)	0.286***	0.204***	0.243***	0.227***	0.227***	0.223***
	(0,044)	(0,048)	(0,056)	(0,062)	(0,069)	(0,074)
log (Wage per Worker)	0.0567***	0.0464**	0.0547**	0.0816***	0.107***	0.107***
	(0,019)	(0,022)	(0,027)	(0,031)	(0,035)	(0,037)
Observations	43466	43466	43466	43466	43466	43466
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating actual FPM transfers, expenditure and labor market outcomes to law-implied FPM Transfers. Panel A reports fixed-effect OLS coefficient estimates on actual FPM transfers and Expenditure. Panel B and C report estimates on Public (Private) Sector Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). All columns report estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(6) report global (RD) regression estimates that include higher-order (1st-5th) polynomial on normalized population. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 19 - Regional Spillover Effects into neighbouring municipalities
FPM Transfers, Expenditure and Labor Market Outcomes

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		PANEL A: FPM Transfers and Expenditure					
log (Regional FPM Transfers)	0.0449**	0,029	0,059	0,058	0,081	0,096	0,133
	(0,018)	(0,032)	(0,057)	(0,073)	(0,050)	(0,065)	(0,098)
log (Regional Expenditure)	0,019	0,018	0,058	0,038	0,074	0,096	0,123
	(0,019)	(0,037)	(0,066)	(0,083)	(0,057)	(0,075)	(0,113)
		PANEL B: Public Sector					
log (Regional Total Earnings)	0,002	-0,012	0,019	-0,023	0,026	0,057	0,042
	(0,023)	(0,040)	(0,063)	(0,089)	(0,059)	(0,075)	(0,123)
log (Regional Employment)	0,014	-0,016	-0,005	-0,036	0,000	0,012	-0,004
	(0,017)	(0,022)	(0,033)	(0,044)	(0,030)	(0,039)	(0,060)
log (Regional Wage per Worker)	-0,001	-0,014	0,009	-0,014	0,007	0,022	0,012
	(0,016)	(0,025)	(0,037)	(0,051)	(0,036)	(0,045)	(0,072)
		PANEL C: Private Sector					
log (Regional Total Earnings)	-0,003	0,004	0,019	0,008	0,020	0,047	0,076
	(0,026)	(0,039)	(0,060)	(0,077)	(0,053)	(0,068)	(0,101)
log (Regional Employment)	-0,014	-0,019	-0,013	-0,034	-0,011	0,012	0,007
	(0,023)	(0,028)	(0,036)	(0,043)	(0,033)	(0,040)	(0,055)
log (Regional Wage per Worker)	0,019	0,019	0,034	0,025	0,045	0,042	0,057
	(0,014)	(0,022)	(0,035)	(0,043)	(0,030)	(0,040)	(0,059)
Observations	43466	11349	8471	4522	11349	8471	4522
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating regional (at the meso-region level) actual FPM transfers, expenditure and labor market outcomes to local (municipal) law-implied FPM Transfers. A meso-region is a subdivision of states defined by the IBGE (Brazilian Institute of Geography and Statistics) which congregates a few municipalities in a given geographical area with economic and social similarities. They do not constitute any sort of poliitcal or economic entities. Panel A reports fixed-effect OLS coefficient estimates on regional actual FPM transfers and Expenditure. Panel B and C report estimates on regional Public (Private) Sector Total Earnings, Employment and Wage per Worker. All regional variables exclude the local municipalitity. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 20 - Delayed Effects (Time-to-build)
Earnings, Employment and Average Wage in the Private Sector at t+1

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log (Total Earnings$_{t+1}$)	0.261***	0,063	0,079	0,053	0,058	0,060	0,081
	(0,040)	(0,042)	(0,048)	(0,058)	(0,051)	(0,056)	(0,065)
log (Employment$_{t+1}$)	0.221***	0,042	0,0446	0,028	0,054	0,0534	0,0573
	(0,041)	(0,044)	(0,048)	(0,055)	(0,054)	(0,057)	(0,063)
log (Wage per Worker$_{t+1}$)	0.0386**	0.033*	0.052*	0,044	0,025	0,033	0,042
	(0,018)	(0,019)	(0,021)	(0,029)	(0,025)	(0,028)	(0,033)
Observations	43425	11328	8451	5645	11328	8451	5645
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating law-implied FPM Transfers in year t to municipal private sector labor market outcomes in year t+1. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 21 - Estimates excluding observations with positive changes in population brackets
Employment in Agriculture, Manufacturing and Services

