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DETERMINANTS OF SLUM FORMATION: THE ROLE OF LOCAL POLITICS AND
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ABSTRACT

One-third of the developing world's population lives in urban slums and the absolute number of slum residents grew from 650 million in 1990 to 863 million in 2012. Although negative impacts of slum living conditions on several dimensions of slum residents' lives are well documented, much less research exists on why slums emerge and grow in the first place. This paper provides novel evidence on the effect of local political conditions and slum policies on slum growth. Using a regression discontinuity design in close municipal elections in Brazil, I show that victories by a center-left, pro-poor party led to both more slum upgrading policies and a higher share of slum housing. I further show evidence indicating that the pro-slum incentive effect from slum upgrading policies was the main mechanism behind this party's effect on slum growth. By highlighting the relevance of local institutional conditions for understanding where slums are more likely to grow, these findings innovate over traditional explanations based on the role of rural-urban migration and rapid urban economic growth. This paper's evidence on the potential incentive effect of slum upgrading policies on slum growth does not imply that slums upgrading efforts should stop. Given the solid evidence on the positive impacts of slum upgrading programs on the lives of the poor, these programs should continue to develop, and governments should consider, for example, complementing slum upgrading efforts with policies expanding the supply of non-slum housing.

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EL ROL DE LA POLÍTICA Y LAS POLÍTICAS LOCALES EN EL CRECIMIENTO DE LOS ASENTAMIENTOS

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RESUMEN

Un tercio de la población de los países en desarrollo vive en asentamientos de acuerdo a UN-Habitat. Existe buena evidencia sobre los impactos negativos de las condiciones de vida en los asentamientos sobre sus habitantes pero las causas del crecimiento de los asentamientos han sido menos estudiadas. En este documento se presenta nueva evidencia sobre el efecto que tienen las condiciones políticas locales y las políticas urbanas sobre el crecimiento de los asentamientos. Utilizando un diseño de regresión discontinua, se muestra que cuando un partido de centro izquierda con una agenda redistributiva toma el control del gobierno municipal en Brasil, este partido implementa más políticas de urbanización de asentamientos y los asentamientos crecen. El análisis conjunto de la evidencia y el contexto político apunta a que el mecanismo principal por el que crecen los asentamientos se debe a que las políticas de urbanización de asentamientos hacen más atractivas a este tipo de viviendas. El hecho de que los programas de urbanización de asentamientos puedan incentivar el crecimiento de los asentamientos en el futuro no implica que este tipo de programas no deba implementarse. Al contrario, dada la evidencia sobre los impactos positivos de estos programas sobre la calidad de vida de los habitantes de los asentamientos, los gobiernos debieran considerar complementar las intervenciones de urbanización con otras que promuevan la expansión de vivienda formal y con servicios.

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Determinants of Slum Formation: The Role of Local Politics and Policies

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Abstract

One-third of the developing world's population lives in urban slums and the absolute number of slum residents grew from 650 million in 1990 to 863 million in 2012. Although negative impacts of slum living conditions on several dimensions of slum residents' lives are well documented, much less research exists on why slums emerge and grow in the first place. This paper provides novel evidence on the effect of local political conditions and slum policies on slum growth. Using a regression discontinuity design in close municipal elections in Brazil, I show that victories by a center-left, pro-poor party led to both more slum upgrading policies and a higher share of slum housing. I further show evidence indicating that the pro-slum incentive effect from slum upgrading policies was the main mechanism behind this party's effect on slum growth. By highlighting the relevance of local institutional conditions for understanding where slums are more likely to grow, these findings innovate over traditional explanations based on the role of rural-urban migration and rapid urban economic growth. This paper's evidence on the potential incentive effect of slum upgrading policies on slum growth does not imply that slums upgrading efforts should stop. Given the solid evidence on the positive impacts of slum upgrading programs on the lives of the poor, these programs should continue to develop, and governments should consider, for example, complementing slum upgrading efforts with policies expanding the supply of non-slum housing.

Keywords: Slums, Brazil, Elections.

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1 Introduction

One-third of the developing world’s population lives in urban slums, and given the rapid urbanization, the absolute number of slum residents grew from 650 million in 1990 to 863 million in 2012 (UN, 2012). Although negative impacts of slum living conditions on several dimensions of slum residents’ lives are well documented, much less research exists on why slums emerge and grow in the first place.¹ By establishing the basic incentives for households’ housing choices between slum or non-slum housing, governments’ slum-related policies, such as slum infrastructure upgrading and slum eviction and titling policies, are key to understanding slum growth.

This paper presents the first causal evidence on how changes in local politics and policies affect slum growth. I show how victories by the center-left party Partido dos Trabalhadores (PT) in Brazilian municipalities led to more slum upgrading efforts and higher slum incidence. I further show that the party did not change a broad class of urban policies and expenditure measures, which supports the hypothesis that slum upgrading policies incentivized households to choose slum over non-slum housing. In addition, the absence of effects on municipalities’ demographic composition points to the relevance of within-city housing choices for understanding slum growth in highly urbanized countries, such as Brazil.²

Empirically identifying the causal effects of changes in local politics and policies is always challenging. For instance, the typical economic forces causing slum growth, such as changes in cities’ level and distribution of income, affect who wins elections and what policies are implemented.³ I provide plausible causal evidence on the effect of politics and policies on slum growth by using a regression discontinuity design (RDD) in close elections (Lee et al., 2004; Lee, 2008). I look at the effects of municipality-level victories by PT in the 2000 election on the local policies implemented between 2001 and 2004 and slum growth between the 2000 and 2010 censuses. The paper’s empirical exercise

¹Several studies document the negative impacts of the absence of basic water and sanitation services on households’ welfare (Troesken, 2004; Alsan and Goldin, 2015; Kesztenbaum and Rosenthal, 2017), poor housing quality (Kaufmann and Quigley, 1987; Galiani et al., 2017), and absent property rights (Kaufmann and Quigley, 1987; Field, 2005, 2007; Tella et al., 2007; Galiani and Scharfrodsky, 2010). Different authors have emphasized the need of improving our understanding of the causes of slums beyond seeing them as a manifestation of urban poverty (Duranton, 2008; Feler and Henderson, 2011; Marx et al., 2013).

²Alternatively, in countries with low urbanization rates, slum growth is usually related to high rural-urban migration.

³For studies on the economic forces behind slum growth, see, for instance, Cai et al. (2015); Cavalcanti et al. (2016); Alves (2016).

introduces a novel slum measure based on census-tract data and puts together several sources of publicly available data on urban policies, local finances, and electoral results.

