On the determinants of Slum Formation: the role of Politics and Policies

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Abstract

Slums are a widespread phenomenon affecting millions of households in developing world cities. Policies bringing infrastructure and services to slums are also prevalent and have been found to improve the lives of slum dwellers in several ways. This paper uses a regression discontinuity design in close elections in Brazil to show that victories by a center-left party led to both more slum upgrading policies and slum expansion. These results contribute to the scarce literature on the causes of slum expansion by pointing to the central role of political economy forces and to the potential incentive effects of slum upgrading policies, two key aspects that have been largely ignored in previous studies.
1 Introduction

The 2012 UN Millennium Development Goals report estimated that one third of the developing world population lives in slums (UN, 2012). In a context of rapid urbanization of the most populous countries in the developing world, the absolute number of slum residents went up from 650 million in 1990, to 863 million in 2012 (UN, 2012). Several studies have pointed both to the negative effects of slums and to the positive impacts of slum upgrading programs on different relevant dimensions of people’s lives (Kaufmann & Quigley, 1987; Field, 2005, 2007; Tella et al., 2007; Galiani & Schargrodsky, 2010; Marx et al., 2013; Galiani et al., 2013). However, much less is known about two key questions: What causes slums to form in the first place? Which are the impacts of widespread slum upgrading policies on the subsequent dynamics of slum formation?

Different authors have previously emphasized the need of improving our understanding of slums beyond them being just one additional manifestation of urban poverty (Duranton, 2008; Feler & Henderson, 2011; Marx et al., 2013). In other words, although slum incidence at the national level is clearly negatively correlated with average income, there is a great deal of between and within countries variation remaining to be understood. A key defining dimension of the slum phenomenon is that of property rights (Brueckner & Selod, 2009). Since many slums start as illegal occupations of private or public land, one key question is why countries, such as Brazil or Mexico, where expropriations are things of the distant past, still experience this type of basic property rights’ violation. The answer to this question inevitably leads us to look at political economy forces; it must be that local or national authorities somehow, more or less explicitly, favor this type of housing. ¹

With respect to slum upgrading policies, although they are a popular policy tool which has been subjected to several evaluations as noted above, two important issues about them have been largely overlooked. First, implementing slum upgrading programs once slums form is usually much more expensive than providing fully serviced urban land for the poor on vacant land (Abiko et al., 2007). It is more difficult in general to bring basic infrastructure such as water or sewage to an already densely populated settlement than to previously unoccupied land.² Second, and most importantly, slum upgrading policies might incentivize the formation of new slums since they increase the expected utility of living in a slum (Duranton, 2008; Smolka & Biderman, 2011).

This paper presents new quasi-experimental evidence from Brazil on how victories by a center-left party at the local level led both to more slum upgrading programs and to greater growth in slum incidence.³ A key political economy channel emerges in which parties with strong support among the poor implement slum upgrading policies which effectively transfer substantive resources to the

¹For example, Lanjouw and Levy (2002) report that a very small minority of squatters with no title report seeing a future eviction as possible. The inexistence of eviction is also a characteristic feature of the Brueckner and Selod’s (2009) model.
²Costs are even greater because many slums form in floodable or high slope areas (IBGE, 2013). These higher costs can be thought as a consequence of agents not fully internalizing the cost of infrastructure provision.
³Ethnographic evidence on this type of processes in the Latin American context has been previously documented for Montevideo in Uruguay (Alvarez, 2009) and Rio de Janeiro in Brazil (Gay, 1994).
The findings also give support to the hypothesis that slum upgrading programs may lead to the formation of new slums. Since slum dwellers do not fully internalize the infrastructure costs associated with their location decisions, slum upgrading can be interpreted as a stylized case of inefficient redistribution which is potentially Pareto dominated by a set of less incentive-distorting policies.

In order to identify the effect of politics and policies on slum growth I use a regression discontinuity design in close elections (Lee et al., 2004; Lee, 2008). I look at the effect that electoral victories by the center-left party Partido dos Trabalhadores (PT) at the municipality level had on local policies and slum growth. The empirical analysis puts together several publicly available data on slum incidence, urban policies, local finances and electoral results.

A recent overview paper by Marx, Stoker and Suri (2013) made strong emphasis on how scarce the empirical literature on the economics of slums is. Feler & Henderson (2011) is to my knowledge the only paper dealing empirically with the causes of slum formation. They use data from Brazil and show that slums can be thought as a consequence of the exclusionary efforts of wealthier incumbents to prevent poor migrants from coming to their jurisdiction. While in developed countries this can be achieved with tools such as zoning regulations, in developing countries characterized by poor institutions withholding services might be the only exclusionary tool available.

The paper contributes to the literature on the causes of slum formation in several ways. First, it provides the first evidence on the role of local political economy forces in explaining slum formation. Second, it points to the potential incentive effects of slum upgrading policies as a key channel through which local politics affect slum growth. Third, the paper introduces a new measure of slum incidence based on census tract data, which has the merit of capturing multiple dimensions of the slum phenomena as recommended by current international standards (UN, 2003, 2012). In particular, the new measure incorporates an spatial agglomeration component, which is essential for any slum definition but has been largely absent in previous attempts to measure slum incidence. An important limitation of the empirical analysis is that since PT victories may also affect other policies beyond slum upgrading (property rights’ enforcement for example), I can’t provide a numeric causal estimate of the impact of slum upgrading programs on slum formation (i.e. the exclusion restriction of the instrument doesn’t hold). Nevertheless, I make use of rich data on local policies and public finances to show that PT majors didn’t do a lot of other things differently beyond slum upgrading, which leads to this being the main candidate through which PT victories caused higher growth in slum incidence.

