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Cities and Innovation

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DO POLITICAL PARTIES MATTER FOR LOCAL LAND USE POLICIES? [i]

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ABSTRACT: Despite interest in the impact of land use regulations on housing construction and housing prices, little is known about the drivers of these policies. The conventional wisdom holds that homeowners have an influence on restrictive local zoning. In this paper, we contend that the party controlling local government might make a major difference. We draw on data from a large sample of Spanish cities for the 2003-2007 political term and employ a regression discontinuity design to document that cities controlled by left-wing parties convert much less land from rural to urban uses than is the case in similar cities controlled by the right. The differences between governments on the two sides of the political spectrum are more pronounced in places with greater population heterogeneity and in those facing higher housing demand.

JEL Codes: H7, Q15, R52

Keywords: Land use regulations, urban growth controls, political economy

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1. Introduction

The housing construction rate grew at an extraordinary pace during the last economic boom. In the period 2003-2007 more than 18 million housing units were built in the US, roughly 15% of its historical record (American Housing Survey, 2009). In Spain, our case of study, growth was of a similar magnitude, with 4.3 million new housing units being built during the same period, representing 17% of the housing stock. In both cases, such growth has markedly increased the area of land under development while reducing overall urban density. For instance, in the US, 80% of the units built were single-family homes. In Spain, the amount of developed land rose by more than 30%, whereas the population grew by just 12% (see www.catastro.es and www.ine.es), gradually changing the landscape to one characterized by low-density sprawl as in many areas of the US.

The acceptance or otherwise of such development varies from one stakeholder to another. Homeowners, it is claimed, dislike development because of its impact on the quality of life in the community and/or on housing values (see, for example, Brueckner and Lai, 1996; Ortalo-Magne and Prat, 2011). Environmentally sensitive citizens worry about the loss of valuable open spaces (European Environmental Agency, 2006; Greenpeace, 2010) and about the impact of pollution and increased resource consumption (see, for example, Kahn, 2000). Renters and potential new home-buyers welcome the improvement to housing affordability brought about by such developments (Glaeser and Gyourko, 2003). Developers and/or owners of undeveloped land see development as an opportunity to increase their profits (Glaeser *et al*., 2005a; Hilber and Robert-Nicoud, 2011). The unemployed and those employed in the construction sector and tourism industries see their possibilities of finding or retaining a job enhanced.

Little is known about how governments take into consideration this wide array of interests when determining their land use regulations. Most of the zoning literature holds to the view that it is the homeowners that control the political process (Fischel, 1985 and 2001). However, this narrow view is probably a reflection of the almost exclusive focus in the literature on zoning policies in the suburbs of US cities, where the median voter is a homeowner that commutes to work (and who, therefore, sees no job gains from such development), where population is highly homogenous, and where direct democracy regarding such issues is common (Gerber and Phillips, 2004 and 2005). Yet, any empirical evidence in favor of this hypothesis is scarce (Dhering *et al*., 2008), suggesting the need to look elsewhere for a fuller picture. Indeed, various authors have recently provided evidence that interest groups, comprising both developers and environmentalists, might also be fairly

influential (e.g., Glaeser *et al*., 2005a; Hilber and Robert-Nicoud, 2011; Solé-Ollé and Viladecans, 2012). The role played by pro-growth coalitions was also highlighted in Molotch's classical study (1976), in which the term 'urban growth machine' was first coined. Fischel (2001, ch.5) also recognizes the relevance of job creation motives for the zoning policies of rural areas and large cities. In these more heterogeneous communities, the role for groups other than homeowners might acquire greater importance, since political parties – known to have preferences regarding land use policies that are more closely in line with those of some of the aforementioned groups – might find it more difficult to commit themselves to the policies desired by the median voter (Ferreira and Gyourko, 2009). Such effects might be further enhanced in places where decisions depend on representative democracy, above all in multiparty systems employing proportional representation[1].In such situations, party platforms and policies can be more extreme, catering to interests regarding land use regulations that differ from those of the median voter (Schofield, 2007). Thus, eventually, the local land use regulations that are introduced might well depend on the party (or coalition) controlling local government – and, hence, on the social groups that wield most influence over them.

To the best of our knowledge, no previous studies have been undertaken to ascertain the role that political parties play in local land use regulations[2], albeit that a few do document the relevance of voter ideology for local land use policy (see, for example, Dubin *et al*., 1992; Gerber and Phillips, 2003). In a recent paper, Kahn (2011) reports that the liberal cities of California (i.e., those with a high percentage of voters registered as Democrats, or as supporters of the Green Party or the Peace and Freedom Party) do not grant as many building permits as their non-liberal counterparts. However, it should be borne in mind that these studies do not address exactly the same issue as the one that concerns us here. For instance, the finding that liberal communities impose strict regulations informs us about the preferences of the median voter, but tells us little about the specific influence of a political party. If electoral competition is strong, parties with disparate views in relation to their devising of land use policies might be forced to adapt their platforms to the preferences of the

[1] The influence of the particular institutions determining land use policies has been studied in Lubell *et al.* (2009) and Gerber and Phillips (2004 and 2005).

[2] Many papers do, of course, analyze the effects of parties on policies at the federal (e.g., Lee *et al*., 2004, Lee, 2008) and state levels (e.g., Plotnick and Winters, 1985, Garand, 1988, and Erickson *et al*., 1989), while there are just a few recent papers on local fiscal policies (see Ferreira and Gyourko, 2009, and Gerber and Hopkins, 2011, for the US, and Pettersson-Lidbom, 2008, and Folke, 2011, for Sweden, and Freier and Odendahl, 2011, for Germany). The conclusion of the US studies is that parties do not matter greatly at the local level, although they might have a more prominent role in more heterogeneous places (Ferreira and Gyourko, 2009) and as regards spending on services for which responsibilities do not overlap with the state (Gerber and Hopkins, 2011). The European studies report a more relevant role for parties, both as regards local fiscal policy in general and other local policies (including, for example, environmental protection and immigration policy).

median voter. Were this to be the case, it might be that the party brand does not matter at all in the case of land use policies or, should it be found to matter, it is simply because certain policy drivers (including voter preferences and demand shocks) are correlated with party brand (e.g., left-wing controlled local governments tend to have a higher percentage of left-wing core supporters that have more extreme preferences regarding land use policies).