Two elements from Brazil's political context in this period are relevant for understanding this paper's findings. First, the PT's implementation of more slum upgrading policies is consistent with its wider pro-poor agenda, which led to rapid growth in the party's support among low-income voters in the 2000s (Zucco, 2008). While the impacts of national-level pro-poor policies, such as the massive conditional cash transfer program Bolsa Familia, have received wide attention, slum upgrading policies constitute a typical case of special-interest redistributive politics operating at the local level.⁴ A second element is that the PT was in power at the federal level from 2002 to 2016. While expenditure decisions in Brazil are highly decentralized, with municipalities in charge of local infrastructure and land use decisions, municipalities' revenues are highly dependent on the federal government, particularly for infrastructure investment. Brollo and Nannicini (2012) showed that when the same party is in power at both the municipal and federal levels in Brazil, this leads to higher transfers for infrastructure from the federal government to politically aligned municipalities. Consistent with Brollo and Nannicini's work, I find a discontinuity in infrastructure transfers favoring PT municipalities in those years. These transfers then gave material support for urban infrastructure improvements in low-income communities in municipalities governed by the PT.

This paper contributes to different strands of literature on the determinants of slum growth.⁵ First, a well-established theoretical literature, as in Jimenez (1985) and Brueckner and Selod (2009), has looked at the role of governments in setting the basic incentives for households' housing choices in dual housing markets. More recently, a few papers also examine governments' active role in determining slum incidence in calibrated and estimated models of a city with slum and non-slum housing (Cai et al., 2015; Cavalcanti et al., 2016). I contribute to this strand of literature by providing the first direct evidence on the causal role of local governments in determining slum growth. Second, Feler and Henderson (2011) share this paper's focus on the role of political and

⁴In slum upgrading policies, a well-defined group -the current and potential slum residents- receive valuable transfers. The value of these transfers for slum residents has been shown in several studies (Kaufmann and Quigley, 1987; Field, 2005, 2007; Galiani and Schargrodsky, 2010; Alsan and Goldin, 2015; Kesztenbaum and Rosenthal, 2017; Galiani et al., 2017).

⁵A recent overview paper by Marx, Stoker, and Suri (2013) emphasized how scarce the empirical literature on the economics of slums is.

institutional factors for understanding slum formation in Brazil. They show that the existence of houses without water in Brazilian municipalities might be a consequence of exclusionary efforts by wealthier incumbents to prevent poor migrants from coming to their jurisdiction. Two key aspects differentiate my paper from that of Feler and Henderson (2011). First, while Feler and Henderson (2011) show that local governments try to worsen low-income housing conditions to prevent migration, I show that, depending on their political affiliation, local governments may have a positive attitude toward slums, which ends up incentivizing slum growth.⁶ A second difference is that my paper looks at actual electoral and policy data in addition to census data to document the impact of local institutions on slum growth, while Feler and Henderson look at census data only. A third strand of literature in the social sciences has documented the relevance of local politics for slum growth in Latin America with a mix of ethnographic, survey, and time-series evidence (Perlman, 1980; Gay, 1994; Alvarez Rivadulla, 2017; Holland, 2017). I contribute to this literature by providing the first quasi-experimental evidence of the relevance of local political conditions for slum growth.

This paper also contributes to the strand of the political economy literature analyzing whether different political parties implement different policies or whether their policies tend to converge, as predicted by the median voter theorem (Lee et al., 2004; Pettersson-Lidbom, 2008; Gerber and Hopkins, 2011; Solé-Ollé and Viladecans-Marsal, 2013). In an influential study, Lee et al. (2004) looked at the U.S. House of Representatives and found that parties do choose different policies at the federal legislative level. At the local level, which this paper examines, results are more mixed. For example, on one hand, Ferreira and Gyourko (2009) did not find any effect of parties on policies at the city level in the US. On the other hand, Pettersson-Lidbom (2008), Gerber and Hopkins (2011), and Solé-Ollé and Viladecans-Marsal (2013), looking at different countries, find that parties matter in different ways. Pettersson-Lidbom (2008) reports that left-wing parties in office increase expenditure, revenue, and public employment levels at the municipality level in Sweden. Solé-Ollé and Viladecans-Marsal (2013) find that left-wing party control led to lower growth of developable land in Spain. Finally, Gerber and Hopkins (2011) report that mayors belonging to the

⁶Although both papers look at Brazil, they look at different periods with opposite political contexts. While their baseline water provision levels are mostly a consequence of policies of the dictatorship era in Brazil, I am looking at a democratic era with particularly intense political competition.

Democrat Party in the US cause lower public safety spending when they are in office. This paper helps reconcile these heterogeneous findings by showing that PT mayors did more slum upgrading but did not do other things differently, including not spending more. More generally, this paper points to the relevance of the specific institutional and political context to determine the impacts of parties on policies. In this case, for example, the simultaneous presence of the PT at both the federal and municipal levels, proved to be crucial in allowing PT mayors to expend more on slums' infrastructure.

The rest of the paper is organized as follows. The next section describes the institutional context and data sources. A methodology section follows, presenting the regression discontinuity design. Next, I present the paper's results, and then I offer some concluding remarks.

2 Context and Data

Brazil is a relatively highly decentralized country in terms of public expenditure decisions (Ter-Minassian, 1997). In particular, for policies relevant to this paper, it is the municipalities that manage land use regulation and are in charge of local infrastructure (Garman et al., 2001). This makes municipalities the natural jurisdictional level at which to study the impact of changes in politics on policies and slum growth. Municipalities are governed by a mayor, who is elected for a four-year term.⁷ Data on mayoral elections is publicly available from the national electoral authority (Tribunal Superior Eleitoral).

Two issues point to why PT would choose to adopt a pro-slum role at the local level. First, the PT has commonly been labeled as a programmatic party with a strong pro-poor, redistributive agenda (Samuels and Zucco, 2014; Klasnja and Titiunik, 2017), and the available evidence on the evaluations of slum upgrading programs indicates that these policies are in fact a powerful local redistributive tool.⁸ Second, there is evidence that the poor in Latin America, and in Brazil in particular, tend to approve of squatting and land invasions (Holland, 2017).

⁷Mayors are elected by simple majority rule in municipalities with fewer than 200,000 people and absolute majority when the municipality population is 200,000 or more. See Brollo and Nannicini (2012) and Fujiwara (2015) for detailed descriptions of Brazil's political system.

⁸Their redistributive power relies on the well-documented positive impacts of slum upgrading policies (Kaufmann and Quigley, 1987; Field, 2005, 2007; Tella et al., 2007; Galiani and Scharfrodsky, 2010; Galiani et al., 2017).

Another relevant point about this paper’s political and institutional context is that the PT was in office at the federal level from 2002 to 2016. Previous work has found that the alignment in the political affiliation of municipal and federal governments in Brazil leads to higher transfers for infrastructure in pre-election years from the federal to the municipal level (Brollo and Nannicini, 2012). This alignment then provided the necessary resources for PT mayors to improve urban infrastructure in slums from 2002 onward.