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	0.408***	0.223**	0,103	0,073	0,202	0,116	-0,130
	(0,076)	(0,113)	(0,129)	(0,159)	(0,143)	(0,162)	(0,200)
Manufacturing	0.310***	0,139	0,086	0,259	0,259	0,149	0,215
	(0,093)	(0,175)	(0,241)	(0,176)	(0,176)	(0,215)	(0,291)
Services	0.353***	0.194***	0.137**	0.165**	0.167**	0.137*	0.238**
	(0,051)	(0,054)	(0,058)	(0,080)	(0,068)	(0,077)	(0,096)
Observations	40912	9395	6725	4256	9395	6725	4256
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating private sector labor market outcomes by sector to law-implied FPM Transfers. The sample is restricted by dropping observations of municipalities with positive changes in population brackets from one year to the next. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on employment in Agriculture, Manufacturing and Services. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 22 - Estimates with mayor-specific fixed-effects
Employment in Agriculture, Manufacturing and Services

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	0,092	0,014	-0,055	-0,057	-0,038	-0,066	0,059
	(0,070)	(0,130)	(0,160)	(0,212)	(0,156)	(0,181)	(0,239)
Manufacturing	0,080	0,081	0,207	0,343	0,116	0,205	0,331
	(0,085)	(0,139)	(0,169)	(0,247)	(0,157)	(0,209)	(0,311)
Services	0.106***	0.153**	0.155*	0.210**	0.152*	0.181*	0.248*
	(0,037)	(0,063)	(0,080)	(0,102)	(0,078)	(0,101)	(0,133)
Observations	40912	9395	6725	4256	9395	6725	4256
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression estimates associating private sector labor market outcomes by sector to law-implied FPM Transfers. Rows (1)-(3) reports fixed-effect OLS coefficient estimates on employment in Agriculture, Manufacturing and Services. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel.All specifications include mayor-specific, state-year and cutoff-year fixed-effects (constants not reported). Mayor-specific fixed effects are equivalent to municipality fixed-effects interacted with mayor term dummies. Mayor terms in our sample consist of the following 4-year periods: 1997-2000, 2001-2004, 2005-2008, 2009-2012 and 2013-2016. Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 23 - Earnings, Employment and Average Wage in the Private Sector Agriculture, Manufacturing and Services

Specification in Differences - OLS and LAD local estimates

	log-differences			OLS-differences			LAD-differences		
bandwidth	<4%	<3%	<2%	<4%	<3%	<2%	<4%	<3%	<2%
dep.var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Panel A: Agriculture					
log (Total Earnings)	0,168	-0,128	-0,257	0,097	0,098	0,069	0,001	0,001	-0,004
	(0,226)	(0,238)	(0,247)	(0,059)	(0,070)	(0,056)	(0,004)	(0,006)	(0,007)
log (Employment)	0,091	0,009	0,023	0.014*	0,011	0,016	-0,002	-0,003	0,003
	(0,063)	(0,073)	(0,097)	(0,007)	(0,009)	(0,012)	(0,001)	(0,001)	(0,002)
log (Wage per Worker)	0,013	-0,003	-0,032	-0,011	-0,025	-0,071	0,018	0,011	-0,002
	(0,029)	(0,028)	(0,034)	(0,048)	(0,068)	(0,072)	(0,016)	(0,021)	(0,024)
				Panel B: Manufacturing					
log (Total Earnings)	0,267	0,541	0,260	0,178	0,151	0.380***	0.032**	0.037*	0.056*
	(0,309)	(0,388)	(0,507)	(0,110)	(0,124)	(0,145)	(0,014)	(0,021)	(0,033)
log (Employment)	0.144*	0.188*	0.274**	0,017	0,012	0.039**	0.005*	0,006	0,007
	(0,078)	(0,097)	(0,132)	(0,013)	(0,015)	(0,018)	(0,003)	(0,005)	(0,005)
log (Wage per Worker)	0,038	0,002	0,040	-0,004	-0,098	0,061	0.060**	0.101***	0,078
	(0,041)	(0,048)	(0,056)	(0,127)	(0,170)	(0,157)	(0,030)	(0,035)	(0,052)
				Panel C: Services					
log (Total Earnings)	0.152***	0.166***	0.186***	0.225***	0.170*	0,128	0.057***	0.062**	0.060*
	(0,039)	(0,049)	(0,062)	(0,075)	(0,089)	(0,125)	(0,021)	(0,026)	(0,033)
log (Employment)	0.105***	0.118***	0.145***	0.032***	0.030***	0.0278*	0.010**	0.011**	0.016**
	(0,031)	(0,036)	(0,045)	(0,010)	(0,012)	(0,016)	(0,004)	(0,005)	(0,006)
log (Wage per Worker)	0.046**	0.041*	0,021	0.118***	0.101**	0,043	0.0490**	0,033	0,055
	(0,018)	(0,022)	(0,026)	(0,040)	(0,047)	(0,052)	(0,020)	(0,025)	(0,039)
Observations	6908	4620	2554	6908	4620	2554	6908	4620	2554
State-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cutoff-year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports regression estimates associating differences in Private Sector Labor Market outcomes to differences in law-implied FPM Transfers. Panel A-C report estimates on Agriculture, Manufacturing and Services. Rows (1)-(3) report fixed-effect OLS coefficient estimates on Total Earnings, Employment and Wage per Worker. Columns (1)-(3) report OLS coefficient estimates when both variables are expressed in simple differences (no transformation). Columns (4)-(6) report OLS coefficient estimates when both the dependent the independent variable are expressed in logs. Columns (7)-(9) report least-absolute-deviation (median) estimates of simple differences. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Specifications restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. All specifications include state-year fixed effects and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.