This makes the identification of the effects of a particular political party on land use policies a far from straightforward task. To tackle the problem we follow a number of recent studies that adopt a regression discontinuity design to identify the effects of political parties on policies (see, for example, Lee *et al.*, 2004; Lee, 2008; Albouy, 2012). Intuitively, the method consists of regressing the outcome variable of interest on a dummy indicating whether a given party won more than 50% of the vote (and therefore holds incumbency) controlling for a flexible function of the vote share. Pettersson-Lidbom (2008), Ferreira and Gyourko (2009) and Gerber and Hopkins (2011) use this methodology to analyze the effect on a broad range of local fiscal policies, although they do not specifically study land use regulations[3].

Here, we adapt this methodology to the peculiarities of the representative democratic system used at the local level in Spain. We have to deal with the fact that many local governments in Spain are coalitions and with the peculiarity of the method used to allocate seats (namely, the d'Hondt rule), which generates many possible thresholds at which one more vote can give a party an additional seat. Specifically, we use the discontinuity at the 50% seat threshold and focus on close elections, defined as those in which the left-wing bloc just won/lost in terms of the number of votes needed to secure a majority of seats in the local council. In justifying this procedure we show that most government coalitions in Spain are formed along ideological lines – i.e., majorities secured by a left-wing bloc tend to generate left-wing controlled governments, defined as those led by a left-wing mayor. This method is then used to estimate the effect of left-wing controlled local governments on the amount of new land assigned for development during a term-of-office, which is the primary land use policy decision that can be taken by Spanish local governments (see also Solé-Ollé and Viladecans-Marsal, 2012). The decision (and our variable) is entirely at the discretion of the local government team in office and does not reflect policy decisions taken by previous administrations. The use of this variable therefore overcomes many of the problems encountered in earlier analyses, which were unable to match a land use policy variable with

[3] Regression discontinuity design has been used in evaluating a wide range of policies (see Imbens and Lemieux, 2008, and Lee and Lemieux, 2010, for recent surveys). Recently, it has also been applied to the evaluation of the effects of land use policies (see Turner *et al*., 2011, and Cyrus *et al*., 2011).

the political traits of a given government (Bates and Santerre, 1994 and 2001; Evenson and Wheaton, 2003).

Our main result suggests that party brand is relevant. During the 2003-2007 term-of-office, the amount of land assigned for development by left-wing governments was approximately 65% less than that assigned by right-wing governments. In order to shed further light on this finding, we repeated the analysis by sub-samples and found that the effects were most marked in places in which population heterogeneity was greatest. For instance, the percentage was higher in less fragmented local areas (i.e., those with few municipalities relative to the population they hold) and in places with a high level of social fragmentation (i.e., where neither pro-growth nor anti-growth social groups represent the bulk of the population). We also found that the differences between right- and left-wing land-use policies were more marked in areas with a high construction growth rate.

The rest of the paper is organized as follows. In the next section we briefly discuss why, and under which particular circumstances, different political parties can be expected to implement different land use policies. In section three, we present institutional details about our case study area, Spain: the organization of local government, the system of land use regulation, and the position adopted by Spain's political parties on this issue. The empirical methodology and the data used are outlined in section four. Section five presents the results and section six concludes.

2. Political parties and local land use policies: why and where should they matter?

Dating back to Hotelling (1929), Black (1958) and Downs (1957), many formal models of two-party electoral competition have predicted convergence towards the policy desired by the median voter or, more generally, towards the center of the political spectrum. As this prediction has been contested by many empirical studies[4], recent theoretical work has tried to reconcile these findings. First, Alesina (1988) and Besley and Coate (1997) suggest that the lack of credibility of campaign promises accounts for the discrepancies between a party's platform and the policies it subsequently implements. Second, strategic extremism might also generate divergent policies (e.g., Glaeser *et al.,* 2005b) with a party proposing more extreme platforms in order to obtain more voters among its core supporters, either through an increase in turnout or through resource mobilization. Finally, in the context of multi-party elections

[4] Many papers report considerable partisan policy differences at the federal (e.g., Alesina and Rosenthal, 1995, Lee *et al*., 2004, and Lee, 2008) and state levels (e.g., Plotnick and Winters, 1985, Garand, 1988, and Erickson *et al*., 1989).

with voters caring about the quality of candidates, divergence in policy platforms can occur whenever there are relevant centrifugal forces (e.g., Schofield, 2007)[5].

Some authors are skeptical about the relevance of the policy-divergence prediction at the local level. First, in line with Tiebout (1956), individuals are assumed to choose their municipality of residence according to their preferences for local public goods, at least within a local labor market. The outcome of this process is a sorting of individuals into more homogeneous communities. With low intra-municipal demand heterogeneity, political discrepancies should be much smaller. Similarly, with less heterogeneity, the promises of politicians should be more credible and the ability to target core supporters with extreme preferences should be lower (see, for example, Ferreira and Gyourko, 2009). The relevance of this line of reasoning might be limited by the (relatively) low degree of residential mobility in Spain, by the fact that the majority of people in certain areas lives and works in the same place, and by the substantial intra-city heterogeneity observed in our sample.

Second, it could also be argued that decisions related to the provision of local public services are of a largely technical nature and do not involve policy preferences (i.e., 'there is no right- or left-wing way of picking up garbage') and that policy differences between parties are more likely to be found in areas related to redistribution or to moral issues, which are the responsibility of higher tiers of government (see Gerber and Hopkins, 2011). Moreover, the claim might be made that local land use policies are not (or, at least, should not be) a partisan issue, since with proper side payments the policy would provide benefits for all social groups (see Fischel, 1985). However, once again, heterogeneity hinders the achievement of such deals. Informal evidence suggests that in Spain, at least, there is a great deal of ideological controversy related to these policies (see next section).