Turning to data construction details, I measure slums following the basic structure of the United Nations Human Settlements Programme (UN-Habitat) slum definition (UN, 2003). This definition identifies a slum household as one that exhibits deprivation in some of the following dimensions: basic services, property rights, housing quality, and living space. Following common intuition and the practice of several national statistical agencies, such as those of Brazil and India (IBGE 2011, Census of India, 2013), I add an agglomeration dimension to the UN-Habitat definition and identify housing as a slum when a critical number of contiguous households experience some of the deprivations above. I identify contiguous households using the aggregates by census tracts data from the IBGE.⁹ Different criteria exist to determine the minimum number of households in a contiguous area needed to define a slum. I follow Brazil’s official slum definition, setting the benchmark at 50 households, and then I check the results’ robustness for alternative thresholds of 25 and 75 households.¹⁰

The selection of the set of variables included in the slum measure follows two rules. First, the variables must be available and consistently measured in the aggregates by census tract data in both the 2000 and 2010 censuses. Second, the variables must be included in the dimensions of the UN-Habitat slum definition mentioned above. Five variables comply with these two rules: access

⁹Census tracts in Brazil are relatively small, with an average of 240 households per tract in the 2000 census, so this constitutes an advantage in terms of identifying neighboring households in comparison with other countries with larger tracts. For instance, US tracts have between 1,200 and 8,000 people.

¹⁰The IBGE classifies census tracts as slums using the subnormal agglomerates category. A tract is classified as subnormal agglomerate if the majority of at least 51 households has each of the following conditions: lacks essential public services (water, electricity, trash collection, sanitation), has occupied until recently (10 years or fewer) or currently occupies land without property rights, and constitutes a dense and disordered settlement. Although this classification is in principle interesting, since it provides an official direct multidimensional measure of slums, the IBGE explicitly states that this measure should not be used to compare slum growth between the 2000 and 2010 censuses. This is because the classification is not exhaustive and there is no measure on how exhaustive it is. The ability to identify a subnormal agglomerate improves over time depending on the success of collaboration between the IBGE and local authorities. This might lead to serious bias in an analysis of the impact of local policies and politics on slum dynamics.

to water, access sanitation, and access to trash collection, the existence of a bathroom, and status as a renter or owner of the house. I again take the UN-Habitat slum definition as a reference to define what constitutes a situation of deprivation in each of the five variables. I define deprivation in water as having no piped connection or well or spring inside the property. For sanitation, I define a situation of deprivation when the house is not connected to the local sewer system or has no septic tank. I define deprivation in trash collection as the household not having its trash collected by a trash company, so it buries or burns it on the property or throws it into vacant land, a river, or the sea. The absence of a bathroom for exclusive use of the household also defines a situation of deprivation. Finally, the indicator in the legal dimension establishes that the household is in a situation of deprivation if it reports that the occupant does not own, rent, or have another other type of legal permission from the owner to live in the house. In summary, a census tract is defined as a slum if at least 50 households in that tract show deprivation in at least one of those five variables.

Besides using the aggregates by census tract data to measure slums, I use the 10 percent sample census data to compute auxiliary statistics on municipalities' demographics, such as migration, education, and income composition. I study the public policies implemented by elected mayors using two data sources. The first is a survey performed by the IBGE, asking municipalities' authorities about policies implemented in previous years. This survey, known as MUNIC, covers all municipalities and has been implemented in almost every year since 1999. The main question I look at in this survey is "has the municipality conducted slum upgrading policies in a joint effort with other private or public institutions?". I further look at a broader set of policies in the MUNIC survey to evaluate alternative channels by which local policies may have affected slum dynamics. The main limitation of this survey is that most questions have a binary structure of the type "did you do policy X or not", and there is no quantitative measure on how important the policy was. I address this limitation using Brazil's Federal Ministry of Finance (Secretaria do Tesouro Nacional) database on municipalities' finances. This database features total expenditure and revenue for different categories for all years, and I can thus test if MUNIC answers are consistent with actual expenditure data.

3 Methodology

Looking at the effect of changes in the political environment on economic outcomes is always challenging because a variety of unobserved phenomena affect both electoral and economic outcomes. I address this issue by using a RDD in close municipal elections. In general, the RDD is defined when there is a treatment variable T that depends on a continuous observable variable v , such that:

$$T = 0 \quad \text{if} \quad v < 0, \quad T = 1 \quad \text{if} \quad v \geq 0 \quad (1)$$

The researcher's interest relies in the impact of T on an outcome variable Y , with the usual problem being that there might be unobserved variables that are correlated with both T and Y . The key assumption of the RDD is that the relationship between any relevant unobserved variable and v is continuous at the threshold, and then any observed discontinuous variation in Y may be rightly attributed to T .¹¹ Adopting the potential outcomes notation and adding the subscript i to indicate municipalities, the RDD estimate of the treatment effect of T_i on Y_i at $v = 0$ is:

$$\lim_{\epsilon \uparrow 0} E[Y|v = 0 + \epsilon] - \lim_{\epsilon \downarrow 0} E[Y|v = 0 + \epsilon] = E[Y_i(1) - Y_i(0)|v = 0] \quad (2)$$

In a close elections setup, the forcing variable v is the difference in votes by which a candidate won or lost an election. Because Brazil has a multi party system, I define the forcing variable for only the set of municipalities in which a PT candidate finished first or second in the mayoral election. The main outcome variables Y in the paper are the measures of the change in slum incidence between 2000 and 2010 and the implementation of slum upgrading policies between 2001 and 2004.

A key tool in the RDD is the graphical analysis of the conditional means of the outcome variable on the forcing variable. I provide these graphs for the impact of PT victories on slum growth and slum policies and complement them with estimation techniques following the recommendations of Cattaneo et al. (2017). In contexts with a small number of observations, Cattaneo et al. (2017) recommend using a local randomization approach to estimate the local treatment effect. The

¹¹See Lee and Lemieux (2010) and Cattaneo et al. (2017) for a detailed explanation of RDD design.

intuition behind this approach is that the RDD can be viewed as a randomized experiment near the cutoff.¹² Since this implies using very few observations, Cattaneo et al. (2017) recommend using finite sample methods for inference. I implement these finite sample estimates and complement them with flexible polynomials of the forcing variable estimated separately on each side of the discontinuity, as recommended by Lee and Lemieux (2010).