The theoretical literature on slums can be characterized as having two main strands and in both of them the government always has been assigned an anti-slum role. One strand proposes that when

\(^4\) The “effectiveness” of this resource transfer relies on the fact that slum upgrading programs usually increase property values and that most slum dwellers in Brazil report to own their houses (see Table 1). For instance, if they didn’t own their houses the effects of slum upgrading policies capitalized in land values would be appropriated by non-slum landlords

\(^5\) For example, Feler & Henderson (2011) only measure if the household has public water provision
property rights on private or public land are not perfectly enforced, a dual urban housing market emerges with government or private landowners expending resources in evicting slums and squatters in protecting themselves from eviction (Jimenez, 1985; Brueckner & Selod, 2009; Shah, 2014). In these models the government is seen as acting against slums, either exogenously (Jimenez, 1985) or because it represents the interests of non-slum residents (Shah, 2014). Another strand of the literature adopts a system of cities approach in the spirit of Henderson (1974) and models slums as the product of local exclusionary efforts reflecting the interests of the majority of non-slum residents. These efforts may consist in the adoption of formal zoning policies (Duranton, 2008) or in the withholding of basic services of Feler & Henderson (2011) commented before. The explanation proposed by this paper comes then to enrich the existing literature by assigning a new role to governments in how they deal with slums.

The paper also makes an important contribution to the strand of the political economy literature analyzing if different political parties implement different policies or if their policies tend to converge, as predicted by the median voter theorem (Lee et al., 2004; Pettersson-Lidbom, 2008; Gerber & Hopkins, 2011; Solé-Ollé & Viladecans-Marsal, 2013). In an influential study, Lee et al. (2004) looked at the U.S. House of Representatives and found that parties do matter at the Federal legislative level in terms of the policies they choose. At the local level, where this paper is looking at, results are more mixed. On one hand, Ferreira & Gyourko (2009) don’t find any effect of parties on policies implemented at the city level in the US. On the other hand, Pettersson-Lidbom (2008), Gerber & Hopkins (2011) and Solé-Ollé & Viladecans-Marsal (2013) find that parties do matter in different ways. Pettersson-Lidbom (2008) reports that left parties in office cause higher expenditure, revenue and public employment at the municipality level in Sweden. Solé-Ollé & Viladecans-Marsal (2013) find that left wing parties led to lower growth in developable land in Spain. Finally, Gerber & Hopkins (2011) report that Mayors belonging to the Democrat party in the U.S. cause lower spending in public safety when they are in office.

The rest of the paper is organized as follows. First I will provide the conceptual framework for the paper by discussing what slums are and why slums form in the proposed political economy framework. In the following section, I will present the empirical methodology. Then I will proceed

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6This group of papers generally works with a closed city model and characterize the existence of slums as an inefficient equilibrium, with inefficiency emerging from slums posing negative externalities on the formal housing sector. In one of the extensions of the model in Brueckner and Selod (2009) the authors “open” the closed city model by adding an infinite supply of rural migrants. Rural migrants come to the city up to the point in which everyone reaches an exogenous reservation utility.

7At the time of the Jimenez (1985) paper, the exogenous government assumption may have been more reasonable because of the non-democratic nature of many developing countries’ governments at the time. In Brueckner and Selod’s (2009) main setup there is no government and the task of fighting land occupations is modelled as decided by landowners.

8In the system of cities’ literature (Duranton, 2008; Feler & Henderson, 2011) the assumption that the government only represents the interests of non-slum residents can be thought as a consequence of the idea that slum residents usually come from the countryside or from other cities. While this might be true for rapidly urbanizing countries, it may not be the case in countries which are already highly urbanized (most of Latin America). If slums emerge as within city residential choices, it becomes more reasonable to assume that the government may also represent the interests of these households.
to present the data sources and the details on the construction of the main variables. A results section will follow and then I will conclude with some final remarks.

2 Conceptual framework

In this section I will briefly review the existing literature on two topics. First, I present a characterization of the slum phenomenon and its consequences. This will provide the conceptual base for the slum measure. Second, I introduce a theoretical explanation for the papers’ main findings.

2.1 What are Slums?

There are several different definitions on what a slum is (UN, 2003; IBGE, 2011; Census of India, 2013). A common feature among all definitions is that slums are a multidimensional phenomena. The international standard for slum measure is the one by the United Nations Settlements Programme (UN-HABITAT), which is used for monitoring the progress of the Millennium Development Goals. This definition came out of an expert group meeting in 2002 and since then it has established itself as the most common measure of slum incidence around the world. The definition considers a household to be a slum household if it lacks one or more of the following conditions: access to improved water, access to improved sanitation, access to secure tenure, durable housing and sufficient living area (UN, 2003).

The UN-HABITAT definition is naturally constrained by the fact that it was conceived to be applied globally. As such, regional or national definitions can always improve upon it since they are less constrained by cross-country data availability requirements. Two important national definitions, due both to the absolute and relative size of their slum populations, are those of the national censuses of Brazil and India (IBGE, 2011; Indian Census, 2013). These definitions incorporate an important missing element to the UN-HABITAT definition which is the agglomeration dimension of the slum phenomenon: a household can’t be considered a slum household if it is not surrounded by other households sharing similar conditions. After reviewing these different definitions, I have identified four key dimensions that should form part of an ideal definition of what a slum is:

- Lack of services

This is the most common dimension among different definitions. The list of services considered and what is required for a given service to be adequate varies between countries and even between regions or cities in a given country. The two most common services included in operational definitions are water and sanitation (UN, 2003; IBGE, 2011; Census of India, 2013). Trash collection and electricity are two other services which are sometimes considered (IBGE, 2011).
• Agglomeration

A slum is a group of neighboring urban houses sharing some characteristics. This dimension emphasizes both that slums are an urban phenomenon and that some critical number of neighboring households sharing some characteristics is required to define a slum. For instance, a group of rural houses does not constitute a slum in any case and dispersed/non-neighboring houses in a city don’t make a slum either.\(^9\)

• Housing quality

This dimension typically focuses on poor construction materials and structures, high people per space/room ratios and the absence of a bathroom.