Third, any partisan discrepancy between land use policies in a specific municipality might depend on whether the issue acquires relevance during the electoral campaign. Unlike fiscal matters, which are always important, the salience of local land use policies and, especially, the amendment of land use plans to allow for more development (the policy instrument we focus on here) depend on the situation in which the housing market finds itself. Consider, for example, a situation in which a municipality is undergoing a substantial demand shock, with the possibility that the amount of land made available for development

[5] For instance, these centrifugal forces increase in strength as voters' preferred policies become more heterogeneous and the differences between the perceived qualities of the candidates become more marked. These models clearly predict that party positions during the campaign can disseminate along a principal policy axis. Post-election coalition bargaining between the parties determines the final policy implemented, lying at some point between the positions of the parties forming the eventual coalition. Several empirical analyses seem to corroborate this theory, especially in the case of proportional electoral laws (see, e.g., Schofield and Sened, 2006).

will not be enough to accommodate the portfolio of existing housing projects. In this case, the platforms of the different parties *could* be very different, the left-wing party opposing and the right favoring the amendment of the plan in order to convert more land for development[6]. However, in a municipality with low housing demand, the right-wing party will have to adhere to a policy platform that proposes much less development than it would have preferred in an unconstrained situation. This would move the platform of the right-wing party to the center, thereby attracting many votes while forcing the left-wing party to converge to the center too. High housing demand can thus be expected to lead to a higher degree of divergence in the policies of left- and right-wing parties.

This revision of the aforementioned theories generates expectations as to the possible partisan differences that might appear in relation to Spain's local land use policies. First, there are expectations that partisan differences might be stronger in Spain than in the US, given the country's electoral institutions (i.e., multiparty proportional elections) and the lower degree of residential mobility. Second, in municipalities located in fragmented local labor markets (where residential choice is enhanced) and/or with lower population heterogeneity, partisan differences should be smaller. Finally, differences should be greater in periods and/or areas undergoing strong housing demand shocks.

3. Institutional setting

3.1. Spain's local government

Municipalities are the main tier of local government in Spain, there being nearly 8,000 local government authorities, most of which are quite small. Since 1979, the members of these municipal councils (comprising between 9 and 57 representatives in our sample, depending on population size) have been elected. Elections are now held every four years simultaneously throughout all the municipalities. Voters choose between various party lists, which being closed means that no preferences regarding the ranking of the names on these lists can be expressed. The electoral system is proportional and seats are allocated according to the d'Hondt rule (more details in section 4.1). In most municipalities, several right- and left-wing parties run separately, with pre-election coalitions being very rare. Some of these parties adopt more central platforms while others are more extreme, particularly in the case of land use regulations (see section 3.2 for details).

[6] See the next section for an explanation of why these might be the preferences of the left- and right-wing parties in Spain.

The mayor is then elected by a majority of the council (see Colomer, 1995). A substantial proportion of governments are coalitions (around 30% during the term we analyze here), formed mainly along ideological lines. This rule, however, is not always respected, especially in small municipalities where there is also a proportion of seats and mayoral offices held by local parties. The council operates as a small representative democracy, and has to reach a majority vote to pass the initiatives and regulations proposed by the mayor, who acts as the agenda-setter[7]. The discipline enforced by Spain's party system means that the chances of amending the mayor's proposals are quite low when the mayor's party or coalition controls a majority of the seats. In the case of multi-party coalitions, the impossibility of calling an election before the end of the term provides an incentive to adhere to the initial coalition agreement.

3.2. Local land use policies

Land use regulations in Spain are controlled by a very detailed, rigid system (Riera *et al*., 1991), although they do not differ greatly from the zoning regulations operating in various parts of the US. A key characteristic of the Spanish system is that, although an individual might own the land, the government is empowered to control and implement all processes of urban development. Landowners are not permitted to develop their land without the prior agreement of the local administration. It is not simply that they need a building license: before reaching this step, the government must have declared the land 'developable' and have precisely defined the conditions for such development. The main tool that the government uses to do this is its urban plan. Thus, land use planning in Spain is essentially a municipal responsibility, but as there are more than 8,000 municipalities, the system is highly fragmented (as in the US).

Municipalities draw up a 'General Plan', which provides a three-way land classification: *built-up land*, *developable land* (the areas of the community where future development is allowed), and *non-developable land* (the rest of the territory – agrarian and other uses, where the development process is strictly prohibited, at least until a new plan is approved). In theory, the 'General Plan' has to be updated every eight years, but the land classification can be quite easily modified before that date. The amendment plan, known as a 'Partial Plan', is also a legally binding document. The plan includes very detailed regulations regarding many other aspects: land zoning (residential, commercial, industrial), the maximum floor-to-area ratio for each plot, the setting aside of land for streets, green spaces and public facilities, etc. While it

[7] Direct democracy mechanisms are not used and participatory channels are quite limited. This means that residents' ability to influence policy has traditionally been limited to their decisions at the ballot box.

would be of great interest to analyze these other regulatory dimensions, no data are available to measure them. Note, however, that most development in Spain in these years has been really quite sparse[8]; the complaints made by green organizations and other civic groups are mostly concerned with the excessive occupation of the territory (see, e.g. Greenpeace, 2010).

3.3. Political parties and land use

Most of the elected members of Spain's local councils run as members of either national or regional parties. During the 2003-2007 term (the focus of our empirical analysis), in our sample (see next section), just 7% of the seats and 5% of the mayoral offices were held by local parties. The two main national parties (i.e., the left-wing 'Partido Socialista Obrero Español', PSOE, and the right-wing 'Partido Popular', PP) accounted for 71% and 76% of the mayoral offices and seats, respectively. The main party during this term was the PSOE, providing 46% of the mayors and occupying 41% of the seats. The PP provided 34% of mayors and 35% of seats. Other left-wing parties[9] accounted for 7% of mayors and 10% of seats. Several regionally based right-wing parties[10] provided the remaining mayors (13%) and seats (14%).

The parties on the left and right of the political spectrum hold very different views as to how land use policies should be designed. These differences can be documented by looking at the party manifestos of these parties. Before the local elections, all nationally or regionally based parties launch a common party manifesto for the whole country (or region), which presents the guidelines of the party programs in each municipality (the so-called 'Programa Marco'). In recent elections, much attention has been devoted to environmental and other problems caused by excessive growth and urban sprawl. The proposals included in the manifestos of the main national left-wing parties (PSOE and IU) are illustrative of the emphasis placed on restricting urban growth. For example, the PSOE program proposes[11]:

> "To establish limits to urban growth (…) based on the real and potential economic and demographic demand in the city, on the capacity to absorb growth, on the stock and capacity of existing infrastructure, and on the natural environment."