4 Results

4.1 Sample and Period Choice and Descriptive Statistics

Looking at the impact of PT victories in close elections in Brazil’s multi party system implies restricting the sample to those elections in which a PT candidate came in first or second.¹³ Since slums are an urban phenomenon, I focus on 1,348 urban municipalities. I define urban municipalities as those that belong either to a metro area or had an urban population of more than 50,000 in 2010.¹⁴

The choice of looking at slum growth between 2000 and 2010 relies on the availability of census tract data. Although Brazil has publicly available data for previous censuses, there is no data by census tracts before 2000.¹⁵ In terms of choosing the election year, between the 2000 and 2010 censuses there were mayoral elections in 2000, 2004, and 2008. The choice of the 2000 election is motivated by leaving enough time for dual housing markets’ equilibrium to adjust to the policies implemented during mayors’ four-year mandate.¹⁶ Given these decisions, the main sample for the

¹²The local randomization approach and, the most commonly used, continuity-based approach share the same intuition on units on both sides of the discontinuity being comparable. The difference relies in the formalization of this intuition. While the former approach mimics the conditions of an experimental design around the discontinuity, the latter assumes the existence of a continuous relationship between the outcome and the running variable. The key limitation for using the continuity approach in this context is the small number of observations. For instance, Calonico et al. (2014)’s procedure for optimal bandwidth selection yields a bandwidth with less than 30 observations on both sides.

¹³In the close elections sample, 16 of the 170 elections correspond to runoff results. The main results of the paper are robust to not including these 16 (available from the author upon request).

¹⁴The total number of municipalities went from 5,507 in 2000 to 5,565 in 2010. Only one of the newly created municipalities was part of a municipality that had more than 50,000 or belonged to a metro area in 2010. This was the municipality of Mesquita, located in the Rio de Janeiro metropolitan area. For this specific municipality, which should be in the sample but did not exist back in 2000, I identify the census tracts in the 2000 census corresponding to the municipality area in 2010 using census tracts shape-files provided by the IBGE.

¹⁵In addition, dealing with the rapid process of municipalities’ division in the 1990s in Brazil would further reduce the (already small) number of municipalities in the sample.

¹⁶Households’ housing decisions typically take time to fully adjust, and policies implemented near the end of mayors

RDD exercise is defined as the 170 urban municipalities for which the PT finished first or second in the 2000 election.¹⁷

Table 1 shows the 2000–2010 evolution of population, income, and the five variables behind the slum indicator for the universe of Brazil’s urban municipalities. This was a period of moderate but generalized progress in Brazil. Households’ income grew and the income distribution became less unequal, which led to an overall reduction in poverty measures, including reductions in the incidence of the five variables included in the slum indicator (Lustig et al., 2013). Table 2 shows similar statistics for 2010, distinguishing between municipalities in which the PT finished first or second in the 2000 municipal election and those that did not. Urban municipalities where the PT enjoyed higher support have larger population and higher average incomes, and they exhibit lower incidence in the set of variables behind the slum indicator, except for the one capturing the property rights dimension.

Table 1: 2000–2010 descriptive statistics

	2000	2010
Population	78,249	90,993
Avg hhs income (USD)	298	588
% Share of households with no:		
piped water	6.5	4.1
sewerage or septic tank	39.3	37.4
bathroom	5.7	0.9
trash collection	12.1	3.5
owning or renting the house	0.7	0.4

Data for the universe of Brazilian municipalities. Source: own processing of 2010 Census data.

In Table 3, I study the correlates of the implementation of slum urbanization programs in Brazil between 2001 and 2004. The first row shows a strong positive correlation between the PT being in power in the municipality and the implementation of slum urbanization policies. This correlation is robust to controlling for income, slum population, total population, poverty rate, and region fixed effects in Columns 2 and 3. Furthermore, the regression coefficients for this set of controls in Columns 2 and 3 have intuitive signs. In terms of the demand for slum upgrading policies,

elected in the 2004 election would have only two years to have an effect.

¹⁷Although the PT won consecutive presidential elections in 2002, 2006, and 2010 presidential elections, the party’s local electoral strength has been always weaker than their national electoral strength, especially in 2000, when the party enjoyed much less support than it would the following decade.

Table 2: 2010 descriptive statistics by PT being 1st or 2nd or not

	PT 1st or 2nd		p-value
	No	Yes	
Number of municipalities	1,150	170	
Urban Population	61,412	290,976	0.00
Average Income (Reais)	993	1,288	0.00
Urban 2000-2010 growth in number of HHs	49.5	66.8	0.00
Proportion of HHs who:			
Do not have water from pipe or well	4.5	2.3	0.00
Do not have sewage or septic tank	39.6	20.8	0.00
Do not have a bathroom	0.9	0.4	0.00
Do not have trash collection	3.7	2.2	0.00
Are in poverty	21.1	15.0	0.00

Source: own processing of 2010 Census data. I calculate the poverty rate with a relative poverty line of half of Brazil's median income.

municipalities with higher poverty rates and slum populations implement more of these policies. In terms of municipalities' potential for supplying these policies, municipalities with more population and more income do more slum upgrading policies, which is consistent with these municipalities having higher revenues and expenditure. These correlations are a good illustration of the point made earlier that when slum policies are correlated with variables that affect both slum growth and political outcomes, non experimental studies of changes in politics and policies on slum growth are threatened.

4.2 The Impact of the PT on Slum Growth and Slum Policies

Figure 1 presents evidence in favor of the hypothesis that PT mayors in office between 2001 and 2004 led to higher slum growth between 2000 and 2010 in comparison with non-PT municipalities. Both the binned local averages and the third order polynomials show a clear discontinuity in the change in the share of slum households in the municipality. Regression results in Table 4 confirm a large effect of PT mayors on the change in municipalities' slum share on the order of 10 percentage points. This result holds when simply comparing the unconditional means around 3, 5, and 10 percentage points from the threshold (columns 1 to 3) as well as when estimating the discontinuity using polynomials of different degrees with all the observations (columns 4 to 7).