• Legal aspects

The term informal housing is usually used to characterize the conflicting legal nature of slums. Informality means that houses don’t respect formal rules either or both in terms of land property rights and urban regulations. Many slums are squatter settlements in public or private land and as such they don’t have legal property rights on the land. With respect to urban regulations, most slums violate land use regulations like minimum lot size and urban perimeter laws and don’t pay housing related taxes such as the property tax.

2.2 Politics, Policies and Slum formation

In order to provide a simple formal framework to think about the links between politics, slum policies and slum growth we can think of a household making a discrete choice between living in a slum and some other non-slum outside option (i.e. living in a non-slum house or in some other city or the countryside). Let’s start by assuming that living in a slum yields utility:

\[
U_S = f(SP, X, \varepsilon), \text{ with } f_1 > 0, f_3 > 0 \text{ and } \varepsilon \sim F_\varepsilon. \quad 10
\]

where \(SP\) stands for Slum Upgrading Policy and it is a binary variable that exogenously changes from zero to one when the pro-poor party wins an election. \(X\) is a set of variables which affect the utility of living in a slum, for example distance from the slum to the center of the city. \(\varepsilon\) represents households’ heterogeneity with respect to the value of the slum option. Factors such as household wealth or job location can be thought as key determinants of this \(\varepsilon\) variable. An outside non-slum option \(U_{NS}\) is normalized to zero.

Let’s further assume that when \(SP = 0\) there is some critical value \(\hat{\varepsilon}\) in the domain of \(F_\varepsilon\) such

\(^9\)The minimum number of households required for a group of neighboring households to be considered a slum varies from country to country. Brazil for example requires at least 51 households to define a Subnormal Agglomerate, which is their official definition of slums (IBGE, 2011). In India, the 2011 Census requires around 300 people or 60 to 70 households in “a compact area” to define a slum (Census of India, 2013).

\(^{10}\)\(f_i\) denotes the partial derivatives to the \(i\) input of the function. Then, \(f_1 > 0\) means that Utility is higher when Slum Policy exists.
that some households exist with \( \varepsilon > \hat{\varepsilon} \) (which implies \( U_S > U_{NS} \)). Thus, there is a positive share of slum households before the pro-poor party wins the election \( P_{SP=0} \), which equals \( 1 - F_\varepsilon(\hat{\varepsilon}) \). Assuming \( F_\varepsilon \) is strictly monotonous at \( \hat{\varepsilon} \) we have that \( P_{SP=1} > P_{SP=0} \), which means that slum incidence grows after the pro-poor party wins the election.

3 Methodology

To empirically evaluate the hypothesis on the impact of politics and slum upgrading policies on slum dynamics I will use a regression discontinuity design (RDD) in close municipal elections in Brazil. In general the RDD is defined by the existence of a binary treatment variable \( T \) which depends on a continuous observable variable \( v \) such that:

\[
T = 0 \quad \text{if} \quad v < 0, \quad T = 1 \quad \text{if} \quad v \geq 0
\]  

(1)

The researcher’s interest relies in the treatment effect or impact of \( T \) on an outcome variable \( Y \), with the usual problem being that there might be unobserved variables which are correlated both with \( T \) and \( Y \) and may bias any estimate of the causal impact. The key assumption of any 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 \( T \).\textsuperscript{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:

\[
\lim_{\varepsilon \uparrow 0} E[Y_i | v = 0 + \varepsilon] - \lim_{\varepsilon \downarrow 0} E[Y_i | v = 0 + \varepsilon] = E[Y_i(1) - Y_i(0) | v = 0]
\]  

(2)

In the close elections setup the forcing variable \( v \) is the percentual difference in votes by which a candidate won/lost an election. Given that Brazil has a multi-party system and I am interested in one specific party (PT), the forcing variable will be defined only for a set of municipalities in which a PT candidate was first or second in the final counting of votes.\textsuperscript{12} When \( v > 0 \) the municipality “gets treated”, which in this context means that it has a PT major. The outcome variable \( Y \) will be either a measure of the change in slum incidence or the implementation of slum upgrading policies at the municipality level.

Lee & Lemieux (2010) recommend that the researcher should check that any observable variable

\textsuperscript{11}For a detailed exposition of the RDD design see Lee and Lemieux (2010).

\textsuperscript{12}This is only one of the disadvantages of using the RDD in close elections in a multi-party system in comparison with a two-party system. While in a two-party system the RDD can potentially use all elections in a multi-party system the set of elections is restricted. A second disadvantage is that \( T = 0 \) in a two-party system implies that the other party is on power, while in a multi-party system \( T = 0 \) includes potentially many different parties. This will necessarily add more noise to the estimations of the causal effects.
available before the election should be continuous at the critical threshold. I will perform this validity check for a set of several relevant variables. A key tool in the RDD is the graphical analysis consisting in plotting the conditional means of the outcome variable on the forcing variable. This will be the central element in terms of the presentation of the empirical results. This graphical analysis will be complemented with regression results. I will follow Lee & Lemieux (2010) and provide estimations with flexible polynomials of the forcing variable estimated separately on each side of the discontinuity. The usual practice in the RDD literature of estimating regressions using only observations within a certain threshold around the cutting point is very constrained in this case by the reduced number of observations. I will then limit the analysis around the threshold to comparisons of unconditional means.\footnote{Lee and Lemieux (2010) show that when using data from Lee (2006) the optimal order of the polynomial using the Akaike information criterion is zero (i.e. regression just consists in comparing means of the dependent on both sides) for thresholds of 1 to 4 percentual points around the discontinuity when there are 106 to 483 observations. In my case the whole sample consists of 170 observations so comparisons of means around the threshold will be limited to the 5% (34 observations) and 10% (65 observations) windows.}

4 Data

In this section I describe the several data sources that were put together for this paper, as well as the construction of the main variables measuring politics, policies and slum incidence.