[8] According to data provided by the aerial photographs of the *Corine Land Cover* project (Ministerio de Fomento, 2006), between 1987 and 2000, Spain's artificial land area grew by 29.5 per cent, roughly one-third of its overall historical record. Similarly, data from the Spanish Property Assessment Office reveal that developed land increased by an additional 11.5 per cent during the 2000-04 period. Moreover, most of this development took the form of low-density urban growth (up by 30 per cent between 1987-2000) and scattered growth (up by 26 per cent), while the area undergoing compact development increased by a mere 4.1 per cent.

[9] Principally the former communists, 'Izquierda Unida', IU, but also some minor left-wing regional parties such as 'Esquerra Republicana de Catalunya', ERC, , and the 'Bloque Nacionalista Galego', BNG.

[10] Including 'Convergencia i Unió', CiU, in Catalonia, and 'Unió Valenciana', UV, in Valencia, among others.

[11] PSOE (2006): "Para una nueva política urbanística y del territorio", Programa Marco Elecciones Municipales 2007, http://www.psoe.es/organizacion/docs/454856/page/programa-marco-elecciones-municipales-2007.html

> "To shift some land-use responsibilities to the regional government, which should introduce supra-municipal zoning plans, establishing criteria and reasonable limits to the urban development conducted by local governments."

The program of the former communist party, IU, likewise includes a number of proposals related to land use policies, concerned primarily with the protection of the environment[12]:

> "To promote a compact city as opposed to a diffuse city. To avoid the generation of isolated areas of development. Any new developments must be adjacent to urban areas that are already well consolidated."
>
> "To preserve non-developable land in order to protect the environment."
>
> "To create green belts surrounding the city, with a combination of parks and agricultural lands."

The programs of both parties include many other proposals related to urban regulation in specific sections concerning environmental issues and public transportation. It should be noted that green parties are marginal to Spanish politics, and that left-wing parties (and especially IU) tend to monopolize this issue. The programs of these two parties also include several proposals for dealing with the housing affordability crisis. For example, the PSOE proposed the reservation of 25% of all developed land for social housing while IU proposed the public provision of rental social housing, contrasting this solution to affordability with the alternative route of providing housing through the market. Note that these parties never propose to make housing more affordable by allowing more land to be developed. The programs of the other left-wing parties include similar proposals, lying somewhere between those of the PSOE and IU.

In general, it could be said that that the discourse of Spain's left-wing parties tends to vilify urban growth while ruling out any relationship between an increased provision of urban land (or the easing of regulatory constraints, in general) and housing affordability. This is in marked contrast with the position taken by right-wing parties and, especially, with that adopted by the PP. The local manifesto of the country's leading right-wing party does not include any specific proposals related to the containment of urban growth. It does, however, include a couple of proposals (and it is the only party's to do so) related to easing regulatory constraints[13]:

> "To improve and simplify the process of urban development."
>
> "To promote the speedy completion of urban developments."

When the PP was elected to lead the central government (1996-2004), it made several attempts at liberalizing the regional regulatory framework. Although it is debatable whether

[12] http://izquierdaa-unida.es/sites/default/files/doc/Programa_Marco_Municipal.pdf
[13]http://www.elpais.com/elpaismedia/ultimahora/media/201105/05/espana/elpepunac_7_Pes_PDF.pdf

this legislation had any influence on local land use policies, its mere existence should be seen as evidence of the attitude of this party to this issue[14]. In general, therefore, the discourse of the PP emphasizes the virtues of the deregulation of the land market as a means of improving housing affordability. Some of the other right-wing parties also adhere to this view, while others are more moderate, but they are generally in favor of urban planning in order to minimize the adverse impacts of growth[15]. Politically, therefore, this group can be considered as lying somewhere between the PP and the PSOE.

4. Empirical analysis

4.1. Empirical design

OLS *with controls*. As a first approach, we estimate the effect of left-wing governments on local land policies using OLS, controlling for a set of covariates and including in the equation a full set of area fixed effects:

$$\Delta u_{ij} = \alpha\, dLeft_i + X_i^{'} \beta + f_j + \varepsilon_{ij} \qquad (1)$$

where Δu is the increase in the amount of land placed under development during the term-of-office (i.e. the amount of land converted from rural to urban uses) in municipality i located in area j. The dummy *dLeft* is equal to one in the case of a left-wing government and zero in the case of a right-wing government. The vector X includes control variables measuring influences on local land use decisions, related either to the intensity of the housing demand shock experienced by each municipality during the period or to the preferences of the resident population for (or against) growth. We describe these variables in detail in the next section. f_j are local area fixed effects, one for each of the urban areas identified and also one for each of the rural sections in each Spanish province. These fixed effects control for any omitted influences on land policies (e.g., economic cycle, area-wide amenities) that are common to the municipalities located in the same local area.

One advantage of this approach over previous methods reported in the literature (see, for example, Bates and Santerre, 1994 and 2001, Evenson and Wheaton, 2003) is that the dependent variable can be precisely matched to the particular government responsible for the policy at that time. Its drawback, however, is the possibility that certain influences on land policy that are correlated with the partisan identity of the local government remain omitted.

[14] The main acts were the 'Law of Land' (Ley 7/1997), and the 'Law of liberalization of the building sector' (Ley 10/2003).

[15] See, for example, the local manifesto of the main right-wing party in Catalonia, CiU, http://ciu.cat/media/55510.pdf.

For instance, it might well be the case that pro-growth residents are concentrated in certain municipalities of the urban area and so tend to vote for right-leaning parties. It might also be the case that places affected by municipality-specific demand shocks during the period analyzed turn to the right in order to facilitate the development projects being implemented. In both instances, failure to account appropriately for the residents' ideology (or for the intensity of the housing demand shock) would bias the *dLeft* coefficient.

Regression discontinuity. To deal with the omitted variables problem a number of papers have recently adopted the close-race regression discontinuity (RD) design framework (e.g. Lee *et al*., 2004; Lee, 2008; Pettersson-Lidbom, 2008; Ferreira and Gyourko, 2009; Albouy, 2012; Folke, 2011; Gerber and Hopkins, 2011). The idea underpinning this methodology is that elections won by a given party by a narrow margin are very similar to the elections lost by that party by a narrow margin. Thus, by focusing on close-races, the RD design generates quasi-experimental estimates of the effects of interest (see Hahn *et al.*, 2001). In a recent survey, Green *et al.* (2009) show that RD designs are comparable in their accuracy to experimental studies.