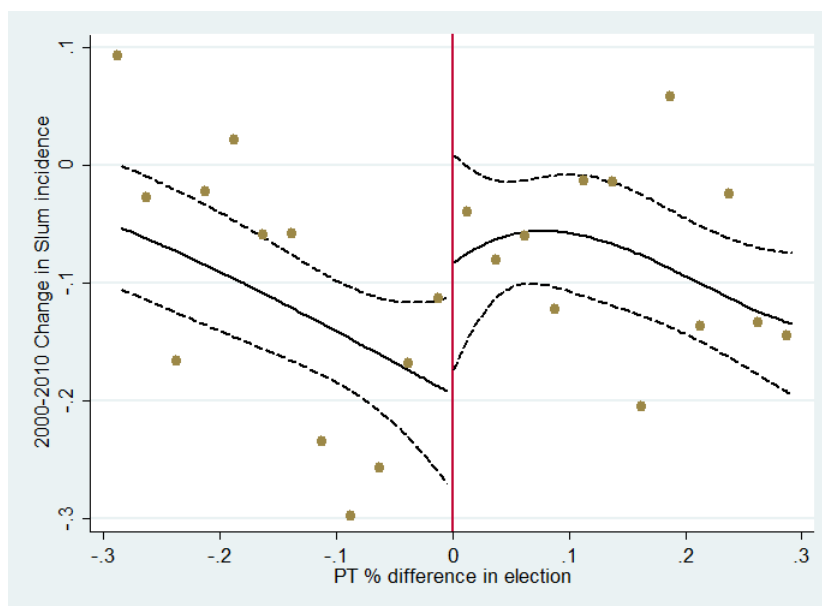
Given this solid evidence of the impact of PT victories on slum growth, the next step is to study

Table 3: Correlates of Slum Upgrading Policies

	Slum Upgrading 2001-2004		
PT_Win	0.33*** (0.06)	0.13** (0.05)	0.13** (0.05)
ln(Income_00)		0.17*** (0.05)	0.15*** (0.05)
ln(SlumPop_00)		0.01** (0.01)	0.00 (0.01)
ln(Pop_00)		0.08*** (0.01)	0.10*** (0.01)
SharePoor_00		0.46*** (0.14)	0.42** (0.17)
Constant	0.25*** (0.01)	-1.79*** (0.33)	-1.64*** (0.33)
Observations	1,320	1,318	1,318
R-squared	0.03	0.21	0.22
Region FE	No	No	Yes

OLS regressions with implementation of slum upgrading policies in the municipality as dependent variable in all columns. Robust SE in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All covariates measured for year 2000

Figure 1: Change in Slum incidence between 2000 and 2010



The x-axis measures PT's vote difference in percentage points and the y-axis measures the change in municipalities' slum share between 2000 and 2010. Dots represent local averages taken by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity and the dotted lines are 10% confidence intervals.

Table 4: Impact of PT victories on slum growth between 2000 and 2010. Main estimations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PT_win	0.08**	0.09**	0.12***	0.09**	0.16***	0.11**	0.11**
P-value	0.02	0.01	0.00	0.02	0.00	0.04	0.03
Window	3	5	10	100	100	100	100
N	20	34	65	170	170	170	170
Pol order	0	0	0	1	2	3	4

Dependent variable is the 2000-2010 change in the share of slum houses in the municipality according to the benchmark slum measure (threshold of 50 households per tract) between 2000 and 2010. Coefficients in Columns 1 to 3 are differences-in-means between municipalities where the PT won and lost by 3%, 5%, and 10% margins. Columns 4 to 7 consider all the data and fit polynomials of degrees 1 to 4 on each side.

the mechanisms behind this effect. In other words, what was it that PT mayors did differently that led to higher slum growth. In order to answer this, I look at potential discontinuities on the policies implemented in the term following the 2000 election. Starting with slum policies, Figure 2 and Table 5 show that PT mayors implemented more slum upgrading policies between 2001 and 2004. In addition, these results on slum upgrading policies are consistent with the results in Figure 3 and Table 6 on the PT receiving more transfers for infrastructure investments from the federal government in the pre election year. PT mayors then not only declared that they made more slum upgrading policies, but they also received abundant funds to implement these policies.

Table 5: Impact of PT victories on slum urbanization policies between 2001 and 2004

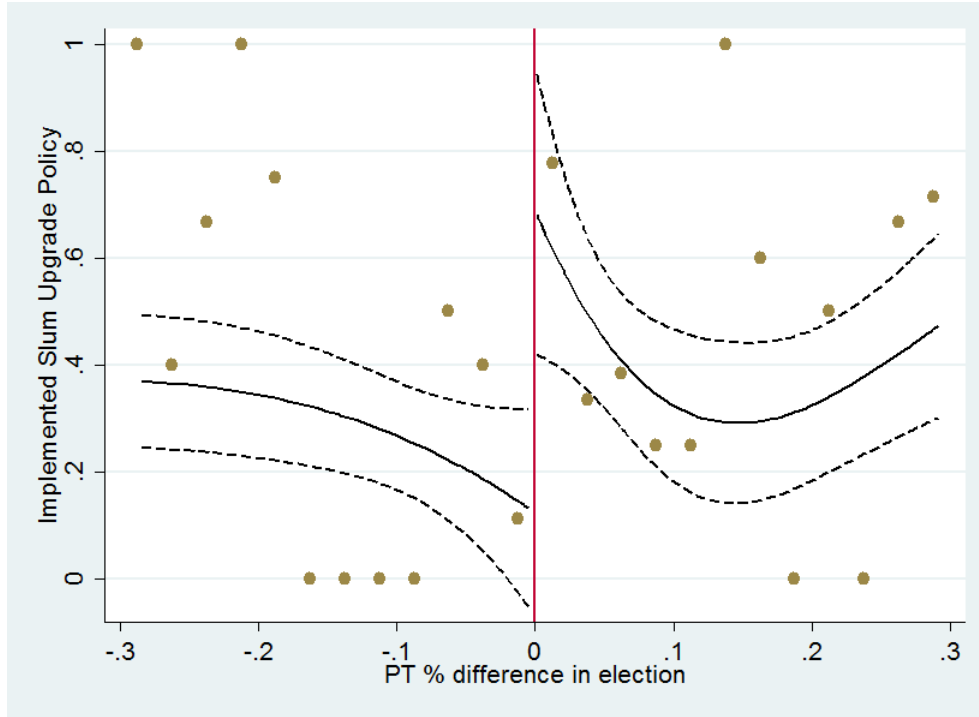
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PT_win	0.60**	0.34*	0.24*	0.18	0.38**	0.57***	0.73***
P-value	0.03	0.08	0.06	0.12	0.01	0.00	0.00
Window	3	5	10	100	100	100	100
N	20	34	65	170	170	170	170
Pol order	0	0	0	1	2	3	4

The dependent variable in all columns takes values of 0 or 1 if the municipality implemented or not some slum urbanization policy between 2001 and 2004. Coefficients in Columns 1 to 3 show the differences-in-means between municipalities where the PT won and lost by 3%, 5%, and 10% margins. Columns 4 to 7 consider all the data and fit polynomials of degrees 1 to 4 on each side.