Appendix Table 24 - Heterogeneity Analysis across Geography and Size
FPM Transfers and Expenditure around the FPM Cutoffs

	full sample	local estimates					
bandwidth	all	<4%	<3%	<2%	<4%	<3%	<2%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	PANEL A: Geography						
	Dep.var: Log(FPM Transfers)						
South	1.058***	1.002***	0.997***	0.981***	1.003***	0.995***	0.981***
	(0,007)	(0,009)	(0,009)	(0,011)	(0,010)	(0,010)	(0,013)
North	0.975***	0.949***	0.948***	0.942***	0.950***	0.946***	0.942***
	(0,008)	(0,012)	(0,011)	(0,012)	(0,014)	(0,013)	(0,013)
	Dep.var: Log(Expenditure)						
South	0.452***	0.341***	0.310***	0.306***	0.323***	0.314***	0.314***
	(0,022)	(0,024)	(0,026)	(0,031)	(0,029)	(0,031)	(0,036)
North	0.488***	0.334***	0.295***	0.288***	0.314***	0.299***	0.298***
	(0,020)	(0,023)	(0,024)	(0,030)	(0,027)	(0,029)	(0,035)
	PANEL B: Size						
	Dep.var: Log(FPM Transfers)						
Thresholds 1-3	1.058***	1.002***	0.997***	0.981***	1.003***	0.995***	0.981***
	(0.00708)	(0.00857)	(0.00885)	(0.0108)	(0.00986)	(0.0104)	(0.0125)
Thresholds 4-7	0.975***	0.949***	0.948***	0.942***	0.950***	0.946***	0.942***
	(0.00783)	(0.0124)	(0.0114)	(0.0116)	(0.0135)	(0.0129)	(0.0133)
	Dep.var: Log(Expenditure)						
Thresholds 1-3	0.452***	0.341***	0.310***	0.306***	0.323***	0.314***	0.314***
	(0.0222)	(0.0242)	(0.0259)	(0.0308)	(0.0286)	(0.0305)	(0.0360)
Thresholds 4-7	0.488***	0.334***	0.295***	0.288***	0.314***	0.299***	0.298***
	(0.0195)	(0.0229)	(0.0242)	(0.0302)	(0.0266)	(0.0286)	(0.0353)
Observations	43466	11349	8471	5663	11349	8471	5663
Municipality Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First order polynomial	No	No	No	No	Yes	Yes	Yes

The table reports regression heterogeneity estimates associating actual FPM Transfers and municipal expenditure (dependent variables) to law-implied FPM Transfers according to geography and municipal population size. Panel A allows coefficients to differ for municipalities in the South/North. Panel B repeats the analysis for municipalities around thresholds 1-3 (6,793-20,376 inhabitants) and thresholds 4-7 (6,793-47,537 inhabitants). Appendix Table 1 reports the complete North/South classification. We construct municipal law-implied transfers applying the FPM allocation mechanism formula (see appendix). Column (1) reports estimates in the full sample that includes municipalities both close and far from the seven FPM cutoffs. Columns (2)-(4) report local regression (RD) estimates that restrict estimation in the neighborhood of the FPM cutoffs using three relative bandwidths (4%-2%) for each cut-off. Columns (5)-(7) include a rectangular kernel. All specifications include municipality, state-year and cutoff-year fixed-effects (constants not reported). Heteroskedasticity-adjusted standard errors clustered at the micro-region are reported in parentheses below the coefficients. Significantly different from zero at 99% (***), 95% (**) and 90% (*) confidence level.