However, the application of this methodology is not straightforward in our case. In Spain, the proportional representation system used at local elections means that it is less evident that the partisan control of the government changes at a given vote threshold. Firstly, the rule used to allocate seats generates many possible thresholds at which an additional vote can bring a party one more seat. Briefly, for each party obtaining more than 5% of the vote, the d'Hondt rule computes a series of 'comparison numbers' by successively dividing its votes by 1, 2, 3, 4, etc. The 'comparison numbers' of all parties are then ranked and a given number of seats allocated to the parties on the basis of this ranking (see Annex B for an example illustrating the application of the d'Hondt rule). For each party's marginal seat, there are an additional number of votes that need to be won in order to gain an extra seat (or which must not be lost in order to hold on to this seat). As such, each party and each seat has a specific vote threshold. Secondly, in a non-trivial proportion of municipalities no party has more than 50% of the seats, the mayor being elected by a coalition of parties. There is thus no straight relationship between the number of seats held by a party or group of parties and their control of local government.

To deal with these difficulties we proceed in two steps. Firstly, we are able to document that most government coalitions are formed along ideological lines: majorities of seats held by left-wing blocs tend to generate left-wing controlled governments. We can thus use the discontinuity at the 50% seat threshold, and so consider as close elections those in which the

left-wing bloc has won/lost by just one seat. By so doing, we are comparing two potential ideologically connected coalitions (i.e., left-wing vs. right-wing) with a seat difference of just one seat[16]. In our design, the jump in the probability of having a left-wing government at the 50% seat threshold is lower than one, suggesting the need to use a 'fuzzy' RD design (see, for example, Van der Klauw, 2002; Lee and Lemieux, 2011). While in a 'sharp' RD design the probability of treatment jumps from 0 to 1 when the assignment variable crosses a threshold, the 'fuzzy' RD design allows for a smaller jump in probability. Since the probability of treatment jumps by less than one at the threshold, the jump in the outcome variable (e.g., Δu) at this point can no longer be interpreted as an average treatment effect. However, the treatment effect can be recovered either by dividing the jump in the outcome variable by the jump in the probability of treatment or by estimating the effect of party control by 2SLS, using the threshold dummy as an instrument for party control.

Secondly, note that elections which are close in terms of seats (-1 or +1 from a seat majority) need not be that close in terms of number of votes. Indeed, in our sample the elections that are close in terms of seats may differ in terms of their vote share by a figure that can reach a maximum of almost 15%. This means the need to control for a non-linear function in the distance in votes to seat change. The method we use to compute this distance is similar to that developed by Folke (2011) and Freier and Odendhal (2011) when analyzing the effect of parties on local policies. The difference here is that while they compute the number of votes that each of the parties need to gain an additional seat in the legislature, we are concerned with the number of votes that one ideological bloc (containing many parties) has to win in order to obtain the last seat that will secure them a majority of seats, which is to all intents and purposes the seat that will allow them to form a government. The vote distance is computed after having first developed an algebraic formula that accounts for the specific characteristics of the d'Hondt rule. We describe this method in detail in section 4.3 and in Annex B.

Once this distance has been computed, the reduced-form equation used to estimate the effect of party identity on local land supply can be expressed as:

$$\Delta u_i = \lambda\, d(\textit{Left seats} > \textit{Right seats})_i + f(\%\,\textit{Votes to left - wing majority})_i + \upsilon_i \qquad (2)$$

where d(*Left seats > Right seats*) is a dummy equal to one if the left-wing bloc has more seats than its right-wing counterpart and, thus, defines the threshold, and f(% *Votes to left-wing*

[16] Although in theory we might compare the actual governing coalition with a hypothetical one, this procedure could be problematic as the formation of a coalition might become more plausible closer to the threshold. This could generate a discontinuity in the forcing variable that could invalidate the design (more on this below).

majority) is a non-linear function (e.g., a polynomial or a locally weighted regression) of the distance in votes to the change to a left-wing bloc seat majority, fitted separately to both sides of the threshold. Alternatively, the following equation could be estimated by 2SLS:

$$\Delta u_i = \delta\, dLeft_i + g(\%\, Votes\ to\ left\ -\ wing\ majority)_i + \xi_i \qquad (3)$$

using *d*(*Left seats > Right seats*) as the instrument for *dLeft.* The δ coefficient is a 'Local Average Treatment Effect' (LATE). The first-stage equation is as follows:

$$dLeft_i = \gamma\, d(Left\ seats > Right\ seats)_i + h(\%\, Votes\ to\ left\ -\ wing\ majority)_i + \omega_i \qquad (4)$$

where $g(\bullet)$ and $h(\bullet)$ are also non-linear functions of the distance in votes to seat majority. If the order of the polynomials used is the same, then the LATE can also be obtained as the ratio between the reduced form coefficient and the discontinuity estimated in the first-stage (i.e., $\delta=\lambda/\gamma$).

4.2. Econometrics

The estimation of the OLS equation with controls is straightforward. The estimation of the RD equation with close elections requires the taking of various methodological decisions. First, our main estimates use the whole sample and controls for a flexible polynomial. We explicitly test for the optimal order of the polynomial using the Akaike information criteria. This method has the advantage of using all the observations and, thus, of improving the efficiency of the estimator. However, by not restricting the bandwidth to a vicinity of the threshold we run the risk that some extreme observations may have an influence on the estimated effect. In our case, moreover, there is an additional problem. As we show in the next section, besides the vote discontinuity that determines that gaining the last seat gives a majority, there are also the discontinuities that determine the allocation of the infra-marginal seats. By using the whole sample, the estimated polynomial relies on information that overlaps with the areas surrounding these other discontinuities. We consider this not to be an excessively grave problem since, as we show below, the increase in the number of seats below the one which finally gives the majority of seats has a very small impact on the probability of controlling government. Despite this, we also present results for a restricted bandwidth. The optimal bandwidth – computed following the procedure proposed in Imbens and Kalyanaraman (2009) – was found to be around 25%. So, following the recommendation made by Lee and Lemieux (2010), we also present the results for the optimal and half optimal bandwidth, using in this case a locally weighted regression as a control. The half optimal

bandwidth is somewhat smaller than the maximum vote distance for the sample of close elections (i.e., where the distance to seat majority in terms of seats is either -1 or +1). This constitutes, therefore, a way of checking that our results are not influenced by the use of a bandwidth that overlaps with other (minor) discontinuities.