4.3 The Impact of the PT on Other Policies and Population Composition

The evidence in the previous section on PT governments implementing more slum upgrading policies makes these policies a key candidate for explaining why PT victories led to higher slum growth. The mechanism behind the effect of slum upgrading policies on slum growth is simple. By improving

Figure 2: Implementation of Slum upgrading policies between 2001 and 2004



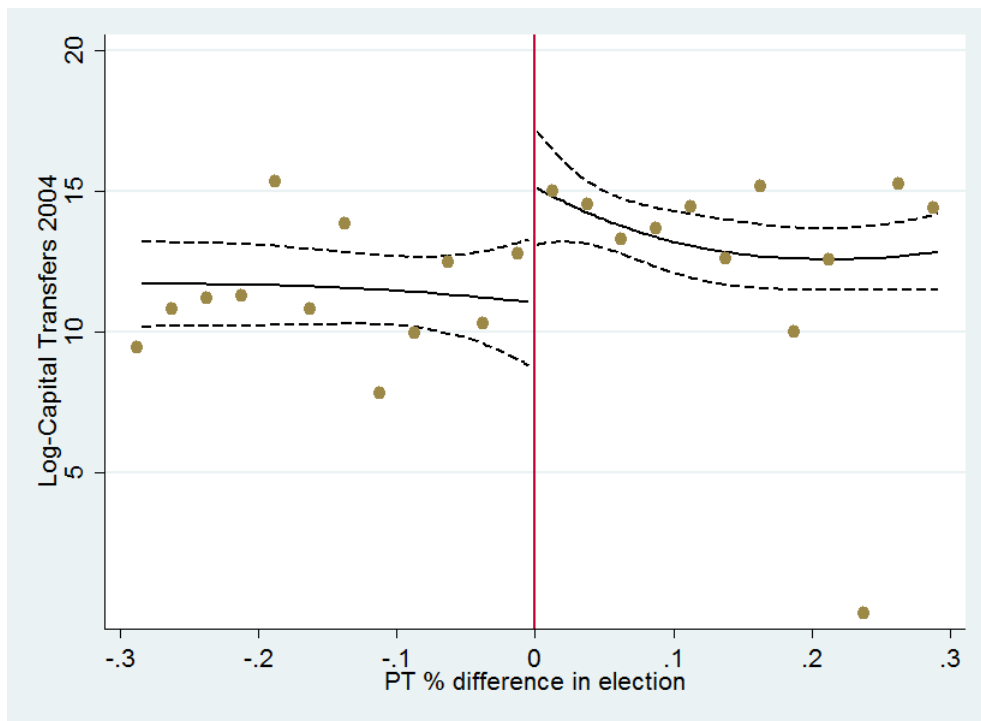
The x-axis measures PT's vote difference in percentage points and the y-axis measures if municipalities implemented slum urbanization policies between 2001 and 2004. Dots represent local averages taken by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity and the dotted lines are 10% confidence intervals.

Table 6: Impact of PT victories on Capital transfers received in 2004

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PT_win	1.8	3.4*	2.9**	2.4**	3.7**	4.1**	2.7
P-value	0.30	0.06	0.02	0.02	0.01	0.02	0.14
Window	3	5	10	100	100	100	100
N	20	33	64	168	168	168	168
Pol order	0	0	0	1	2	3	4

The dependent variable in all columns is the log of capital transfers (in Reais) received by each municipality in 2004. Columns 1 to 3 look at the differences-in-means between municipalities where the PT won and lost by 3%, 5%, and 10% margins. Columns 4 to 7 consider all the data and fit polynomials of degrees 1 to 4 on each side.

Figure 3: Capital Transfers received in 2004



The x-axis measures PT's vote difference in percentage points and the y-axis measures the log of capital transfers (in Reais) received by municipalities in 2004. Dots represent local averages taken by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity and the dotted lines are 10% confidence intervals.

slum houses' amenities, slum upgrading policies change households' incentives for living in slum versus non-slum housing, incentivizing the former over the latter. Despite the plausibility of this mechanism, PT governments could have done other things differently that could have affected slum growth. In the following paragraphs, I evaluate two alternative hypotheses in this direction and provide evidence that tends to discard each of them. This evidence then favors the interpretation that the incentive effects of slum upgrading policies were the main force behind the observed impact of PT mayors on slum growth.

The first alternative hypothesis is that PT mayors could have done other things differently that also affected households' incentives for choosing slum over non-slum housing. Table 7 explores this alternative hypothesis by checking for discontinuities in a set of urban policies which are relevant a priori for households' housing choices in dual housing markets.¹⁸ First, it could be that PT mayors constructed more or less houses or gave more or less land to construct new houses. For instance, if PT mayors had built fewer non-slum houses, the result would automatically have been higher slum growth in comparison with non-PT municipalities. Columns 1 and 2 in Table 7 show that this was not the case. Second, urban land use regulations have been shown to have an impact on restricting housing supply (Quigley and Raphael, 2005; Saiz, 2010), which could potentially lead to higher slum incidence.¹⁹ Columns 3 to 5 in Table 7 show that the PT did not implement different urban land use regulations. Finally, Column 6 shows that PT mayors also did not do more titling programs, which is the property rights component of slum upgrading policies. This result helps characterize the type of slum upgrading policies implemented by PT mayors. The PT's slum upgrading policies were then focused on other components of slum upgrading, typically improving urban infrastructure, which is consistent with the finding above that PT mayors received more transfers for infrastructure from the federal government.

The regression discontinuity analysis of expenditure data in Table 8 reinforces the idea that PT mayors did not change other things that could have affected slum growth. PT mayors did not expend differently in terms of total amount spent or in the amount spent in most of the budget categories,

¹⁸In general, in the following tables I take the differences-in-means estimator in a 5% window as the benchmark. However, in Table 7 mean tests on small windows around the threshold are not feasible because, for some variables, observations are all zero or one on some or both sides of the discontinuity. I then present results with fourth-order polynomials estimated on each side.

¹⁹This channel has been suggested, for example, by Duranton (2008). Alves (2016) provides evidence on the relevance of non-slum housing supply elasticity for understanding slum growth in Brazilian cities.

Table 7: Impact of PT victories on a set of urban policies between 2001 and 2004

	(1)	(2)	(3)	(4)	(5)	(6)
PT_win	0.15	-0.18	-0.08	-0.11	0.09	-0.05
P-value	0.53	0.48	0.16	0.59	0.66	0.83
Window	100	100	100	100	100	100
N	170	170	170	170	170	170
Pol order	4	4	4	4	4	4

Dependent variables are all binary variables indicating (1) Construction of new houses (2) Giving free urban land for construction of new houses (3) Existence of a law delimiting an urban perimeter (4) Existence of a law regulating urban land subdivisions (5) Existence of zoning law (6) Existence of titling programs. All columns control for a fourth order polynomial of the forcing variable, estimated separately on both sides of the discontinuity (mean tests on small windows around the threshold are not feasible because observations are all zero on one or both sides of the discontinuity for some variables).