4.1 Slum incidence

The paper’s slum incidence measure is based on census data. The source for census data is the official Brazilian institution which implements censuses and gathers most official data (IBGE). I will use the aggregate by census tracts data because households in a given census tract are in a delimited contiguous area, and then these data has the potential of capturing the agglomeration dimension of the slum definition.\footnote{An alternative source of census data is that of individual household data for a 10% sample of the population. The main potential of these data consists in having an slightly broader set of variables in comparison with the census tract data. Also, since these data has the household as the unit of observation, it is possible to construct measures of joint deprivations (i.e. number of households without adequate water, sanitation and trash collection), which are sometimes not available when working with data aggregated by census tracts. Given that I want to capture the agglomeration dimension, I will restrict the slum incidence measures to those that can be built with the aggregates by census tract data. I will use the 10% sample data to compute auxiliary statistics such as migration, education and income of the municipality.}

The approach I will develop to measure slum incidence at the municipality level in Brazil borrows its basic structure from the UN-HABITAT internationally accepted indicator. It identifies a slum when in a given census tract there is a critical number of households experiencing one or more deprivations from a set of five.\footnote{The problem of constructing a single dimension index of slum incidence that uses several indicators on different households’ deprivations is analogous to the problem of constructing a multidimensional poverty index (Alkire and Foster 2011). A slum incidence index can be thought as a multidimensional poverty index which is restricted to}
tract level in the 2000 and 2010 censuses exist are: three services (water, sanitation and trash collection), one housing quality measure (existence of a bathroom) and one indicator on the legal dimension. These five deprivations, together with the agglomeration dimension explained below, capture the four dimensions of the slum definition presented in Section 2. In terms of services, I define a deprivation in trash collection when the household does not have its trash collected by a trash company and instead buries or burns it at the property or throws it into vacant land, river or sea; there is a deprivation in water when there is no piped connection or well or spring inside the property; for sanitation the deprivation is defined when there is no sewage or septic tank. In terms of housing quality the absence of a bathroom for exclusive use of the household defines a situation of deprivation. The indicator in the legal dimension establishes that the household is in a situation of deprivation if the occupancy condition is not well defined. This happens when the household reports not owing, renting or having other type of legal permission by the owner to live in the house.

In terms of the agglomeration dimension, the smallest geographical unit for which there is public access census data in Brazil is the census tract and then this is the unit for which agglomeration of households with certain characteristics can be captured. Census tracts in Brazil are relatively small with an average of 240 households per tract in the 2000 Census. As it was mentioned in Section 2, different criteria exist to determine what is the minimum number of households located in a contiguous area which is needed to define a slum. I will consider three different thresholds of 25, 50 and 75 households and check the robustness of the results to this choice. Then, a summary of the slum measure is that a census tract will be then identified as a slum if at least 25, 50 or 75 households in that tract have a deprivation in at least one of the five indicators mentioned above. Because Brazil’s national definition establishes 51 household as the threshold to identify a subnormal agglomerate, I will work with 50 households as a benchmark.

housing aspects of poverty plus the agglomeration dimension. Two key methodological decisions have to be made when constructing a single index of multidimensional poverty (Alkire and Foster 2011). First, for each dimension it must be defined what constitutes a deprivation in that dimension. Second, an aggregation criteria of the different dimensions must be specified.

16See section 4.4 for a discussion of the choice of the period.
17This constitutes an advantage in terms of identifying neighboring households in comparison with other countries.
18In principle I don’t necessarily have to count the whole tract as a slum but only the households in the slum experiencing the deprivation. However, due to the absence of information on the joint densities of deprivations, I can’t count the number of households with deprivations in more than one dimension.
19IBGE classifies census tracts as slums with the category of Subnormal Agglomerates (SA). This classification is in principle very interesting since it provides an official direct multidimensional measure of slums. A tract is classified as a SA 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 less) or currently occupies land without property rights and constitutes a dense and disordered settlement. The key limitation of this measure is that the process of identifying which tracts constitute SA comes from a joint effort between IBGE and municipalities with no clear time and space consistent rule for identifying slums. Although probably all tracts identified as SA comply with the definition above, there are many other groups of households in similar conditions which are not identified as SA. There are then two main drawbacks in using Subnormal Agglomerates as the measure of slums dynamics between censuses. First, the classification is not exhaustive and there is no measure on how exhaustive it is. Second, the identification of SA seems to improve over time according to how successful is the local collaboration between IBGE and local authorities. This might lead to serious bias if we want to analyze the impact of local policies and politics on slum dynamics.
4.2 Elections

The relevant jurisdiction in Brazil for the objectives of the study is the municipality. Municipal elections take place every four years in Brazil and electoral data is publicly available for every election since 1996 from Brazil’s electoral authority (Tribunal Superior Eleitoral). Since Brazil is a multi-party electoral system the sample is restricted only to elections in which PT was first or second. The main variable for the close elections RDD is the proportion of votes for each candidate to the Major position (prefeito in Portuguese).

4.3 Policies

I will use two public sources of data on policies at the municipality level. First, there is a survey performed by IBGE to municipalities’ authorities about policies implemented in the previous years. This survey, known as MUNIC, covers all municipalities and has been performed almost every year since 1999. Given that I will be looking at policies implemented by majors elected in the 2000 elections, I will use the 2004 survey which asked about policies implemented from 2001 to 2004. 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 then there is no quantitative measure on how important the policy was. The key question to be analyzed is “has the municipality done slum upgrading policies in joint efforts with other private or public institutions?”. Beyond this question, I will be also looking at a broader set of policies in order to explore other channels by which local policies may have affected slum dynamics.

The second source of data on local policies is Brazil’s Federal Ministry of Finance (secretaria do Tesouro Nacional) database on municipalities’ finances. I will use this database to compute the per capita expenditure and the expenditure share for eleven budget functions for the years 2002 to 2004. Here the main focus will be put on the budget functions which are potentially related to slum upgrading programs and slum dynamics such as urban infrastructure, housing and sewage. I will also look for discontinuities on other functions, as well as in total per capita expenditure, in order to look for other channels that may contribute to a better understanding of the story.