Second, in order to show that there is a valid case for the RD design proposed, we verify the discontinuity in the treatment probability. We examine the discontinuity graphically and we estimate the jump in the probability of treatment using the whole sample and a flexible polynomial and the reduced bandwidths with a locally weighted regression. Third, we also check the continuity of the forcing variable around the threshold by looking at the histogram, as well as by using a more formal test (see McCrary, 2008). The continuity test is a means of discarding the manipulation of the forcing variable, a problem that some authors suggest can occur in close-election RD designs (Folke *et al*., 2011; Caughey and Sekhon, 2011)[17]. With the same purpose in mind, we also test for the continuity of the pre-determined covariates. Finally, we present the results both without controls and controlling for the same covariates as those used in the OLS analysis. Controlling for covariates helps to reduce the dispersion of the dependent variable and to increase the efficiency of the estimates (see Lee and Lemieux, 2011, and Albouy, 2012).

4.3.- Data

Sample. We carried out the analysis using data from a sample of 2,112 Spanish municipalities for the 2003-07 term-of-office. These years coincided with the peak in the last housing boom, a period in which the conflict between pro- and anti-growth groups was particularly intense and, hence, the perfect setting for the testing of our hypothesis[18]. Although our land use data are available on a yearly basis, we decided to use a long time difference. The dependent variable is, therefore, the increase in developable land between 2003 and 2007, and the control variables refer to the beginning of the period. There are several reasons for this choice.

[17] For instance, Caughey and Sekhon (2011) show that the US Republicans have a greater probability of winning close legislative elections thanks to their ability to mobilize supporters and campaign resources in such contests. Thus, they cast some doubt on the reliability of RD design in two-party elections (such as those in the US), where the popularity of both parties is followed so closely by pollsters and the media. However, they suggest that multiparty elections (such as those analyzed here) might be less prone to manipulation. In any case, given the small size of a typical Spanish town, the resources spent in campaigning and in forecasting the popularity of the candidates are very low, suggesting that parties probably lack the ability to affect the outcome of close elections.

[18] As was explained in section two, when housing demand is low, right-wing parties end up presenting platforms proposing less development than perhaps they would prefer (and so their policy is more in line with the preferences of the median voter). This forces left-wing parties to converge to the position held by the median voter. As such, differences in the policies implemented by right- and left-wing parties are expected to occur only when demand shocks are sufficiently high.

First, political variables (e.g., *dLeft*) can only be measured once, which is when an election takes place. This means that there is no real statistical gain to be made in using yearly data. Second, the dependent variable does not change every year; developable land only changes when a new urban plan is passed, and this is a fairly rare occurrence, happening more frequently when the real estate sector is booming. Thus, by aggregating the data over the term we considerably reduce the number of censored observations in our sample. This helps to reduce the volatility of the data, which is crucial for improving the efficiency of the estimates.

The eventual sample of 2,112 municipalities reflects the availability of our data. Spain has about 8,000 municipalities, but most of them are small (i.e., 90% have fewer than 1,000 residents). The database providing information on land use categories covers the whole of Spain, but most of the other databases used are restricted to municipalities with over 1,000 inhabitants, which means that the smallest municipalities have been eliminated from our sample. We have also eliminated from our sample those municipalities for which we either lacked political data or for which the data were not reliable. We believe the final sample to be representative of the full population because most large municipalities (more than 5,000 residents) are included.

[Table 1 about here]

Land policies. The data used to measure the amount of developable land are taken from the Spanish property assessment agency (*Dirección General del Catastro*) and are derived as a by-product of the assessment process that this agency undertakes on all properties in the country. Although the values of properties are only reassessed from time to time, the up-date in the traits of each property (and so its classification as developed, developable but vacant, or non-developable) is conducted yearly. This is the only statistical source of data covering the whole of Spain that can be used to measure the land use category of undeveloped land plots. Note that GIS data (e.g., coming from the *Corine Land Cover* project, Ministerio de Fomento, 2006) do not help much in this respect, because they only measure what can be seen (already developed land) not what has been approved by the local government but does not yet physically exist (land which may be developed).

Political data. We have information on the number of votes and seats obtained by each party at the 2003 local elections. We also know the party identity of the mayor during the 2003-2007 political term. We classified the parties in five groups: Left-Left, Center-Left, Center-Right and Right-Right and Local parties. Based on informal evidence regarding the position adopted by each party on matters relating to land use regulations (see section 3.3), we classified the main left-wing party (PSOE) as Center-Left and the main right-wing one (PP)

as Right-Right. The former communist party (IU) was classified as Left-Left; also in this group we included many small extreme left-wing and green parties and some of the left-wing regional parties (e.g., BNG, ERC). The Center-Right group includes the right-wing regional parties (e.g., CiU, UV). Local parties were either included in the Center-Right group or excluded from the analysis. We have just 157 observations (from a total of 4,220) of mayors representing Local parties and the results are unaffected by their exclusion. Overall, the proportions of municipalities allocated to the four groups are 6.7%, 44.3%, 14.9% and 33.9%, for Left-Left, Center-Left, Center-Right and Right-Right, respectively. If we consider just the close-election sample (one seat from a majority) the proportions are more or less the same: 3.6%, 42.5%, 16.2% and 37.5%, respectively. The *dLeft* dummy is equal to one for mayors from the parties in the Left-Left and Centre-Left groups. The *d*(*Left seats > Right seats*) is equal to one for municipalities where the seats from parties in the first two groups are higher than those from the last two groups. We also use this information to obtain the results when restricting the sample to pairs of ideological groups: Center-Left vs Center-Right, Center-Left vs. Right-Right, Left-Left vs. Center-Right and Left-Left vs. Right-Right.