except for public safety. In particular, in terms of expenditure in housing-related categories, Columns 2 to 4 show that there were no differences in total expenditure in urban infrastructure, housing, and sewers. The absence of an impact in urban infrastructure expenditure coincides with slum-related infrastructure being a small part of the total urban infrastructure, which includes, for instance, non-slum related expenditure in roads and urban transportation. The non existence of a discontinuity in housing expenditure is consistent with the result on the construction of houses from the MUNIC survey referred to above. Finally, the absence of a discontinuity in expenditure on sewers adds to the result on titling above in terms of characterizing the type of slum upgrading policies implemented by PT mayors.²⁰

Table 8: Impact of PT victories on average 2002-2004 per capita expenditure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PT_win	-0.12	-0.18	0.97	0.62	1.31*	-0.03	-0.12	-0.04	-0.08	-0.92	-0.80
P-value	0.38	0.59	0.33	0.27	0.07	0.88	0.42	0.96	0.48	0.29	0.27
Window	5	5	5	5	5	5	5	5	5	5	5
N	34	34	23	32	25	34	34	20	34	26	33
Pol order	0	0	0	0	0	0	0	0	0	0	0

Dependent variables are logs of municipalities' 2002-2004 per capita expenditure in Reais: (1) total (2) urban infrastructure (3) housing (4) sewage (5) public safety (6) social assistance (7) health (8) labor protection (9) education (10) transport (11) sports and recreation. All coefficients in the PT_win row show differences in means between places where PT won or lost by a difference of less than 5%.

In sum, PT governments caused higher slum growth but did not implement policies other than

²⁰Given the relevance of sanitation as the variable with the highest incidence within the slum definition, a focus on sewer expansion would have mechanically reduced slum incidence in PT municipalities, which would have led to an ambiguous impact of PT mayors on slum growth.

slum upgrading that could have changed the incentives for choosing slum over non-slum housing. Although the existence of other unobserved policies favoring slum housing choices cannot be totally discarded,²¹ the joint consideration of a plausible theoretical mechanism, the solid discontinuities in slum upgrading and infrastructure transfers, and a coherent political environment (see Section 2) give support to the conclusion that slum upgrading did incentivize higher slum growth and was the main mechanism by which PT mayors caused higher slum growth.²²

A second alternative mechanism is that PT mayors' impact on slum growth did not operate by changing the incentives for choosing slum housing but through changes in municipalities' population composition. For instance, given the strong empirical association between slum incidence and poverty and given the PT's strong pro-poor agenda, it could have been that slum growth resulted from increased low-income migration into PT-governed municipalities caused by (unobserved) pro-poor policies implemented by the PT. In Table 9, I evaluate this alternative hypothesis by looking at the impact of PT mayors on a broad set of municipalities' sociodemographic variables. In general, there are no discontinuities in income growth, population growth, poverty rates, or low-income migration.

Table 9: Impact of PT victories on 2000–2010 Demographic changes

	(1)	(2)	(3)	(4)	(5)	(6)
PT_win	-0.09	0.05	0.01	0.50	0.65	0.74
P-value	0.46	0.31	0.41	0.35	0.28	0.23
Window	5	5	5	5	5	5
N	34	34	34	34	34	34
Pol order	0	0	0	0	0	0

Dependent variables are 2000–2010: (1) average HHs per capita income growth (2) growth in the number of households (3) population growth (4) change in the proportion of poor households (5) change in the proportion of migrants (6) change in the proportion of poor migrant households. Poverty rate correspond to a relative poverty line of half of Brazil's median per capita household income. Migrant households are those with at least one member who has not always lived in the municipality. All columns look at differences in means between places where PT won or lost by a difference of less than 5%.

Beyond discarding this second alternative hypothesis, the absence of impacts on municipalities' population composition also contributes to our understanding of the sources of slum growth in highly urbanized contexts, such as contemporary Brazil and most Latin American countries. In

²¹For example, a friendlier government attitude toward slums could also have included less strict behavior in terms of protecting property rights, including impeding new slums to form. Unfortunately, there is no systematic data on evictions or urban land property rights' enforcement.

²²The potential existence of unobserved pro-slum policies different from slum upgrading that also favored slum growth makes me not provide a causal estimate of the impact of slum upgrading policies on slum growth.

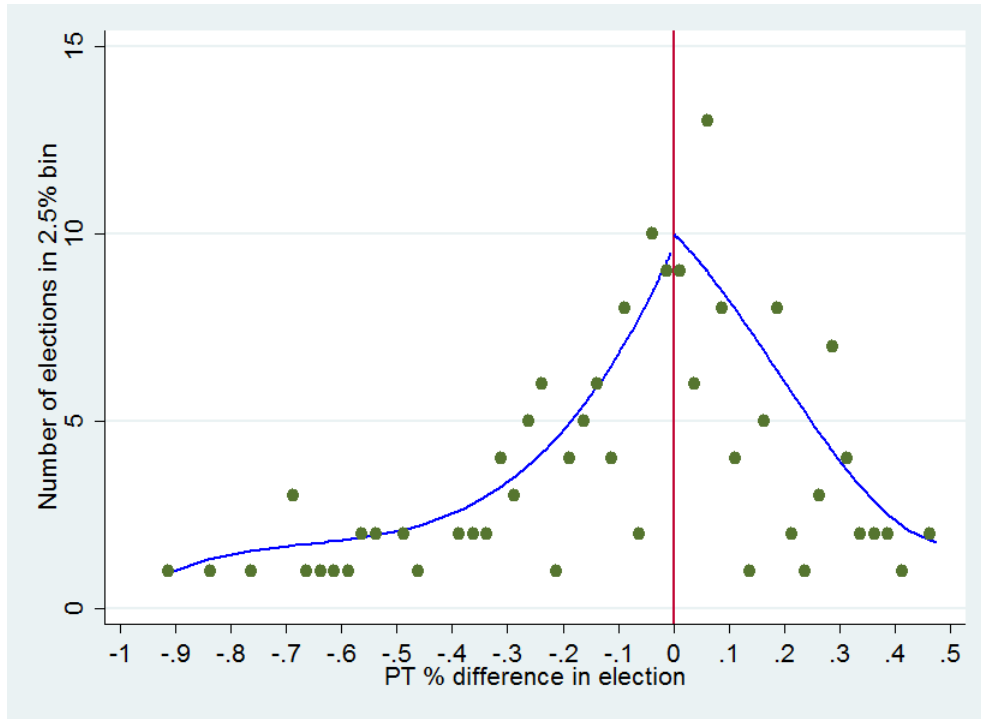
contrast with what happens in rapidly urbanizing countries, where slum growth is related to rapid rural-urban migration, this result points to the relevance of households' within-city housing choices for understanding slum growth.²³

4.4 Validity Checks

Following the recommendations by Lee and Lemieux (2010), I perform two basic checks on the validity of the RDD in my sample of municipalities. First, Figure 4 shows the number of elections by 2.5% bins of the forcing variable. The graph shows that there is no discontinuity at the threshold in the number of elections, which is usually interpreted as evidence against the existence of sorting around the threshold, the main threat to RDD's validity. Second, both Figure 5 and Table 10 show that there is no discontinuity in 2000 in slum incidence or a set of nine other socioeconomic variables. These variables include municipalities' average population, average income, proportion of people who can read and write, proportion of migrants, and the incidence of overcrowding. These two checks then support the validity of the RDD in this specific setup.