4.4 Sample selection

Because slums are an urban phenomenon, I will focus only in municipalities that either belonged to a metro area or had an urban population of more than 50,000 in 2010. This is a set of 1,348 municipalities. I will not include municipalities that did not have elections, elections that were in a runoff, or elections that were in a runoff with runoffs. The main results of the paper are robust to not including these 16 (available from the author).
municipalities among which only 170 had PT being first or second in the 2000 election. These 170 municipalities constitute the main sample for the RDD exercise.\textsuperscript{23}

In Table 1 I present some summary statistics for this set of urban municipalities in Brazil, distinguishing between those that had PT first or second in the 2000 municipal election and those that didn’t. Urban municipalities where PT enjoyed higher support are clearly bigger, have a higher average income and exhibit lower incidence of the different indicators used for measuring slums, except for the one capturing the property rights dimension.

The choice of the period of analysis deserves a small note. First, the choice of the 2000 and 2010 censuses (and not the previous ones) responds both to the fact that before 2000 the number of municipalities was too small to perform this type of analysis and also to the fact that census tract data for previous censuses is not easily available. Given the choice of the censuses, I could use some or all of the 2000, 2004 or 2008 municipal election results. The choice of using only the 2000 election relies in two reasons. First, the sequential nature of the elections and the potential confounding role of incumbency advantage effects (Lee et al., 2004; Lee, 2008; Ferreira & Gyourko, 2009) implies that the result of one election potentially affects the next election. This challenges the simultaneous use of several elections because the effects of each election are not independent of each other. The second reason justifying the use of the 2000 election is that it leaves enough years for potential incentive effects of slum policies on slum incidence to take place, which is less the case when working with 2004 and 2008 elections and 2000-2010 census variations. Since slum growth implies households taking housing location decisions, it is important to give enough time for them to adjust.

5 Data Description?

Table 1: Descriptive statistics for benchmark Slum incidence measures in 2010

<table>
<thead>
<tr>
<th>Threshold # of HHs</th>
<th>25</th>
<th>50</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipalites’ average</td>
<td>59.2</td>
<td>49.7</td>
<td>42.7</td>
</tr>
<tr>
<td>National average</td>
<td>34.8</td>
<td>27.7</td>
<td>23.6</td>
</tr>
<tr>
<td>Average in Normal Tracts</td>
<td>35.9</td>
<td>28.3</td>
<td>23.8</td>
</tr>
<tr>
<td>Average in Slum Tracts</td>
<td>51.7</td>
<td>41.6</td>
<td>33.7</td>
</tr>
<tr>
<td>t-stat of difference</td>
<td>-39.5</td>
<td>-35.4</td>
<td>-28.0</td>
</tr>
</tbody>
</table>

was the municipality of Mesquita, located in the Rio de Janeiro metropolitan area. For this specific municipality, which should be in the sample but didn’t exist back in 2000, the census tracts in the 2000 census corresponding to the municipality area in 2010 were identified using census tracts shapefiles provided by IBGE and GIS software. This permitted the inclusion of the municipality in the sample by preserving a spatially consistent definition of all municipalities.

\textsuperscript{23}Although PT has consecutively won the 2002, 2006 and 2010 presidential elections, their local electoral strength has been always weaker than their national electoral strength, especially back in 2000 when the party enjoyed much less support than what it would have in the following decade.
6 Results

Before turning to the results, it is important to perform some basic checks on the validity of the RDD for the specific setup of the 2000 municipal elections in Brazil. I perform three validity checks following the suggestions of Lee & Lemieux (2010). First, in Figure 1 I plot the number of elections by 2.5% bins of the forcing variable, which is the proportion of votes by which PT won or lost. The graph shows that there is no discontinuity at the threshold in the number of elections. This can be interpreted as evidence against the existence of sorting around the threshold, which is the main threat to the validity of the RDD. Second, both Figure 2 and Table 2 show that there is no discontinuity in the benchmark measure of slum incidence in 2000 (prior to the treatment). Third, Table 3 shows that there are no discontinuities in 2000 for a set of nine other relevant variables, including average population, average income, proportion of people who can read and write, proportion of migrants and incidence of overcrowding. These three checks give then support for the validity of the RDD in this specific setup.

Turning to the main focus of the paper which is the relationship between politics, policies and slum dynamics, Figure 3 presents graphical evidence in favor of the hypothesis that PT majors in office between 2001 and 2004 led to higher slum growth between 2000 and 2010. Both the binned local averages and the third order polynomials show a discontinuity in the change of slum incidence at the threshold. While slum incidence close to the threshold on the left fell in the order of 20%, on the right it fell only by around 10%. Regression results in Table 4 confirm an effect on the order of 10 percentual points. This result is robust to the use of polynomials of different degrees (columns 1 to 4) as well as to simple comparison of unconditional means using only observations around 5 and 10 percentual points from the threshold (columns 5 and 6). The result on the impact of politics on slum dynamics is robust to several specifications. Table 5 presents regressions with alternative measures of slum incidence using critical slum sizes of 25 and 75 households (columns 1 and 2) and regressions controlling for the same polynomial on both sides of the threshold (columns 3 to 6).

The previous paragraphs presented compelling evidence that PT victories led to higher slum growth. But what was the mechanism explaining this link? What was it that PT governments did differently that led to higher slum growth? To give an answer to these questions I will look at potential discontinuities on the policies implemented in the term period following the 2000 election. This exercise will show that PT governments did significantly more slum upgrading policies and did

---

24 In all regressions in Table 3 I control for a third order polynomial estimated separately on each side of the discontinuity. The choice of the order of the polynomial has to do with what I will later argue is the best specification in the main estimation. In any case results hold (treatment variable is not significant) with polynomials of degree 0 to 4 either if they are estimated separately on both sides or not (results not included in the paper to economize in space but available from the author).