To compute the distance in votes to a change in a majority of the seats (% *Votes to left-wing majority*) we use a very similar method to that developed by Folke (2011). He employs an algebraic formulation for this distance applied to the Saint-League system, the one in operation in Sweden. With this formulation he is able to compute the number of votes that each party needs so as to win (or lose) an additional seat. We develop a similar algebraic formulation for the d'Hondt system used in Spain's local elections. What we compute is the additional % of votes that the left-wing bloc needs to win in order to secure a majority of seats (if it is in the opposition) or that will make it lost the majority of seats (if it is actually the incumbent). To make this calculation, we begin by identifying the parties that hold the last seat won by the incumbent bloc and the next seat to be won eventually by the opposition bloc. Then, we compute the number of votes that should be detracted to the party holding the last seat in the incumbent bloc for this seat to transfer to the opposition bloc. We make different assumptions regarding vote by considering that marginal votes derive either from abstentions or from the other bloc. We also assume that the vote gains/loses are distributed between the parties of an ideological bloc according to their initial vote share in the bloc. This assumption allow us to compute the number of votes to be lost by the incumbent's bloc as a whole as the votes to be lost by the party holding the marginal seat divided by the vote share of this party in his ideological bloc. In Annex B we formally development the algebraic formulation used to compute this quantity. Intuitively, in the case we assume that votes only

migrate to abstentions, our method works as if we were giving small quantities of votes to one of the blocs, distributing these votes between the parties of that bloc according to their vote share, while keeping the number of votes for the parties of the other bloc constant. As we supply more votes, seats start shifting from one bloc to the other. We stop giving votes when we observe a shift in seat majority from one bloc to the other. The number of votes needed to reach this stage, divided by the total number of votes cast at the elections, is our measure of vote distance. In Annex B we also provide a numerical example that helps understand how this procedure works.

Control variables. We use the following control variables (data sources provided in Table 1). Firstly, the amount of land assigned for development that remains vacant at the beginning of the period as a proportion of the previous built-up land (%*Vacant Land*). The argument here is that if a lot of land assigned for development remains undeveloped, there will be no immediate need to alter regulations assigning more land for development. Similarly, if there is no vacant land at all, there will be considerable pressure to release more land for development in order to accommodate possible future demands. Secondly, the amount of open land at the beginning of the period as a proportion of previous built-up land (*Open Land*), i.e. the land under the jurisdiction of the municipality which was neither build on nor assigned for development but vacant. If there is a shortage of open land – either because the town grew a great deal in the past, or because it has a small jurisdiction – the government might opt to preserve scarce open space or postpone development decisions until a later date.

Thirdly, a basic set of control variables *Z*, measuring the main traits that account for recent urban growth in Spain, and which includes the *Urban*, *Suburb* and *Beach* dummies. The European Environmental Agency (2006) notes that most of the recent housing growth in Spain has been concentrated in these places, so we expect them to capture a large share of the spatial variation in the demand for land. Fourthly, a full set of local area dummies f_j. These effects are included because the size of the increase in demand depends to a great extent on certain geographical traits (e.g., weather, proximity to the coast, regional regulatory framework, and major infrastructure such as ports or airports) that are common to municipalities located near one another. We use 109 urban area and 50 provincial dummies[19,20].

[19] Since both sets of dummies are introduced simultaneously, the provincial dummies account for the effects common to all municipalities in the non-urban portion of a province.

[20] The urban areas are those identified by the AUDES project using geographic contiguity criteria (see www.audes.es). Alternatively, we could have used local labor markets (LLM) as defined using commuting patterns. According to Boix and Galletto (2006), there are 802 local labor markets in Spain, defined so as to guarantee that at least 75% of the employees work inside this area. The drawback of using this definition of local area is that outside urban areas the number of municipalities per labor market is very low (e.g., 208 of these local labor markets have just 1 or 2 municipalities), meaning that in our restricted sample we will have

Finally, we also use a set of additional control variables, *W*, measuring either the size of the demand increase or the pro- or anti- growth preferences of the residents. This set includes: (a) Exogenous measures of local demographic shocks: % *Aged* 25-40, which measures the number of potential new families at the beginning of the period, % *Immigrants* (i.e. those that arrived during the period, expressed as % of residents at the beginning of the period); (b) Variables that account for the amenity and productivity factors deemed important for location decisions (i.e., an *Amenity index* and a measure of *Road accessibility*); (c) Variables more closely related to a resident's preferences for development, but also arguably correlated to 'demand pressures' (i.e. %*Out-commuters*, %*Homeowners*, %*Unemployed*, %*Graduate*, *Population size*, *Density* and *Income per capita*).

5. Results

5.1. OLS with controls

Table 2 presents the results of the estimation of equation 1 by OLS. Column (i) presents the results without controls. Column (ii) introduces the main set of controls (i.e., the amount of vacant and open land, and the dummies identifying whether the municipality is located in an urban area, whether it constitutes a suburb or it is on the coast). Column (iii) introduces the full set of local area dummies, and Column (iv) controls for a large set of additional covariates. The results indicate that left-wing governments convert less land from urban to rural uses than is the case with right-wing governments. The effect increases as the different sets of controls are added, but it is qualitatively the same in each case. The results of Column (iii), our preferred specification, indicate that the new land that was allowed to be developed during the term (as a proportion of the built-up area at the beginning of the term) is 0.177 less under a left-wing government. That the average value of this variable for the municipalities controlled by the right is approximately 0.50 means that, on average, left-wing governments develop 32% less land than that developed by right-wing governments (0.321=0.177/0.55). In other words, while the average right-wing government permitted an increase in the developable area of the city equivalent to 55% of the initial built-up area, a typical left-wing government only permitted an increase of around 34%.

Although this result is of quantitative importance, we cannot be sure of its meaning, since there may well be many influences on urban growth that we are unable to measure but

many areas with just one observation (e.g., actually, this happens in 560 cases, 430 of them in rural areas and the remaining in urban areas). Moreover, in results not reported here, we show that once we accounted for the former set of dummies (i.e., AUDES urban area dummies plus provincial dummies), adding a set of dummies for each LLM with two municipalities or more does not improve the explanatory capacity of the model.

which are potentially correlated with the partisan identity of the government. Note for instance that, although the equation does identify some of the drivers of growth (i.e., more land is put on the market when there is a shortage at the beginning of the period and where there is plenty of open land, in urban areas, suburbs and on the coast), the explanatory capacity of the model stands at around just 15%[21].