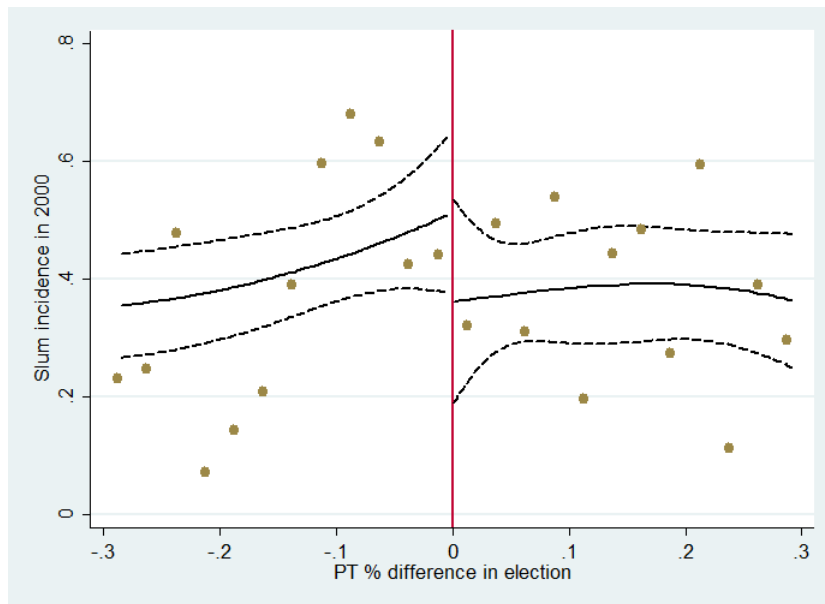
²³Alvarez Rivadulla (2017) has documented a similar phenomenon for the case of Montevideo, Uruguay. During the 1990s, Montevideo's population did not grow but the city did experience rapid slum growth.

Figure 4: Distribution of the forcing variable



The x-axis measures the percentage vote difference of a PT mayor with respect to its closest follower and the y-axis the number of observations by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity.

Figure 5: Slum incidence in 2000



The x-axis measures PT's vote difference in percentage points and the y-axis municipalities' slum share in 2000. Dots represent local averages taken by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity and the dotted lines are 10% confidence intervals.

Table 10: Impact of PT victories on several outcomes in 2000

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PT_win	-0.04	-12.19	0.00	-0.06	0.03	0.01	0.01	0.09	-49.8
P-value	0.71	0.89	0.62	0.24	0.47	0.79	0.43	0.67	0.46
Window	5	5	5	5	5	5	5	5	5
N	34	34	34	34	34	34	34	34	32
Pol order	0	0	0	0	0	0	0	0	0

Dependent variables are all measured in 2000. From Columns 1 to 9, they are: slum share, average household income, proportion of people who can read and write, proportion of migrants, poverty rate (with relative poverty line of half of national median household income), overcrowding rate, proportion of homeowners, proportion of renting households, average household size, and public expenditure at the municipality level (in Reais). Coefficients in the first row are mean differences between municipalities where PT won or lost by a difference of less than 5 %.

A second robustness check looks at the impact of PT mayors on slum growth for alternative thresholds of the census-tract-based slum measure. Table 11 presents regressions with alternative measures of slum incidence using critical slum sizes of 25 (Columns 1 to 3) and 75 (Columns 4 to 6) households and confirms an impact of PT mayors on slum growth of the order of 5 to 10 percentage points.

Table 11: Impact of PT victories on slum growth between 2000 and 2010. Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
PT_win	0.06*	0.06*	0.08**	0.04	0.03	0.08*
P-value	0.05	0.08	0.04	0.30	0.59	0.08
Window	3	5	10	3	5	10
N	20	34	65	20	34	65
Pol order	0	0	0	0	0	0

Dependent variable is the 2000–2010 difference in the share of slum houses using alternative cutoffs of 25 (Columns 1 to 3) and 75 (Columns 4 to 6) households in each tract. The first row shows the differences-in-means between municipalities where the PT won and lost by 3%, 5%, and 10% margins.

5 Conclusion

Despite the growing number of urban slum residents and the popularity of slum upgrading policies, both the causes behind slum expansion and the effects of slum policies on slum dynamics remain poorly understood. This paper contributes to filling this gap by providing new evidence from Brazil on how local politics and policies affect slum dynamics. I show how after a center-left, pro-poor party took power at the local level in Brazil, both slum upgrading policies and the proportion of households living in slums expanded. These findings point to the central role of local political economy forces

and institutions for understanding the dynamics of slum incidence, an aspect previously noted in sociology and anthropology literature (Gay, 1994; Alvarez Rivadulla, 2017; Holland, 2017). The joint consideration of the available evidence, the political context, and a plausible theoretical mechanism points to slum upgrading policies being the key force behind the observed impact of the PT on slum growth. By increasing the expected benefits of slums as a housing choice, these policies may induce households to join existing slums or to form new ones.

While RDDs yield valuable causal estimates, these estimates are always local in nature and this deserves a special note in terms of the internal and external validity of this paper's findings. The local nature of regression discontinuity estimates in this context implies that the causal estimates correspond to a highly competitive electoral context, and candidates in highly competitive electoral contexts have strong incentives to target special interest groups (Persson and Tabellini, 2002). The interpretation of slum upgrading policies, in this context, as a case of special-interest politics can be then be interpreted as reinforcing the findings' internal validity.

In terms of external validity, the paper's message is two-fold. The first message is that researchers and policy makers should pay close attention to local political conditions to understand where and when slums are likely to grow. In particular, as Alvarez Rivadulla (2017) has shown for Montevideo, Uruguay, special attention should be paid to contexts where there is intense political competition for low-income voters. Second, policy makers should not underestimate the potential incentive effects of widespread slum upgrading programs on future slum dynamics. This does not imply that slum upgrading efforts should stop. Much to the contrary, given the solid evidence on the positive impacts of slum upgrading programs on the lives of the poor, slum upgrading programs should probably continue to develop and even expand their reach. Interventions on the supply of non-slum housing should be considered when planning slum upgrading interventions in order to mitigate the potential incentive effects of these policies on slum growth.

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