25 Brazil made great progress during this decade in terms of social indicators and income growth of the poorest households (see for example Ter-Minassian (2012)). In this context it is reasonable for the slum indicator to have fallen for most places.

26 Table 4 includes the Akaike Information Criteria (AIC), which Lee & Lemieux (2010) suggest can be used to choose between different specifications of the regression equation. When using the whole sample of 170 observations the third order polynomial estimation has the lowest AIC.
not do much of other things differently, which naturally leads to slum upgrading being the central mechanism explaining the observed higher slum growth.

Figure 4 and Table 6 show graphic and regression evidence on the existence of a discontinuity in the binary variable indicating if the municipality implemented slum upgrading policies between 2001 and 2004. Although the magnitude of the effect is difficult to assess because different polynomials yield different results, the graph with binned averages shows a clear discontinuity and all average marginal effects from a Probit regression in Table 5 are positive and significant at least at the 10%. PT majors caused then both more implementation of slum upgrading policies and higher growth in slum incidence.

As noted before, the fact that PT governments may have done other things differently that could have had an effect on slum growth invalidates the use of the RDD to provide a causal estimate of the impact of slum upgrading polices on slum growth (i.e. the exclusion restriction of the instrument does not hold). Nevertheless, the available data analyzed on Tables 7 and 8 indicates that PT majors didn’t do many other things differently.

Table 7 examines the existence of discontinuities in several urban policies that may potentially affect slum incidence through different channels. PT majors’ policies didn’t differ in all other aspects for which there is data. In particular, a key aspect in which policies didn’t differ was in urban land supply regulations (columns 4 to 6 in Table 7). Urban land regulations have been shown to have an impact on restricting housing supply (Quigley & Raphael, 2005; Saiz, 2010) and through this channel they could potentially lead to higher slum incidence, as noted by Duranton (2008). PT majors also didn’t do more titling programs, which is the property rights’ component of slum upgrading policies (column 2 in Table 7). Table 8 turns to the analysis of the expenditure data and looks at average per capita expenditure between 2002 and 2004 by budget function. It shows that PT local governments didn’t cause big differences in total per capita expenditure and in most of the budget functions, except for labor protection.

In sum, PT governments caused higher slum growth but didn’t implement policies which could have influenced slum growth other than slum upgrading and construction of new houses. It is important to note tough, that the existence of other unobserved policies favoring slum expansion can’t be discarded. In particular, it is reasonable to think that the apparent observed friendlier government attitude towards slums may have been also included a less strict behavior in terms of protecting property rights and of impeding new slums to form. Overall, the findings are coherent with a story in which PT assumed power with a strong pro-poor agenda, which incentivized households to increasingly choose slum housing over other alternatives.

### Slum and demographic changes

27 This pattern might be related to the limited discretionality municipalities in Brazil have both in terms of decisions over revenue and expenditure (Brollo & Nannicini, 2012).

28 Higher expenditure in labor protection is coherent with the traditionally strong unionist profile of PT. His main figure the ex-president Luis Inácio “Lula” da Silva was originally an union leader.
The previous analysis has shown compelling evidence that PT governments led to higher slum growth. A natural question to ask then is where did this new slum households come from. In Table 10 I look at the impact of PT governments on a set of sociodemographic variables. The general picture emerging from Table 10 and the corresponding RDD graphs (not shown) is that there are no clear discontinuities in terms of population growth or migration. This points to a story in which the main mechanism behind slum growth has to do with within-city movements of households. Notwithstanding this, the signs and magnitudes of the different coefficients in Table 10 are coherent with slum upgrading policies generating small flows of migration of poor households to PT governed municipalities.

7 Conclusion

Slums are an urban economic phenomenon which affects hundreds of millions of households around the world. Despite this and the fact that living in slums can have negative consequences on several areas of peoples’ lives, 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 slums dynamics. It shows 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.

The findings point to a central role of local political economy forces in understanding the dynamics of slum incidence, an aspect previously noted in the sociology and anthropology literatures (Gay, 1994; Alvarez, 2009). The results also highlight the potential incentive effects of slum policies. By increasing the expected benefits associated with adopting a slum housing option, these policies may induce more non-slum households to join existing slums or to form new ones.

The paper also makes a important contribution to the key question in the political economy literature if different political parties implement (or not) different policies at the local level. Beyond a binary answer to this key question, the contribution relies on making it clear that the policies that this pro-poor party did differently were restricted to a very specific area of the set of all local policies, that of housing and slum policies. The party didn’t implement different policies in most other areas and in particular didn’t spend more. These findings may help interpreting previous mixed results in the literature on the effect of politics on policies at the local level (Ferreira & Gyourko, 2009; Pettersson-Lidbom, 2008; Gerber & Hopkins, 2011; Solé-Ollé & Viladecans-Marsal, 2013). Depending on each country’s specific laws, local governments might be very constrained by national level policies in terms of the policies they can implement and this might explain why we observe differences in specific policies (Pettersson-Lidbom, 2008; Gerber & Hopkins, 2011; Solé-Ollé & Viladecans-Marsal, 2013) but not in others (Ferreira & Gyourko, 2009).

One final important note about the policy implications of the papers’ results. The paper’s
findings shouldn’t be taken in any case as indicating that slum upgrading efforts should stop. Much to the contrary, given the quantitative relevance of slums around the world and the evidence on the positive impacts of slum upgrading programs on the lives of the poor, slum upgrading programs should continue to develop and even expand their reach. The central message is that policy makers should not underestimate though the potential incentive effects of these programs on future slum dynamics. City wide interventions expanding the supply of non-slum housing should be considered when planning slum upgrading interventions in order to mitigate the potential perverse incentive effects of these policies.
References


### Appendix

Table 2: Descriptive statistics from the 2010 Census, distinguishing if PT was first or second in the 2000 municipal election or not

<table>
<thead>
<tr>
<th></th>
<th>PT 1st or 2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Number of municipalities</td>
<td>1150</td>
</tr>
<tr>
<td>Urban Population</td>
<td>61412</td>
</tr>
<tr>
<td>Average Income (Reais)</td>
<td>993</td>
</tr>
<tr>
<td>Urban 00-10 Population growth</td>
<td>32.8</td>
</tr>
<tr>
<td>Urban 00-10 growth in number of HHs</td>
<td>49.5</td>
</tr>
<tr>
<td>Proportion of HHs who:</td>
<td></td>
</tr>
<tr>
<td>Do not have water from pipe or well</td>
<td>4.5</td>
</tr>
<tr>
<td>Do not have sewage or septic tank</td>
<td>39.6</td>
</tr>
<tr>
<td>Do not have a bathroom</td>
<td>0.9</td>
</tr>
<tr>
<td>Do not have trash collection</td>
<td>3.7</td>
</tr>
<tr>
<td>Are in poverty</td>
<td>21.1</td>
</tr>
<tr>
<td>Are migrants</td>
<td>69.9</td>
</tr>
<tr>
<td>Are poor migrants</td>
<td>13.3</td>
</tr>
<tr>
<td>Are recent (&lt;5 years) migrants</td>
<td>20.6</td>
</tr>
<tr>
<td>Are poor, recent migrants</td>
<td>4.5</td>
</tr>
<tr>
<td>Own the house</td>
<td>74.8</td>
</tr>
<tr>
<td>Rent the house</td>
<td>18.2</td>
</tr>
</tbody>
</table>

Urban municipalities are those that in the 2010 census either belonged to a metro area or had a population of 50,000 or more.
Figure 1: Distribution of the forcing variable

The x axis measures the percentual vote difference of a PT major 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 2: Slum incidence in 2000

The x axis measures the percentual vote difference of PT in a close election and the y axis the average slum incidence in 2000 by 2.5% bins. The solid line is a third degree polynomial estimated separately for each side of the discontinuity. The dotted lines are the 10% confidence interval of the polynomial prediction.
Table 3: Regression Discontinuity estimates of the impact of PT victories on Slum incidence in 2000

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
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<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>pt_win</td>
<td>-0.0467</td>
<td>-0.153</td>
<td>-0.150</td>
<td>-0.223</td>
<td>-0.120</td>
<td>-0.0417</td>
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<td></td>
<td>(0.0778)</td>
<td>(0.104)</td>
<td>(0.130)</td>
<td>(0.148)</td>
<td>(0.0817)</td>
<td>(0.115)</td>
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<td>170</td>
<td>170</td>
<td>170</td>
<td>65</td>
<td>34</td>
</tr>
<tr>
<td>R-squared</td>
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<td>0.028</td>
<td>0.034</td>
<td>0.032</td>
<td>0.004</td>
</tr>
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<td>AIC</td>
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<td>111.7</td>
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<td>4</td>
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<td>0</td>
</tr>
<tr>
<td>Bandwith</td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variable in all columns is slum incidence in 2000. Columns 1 to 4 include all the data and have different Polynomials of degrees 1 to 4 adjusted on both sides. Columns 5 and 6 compare unconditional means on both sides of the threshold, including observations in a 10 % and 5 % windows, respectively.

Table 4: Regression Discontinuity estimates of the impact of PT victories on several variables in 2000

<table>
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<tr>
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<th>(7)</th>
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<td>-0.00783</td>
<td>0.000382</td>
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<td></td>
<td>(311,484)</td>
<td>(95.58)</td>
<td>(0.0102)</td>
<td>(0.0377)</td>
<td>(0.0516)</td>
<td>(0.0278)</td>
<td>(0.0214)</td>
<td>(0.178)</td>
<td>(80.71)</td>
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<tr>
<td>Obs.</td>
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<td>170</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>169</td>
<td>170</td>
<td>170</td>
<td>167</td>
</tr>
<tr>
<td>R-sq.</td>
<td>0.015</td>
<td>0.122</td>
<td>0.102</td>
<td>0.190</td>
<td>0.018</td>
<td>0.051</td>
<td>0.033</td>
<td>0.030</td>
<td>0.067</td>
</tr>
<tr>
<td>Pol. Order</td>
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<td>3</td>
<td>3</td>
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<td>3</td>
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<td>100%</td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variables are: (1) Municipality Population (2) Average Household Per capita Income (3) Proportion of people who can read & write (4) Proportion of Migrants (5) Poverty rate (taking the poverty line as one half of the national median per capita household income) (6) Overcrowding (defined as more than 3 people per bedroom) (7) Proportion of homeowner households (8) Average number of people per households (household size) (9) Per capita expenditure in Reais.
Figure 3: Change in Slum incidence between 2000 and 2010

The x axis measures the percentual vote difference of PT in a close election and the y axis the average change in slum incidence by 2.5% bins. Solid line is a third degree polynomial estimated separately for each side of the discontinuity with its 10% confidence interval.

Table 5: Regression Discontinuity estimates of the impact of PT victories on slum growth between 2000 and 2010. Main estimations.

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<tr>
<td>pt_win</td>
<td>0.0912**</td>
<td>0.161***</td>
<td>0.109**</td>
<td>0.107**</td>
<td>0.118***</td>
<td>0.0848**</td>
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<td></td>
<td>(0.0379)</td>
<td>(0.0467)</td>
<td>(0.0530)</td>
<td>(0.0495)</td>
<td>(0.0431)</td>
<td>(0.0348)</td>
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<tr>
<td>Observations</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>65</td>
<td>34</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.034</td>
<td>0.064</td>
<td>0.071</td>
<td>0.090</td>
<td>0.119</td>
<td>0.139</td>
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<tr>
<td>AIC</td>
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<td>-52.9</td>
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<td>4</td>
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<tr>
<td>Bandwith</td>
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<td>100%</td>
<td>100%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variable is the difference in the benchmark measure of slum incidence (threshold of 50 households per tract) between 2000 and 2010. Columns 1 to 4 include all the data and have different Polynomials of degrees 1 to 4 adjusted on both sides. Columns 5 and 6 compare unconditional means on both sides of the threshold, including observations in a 10% and 5% windows, respectively.
Table 6: Regression Discontinuity estimates of the impact of PT victories on slum growth between 2000 and 2010. Robustness checks

<table>
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<th>(6)</th>
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</thead>
<tbody>
<tr>
<td>pt_win</td>
<td>0.0913*</td>
<td>0.0499</td>
<td>0.0912**</td>
<td>0.108***</td>
<td>0.150***</td>
<td>0.121***</td>
</tr>
<tr>
<td></td>
<td>(0.0509)</td>
<td>(0.0551)</td>
<td>(0.0404)</td>
<td>(0.0384)</td>
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<tr>
<td>R-squared</td>
<td>0.049</td>
<td>0.050</td>
<td>0.034</td>
<td>0.038</td>
<td>0.066</td>
<td>0.059</td>
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</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Columns (1) & (2): dependent variable are the slum measure with thresholds of 25 and 75 households, respectively. Both control for third order polynomials estimated separately on both sides of the discontinuity. Columns (3) to (6) have as dependent variable the benchmark slum measure with critical threshold of 50 households and control for the same polynomial estimated on both sides of the discontinuity (first, second, third and fourth order polynomial respectively).

Figure 4: Implementation of Slum upgrading policies between 2001 and 2004

The x axis measures the percentual vote difference of PT in a close election and the y axis the average implementation of slum upgrading policies by 2.5% bins. The solid line is a third degree polynomial with its 10% confidence interval estimated separately for each side of the discontinuity.

Table 7: Regression Discontinuity estimates of the impact of PT victories on the implementation of slum upgrading policies between 2001 and 2004

<table>
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<tr>
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<th>(3)</th>
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<th>(5)</th>
<th>(6)</th>
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</thead>
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<tr>
<td>pt_win</td>
<td>0.185*</td>
<td>0.381***</td>
<td>0.555***</td>
<td>0.707***</td>
<td>0.238**</td>
<td>0.337*</td>
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<tr>
<td></td>
<td>(0.112)</td>
<td>(0.148)</td>
<td>(0.188)</td>
<td>(0.234)</td>
<td>(0.114)</td>
<td>(0.167)</td>
</tr>
<tr>
<td>Obs.</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>65</td>
<td>34</td>
</tr>
<tr>
<td>Pol. Order</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bandwith</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The dependent variable in all columns takes values of 0 or 1 if the municipality implemented or not some slum upgrading policy between 2001 and 2004. Columns 1 to 4 are average marginal effects from Probit regressions, include all the data and have different Polynomials of degrees 1 to 4 adjusted on both sides. Columns 5 and 6 compare unconditional means on both sides of the threshold, including observations in a 10 % and 5 % windows, respectively.
Table 8: Regression Discontinuity estimates of the impact of PT victories on the implementation of a set of urban policies between 2001 and 2004

<table>
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<th>(5)</th>
<th>(6)</th>
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</thead>
<tbody>
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<td><strong>pt_win</strong></td>
<td>0.115</td>
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<td>-0.243</td>
<td>-0.174</td>
<td>-0.0901</td>
<td>0.0795</td>
</tr>
<tr>
<td></td>
<td>(0.213)</td>
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<td>(0.266)</td>
<td>(0.429)</td>
<td>(0.211)</td>
<td>(0.209)</td>
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<td><strong>Observations</strong></td>
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<td>170</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>170</td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td>0.052</td>
<td>0.030</td>
<td>0.017</td>
<td>0.033</td>
<td>0.047</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

The dependent variables are all binary variables indicating:
1. Construction of new houses
2. Existence of Titling programs
3. Giving free urban land for construction of new houses
4. Existence of a law delimiting an urban perimeter
5. Existence of a law regulating urban land subdivisions

All columns control for a fourth order polynomial of the forcing variable, estimated separately on both sides of the discontinuity. Coefficients are average marginal effects from a Probit regression.

Table 9: Regression Discontinuity estimates of the impact of PT victories on average 2002-2004 per capita expenditure

<table>
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<td>15.93</td>
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<td>(2.0)</td>
<td>(3.7)</td>
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<td>170</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td><strong>R^2</strong></td>
<td>0.073</td>
<td>0.104</td>
<td>0.127</td>
<td>0.061</td>
<td>0.047</td>
<td>0.120</td>
<td>0.059</td>
<td>0.036</td>
<td>0.130</td>
<td>0.048</td>
<td>0.071</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Dependent variables are 2002-2004 per capita expenditure in:
1. Total
2. Urban infrastructure
3. Housing
4. Sewage
5. Public safety
6. Social assistance
7. Health
8. Labor protection
9. Education
10. Transport

All columns control for a fourth order polynomial of the forcing variable, estimated separately on both sides of the discontinuity.
Table 10: Regression Discontinuity estimates of the impact of PT victories on 00-10 Demographic changes

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pt_win</td>
<td>-0.129</td>
<td>1.154</td>
<td>1.086</td>
<td>0.0356*</td>
<td>0.0277</td>
<td>0.0287**</td>
</tr>
<tr>
<td></td>
<td>(0.147)</td>
<td>(1.148)</td>
<td>(1.051)</td>
<td>(0.0197)</td>
<td>(0.0233)</td>
<td>(0.0120)</td>
</tr>
<tr>
<td>Observations</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td>169</td>
<td>169</td>
<td>169</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.081</td>
<td>0.024</td>
<td>0.024</td>
<td>0.054</td>
<td>0.023</td>
<td>0.053</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent variables are 200-2010 (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 are calculated with a relative poverty line of half the national median HHs per capita income. Migrant HHs are those in which at least one member has not always lived in the municipality. All columns control for a fourth order polynomial of the forcing variable, estimated separately on both sides of the discontinuity.