[Insert Table 2]

5.2. Regression Discontinuity

Exploring the discontinuity. In order to verify the robustness of these results we employ a more demanding identification strategy, comparing left- and right-wing governments involved in close elections. As explained in the previous section, this is not an easy task in the Spanish case, given the system of proportional representation used and the existence of many coalition governments. To overcome these difficulties we started by looking at close elections in terms of the number of seats won. For this exercise to be relevant, having one more seat should be essential for the partisan identity of the government. Figure 1 plots the percentage of left-wing governments against the distance in terms of seats between the left- and right-wing blocs: negative numbers indicate the number of seats that the left-wing bloc would need to obtain so as to gain a majority of seats (i.e., to have one more seat than the right-wing bloc), while positive numbers indicate the number of seats the left-wing bloc would have to lose in order to relinquish this majority. Note that the proportion of left-wing governments jumps considerably between -1 and +1 (i.e., after the left-wing bloc wins a majority of seats). The probability of having a left-wing government jumps by approximately 70% at that threshold. This probability also increases when gaining other seats, but the jump in these other cases is much smaller. This suggests that a close-race RD design can be applied in our case by comparing the municipalities in the vicinity of the 50% seat threshold.

[Insert Figure 1]

However, the fact that under the d'Hondt rule seats are won after only a discrete change in the number of votes means that some of the municipalities in the –1 seats group might be much closer than others – in terms of the number of votes – to gaining the additional seat required to secure a majority (and also that some of the municipalities in the +1 groups are

[21] None of the additional controls proved, individually, to be statistically significant at conventional levels, although some did present the expected signs and t-statistics above one (e.g., growth seems to be lower in places with a large proportion of homeowners and commuters and higher in places with high rates of unemployment). However, the explanatory capacity of this group of variables is very low, as the F-statistics reported in Table 2 demonstrate.

closer than others to losing this). We can use that distance (% *Votes to left-wing seat majority*) to identify a sample of left- and right-wing municipalities that are not only close in terms of seats but also in terms of the number votes needed to lose or win these marginal seats.

[Insert Table 3]

However, before reporting the results obtained when using this approach, we should first show that the proportion of left-wing governments also jumps at the 50% seat threshold when we control for the vote distance variable. This is necessary in order to demonstrate that behind the seat discontinuity there is also a genuine vote discontinuity. Figure 2 reveals this to be the case. The dots are bin averages of the proportion of left-wing governments. The size of the bin is 2.5% of the vote distance and has been selected using the bin test (see Lee and Lemieux, 2011). The black line is a flexible second-order polynomial, fitted separately on each side of the threshold. It is apparent from the graph that the proportion of left-wing governments increases with the vote for the left bloc and that the jump identified in the probability of having a left-government is of the same magnitude as that reported in Figure 2. The existence of this discontinuity is formally tested in Table 3. Here we present the results of the test when controlling for a two-sided polynomial (using the whole sample) and also when using a locally weighted regression (with the sample corresponding to a restricted bandwidth of 25 and 12.5% of the vote). Note that in any case, the estimated size of the discontinuity is very similar and statistically significant at the 99% level. The results with the optimal polynomial (that of the second order, as indicated by the AIC) and with a locally weighted regression are similar, identifying a jump of 70-75% in the probability of a left-wing government.

[Insert Figure 2]

Main results. Table 4 presents the RD estimates of the effect of left-wing governments on urban land growth. Panels (a) and (b) display the results with and without the covariates. The first five columns present the results obtained when using the full sample and a two-sided polynomial. The first four columns present the results of the estimation of the reduced form (equation 2) by OLS when controlling for polynomials of different orders. The optimal polynomial order is two, as indicated by the AIC criterion (see Lee and Lemieux, 2011). The size of the effect changes when moving from a polynomial of order zero and one to a second order polynomial, but very little thereafter. The fifth column displays the results of the 2SLS estimation when using the optimal polynomial. The results change little when adding the covariates. The last two columns report the reduced form estimates when controlling for a

locally weighted regression. In this case, the impact is also of a similar magnitude independent of the bandwidth used, although the level of precision is much lower for the smaller sample.

[Insert Table 4]

As regards the results, note first that the size of the effect obtained when estimating the reduced form with either the optimal polynomial or the locally weighted regression is of a similar magnitude, around 0.2. The 2SLS coefficient is higher, around 0.3, closely reflecting the fact that it should be equal to the ratio between the reduced form coefficient and the size of the discontinuity estimated in the first stage (i.e., -0.315= -0.222/ 0.704). This effect is much greater than that of the OLS presented in Table 2. This means that a left-wing government would, on average, develop 65% less land than a right-wing government (0.654= 0.315/ 0.481)[22]. This effect is even more marked than that recorded previously using OLS. Thus, in our case the use of an RD design (contrary to other papers, see, for example, Ferreira and Gyourko, 2009) reinforces the OLS findings.

[Insert Figure 3]

This effect is displayed graphically in Figure 3. The graph shows 2.5% bin averages and a flexible polynomial fitted to the whole sample. The size of the discontinuity is apparent from the graph. The graph also shows that the slope of the plot is in general negative, especially in the case of right-wing governments, suggesting that governments tend to put more land on the market as they move further from the seat majority threshold. This result, however, should be interpreted with caution, since in an RD design the shape of the non-linear function fitted at both sides of the threshold does not have a causal interpretation.

Additional results: within-bloc differences. In order to gain further insights into these results, we repeated the analysis for several sub-samples. First, we present the results when comparing subsets of left- and right-wing governments. So far in the discussion we have implicitly considered all parties in one ideological bloc as being equivalent. However, the discussion in section 3 suggests that some left-wing parties are more anti-growth than others (e.g., IU, the former communists, closely linked in Spain with the environmental movement), and also that some right-wing parties are more pro-growth (e.g., PP, closely linked with the complete deregulation of the land market). Our results in Table 5 show that there are no differences between Center-Left (CL) and Center-Right (CR) parties, but that the differences

[22] To make this calculation we compared the 2SLS results with the % growth of developable land for a right-wing government located closest to the threshold, which in this case was 0.481.

between Center-Left (CL) parties (the main left-wing party, PSOE, in most instances) and Right-Right (RR) parties (the right-wing party, PP in most instances) are larger than those estimated before in Table 4. Now the 2SLS coefficient is -0.403, which means that a left-wing government would, on average, develop 68% less land than a right-wing government. The difference between Left-Left (LL, here mostly IU) and Right-Right (RR) parties is even more extreme, the coefficient being around -0.5, and the proportional reduction up to 71%. The differences between Left-Left (LL) and Center-Right (CR) parties are smaller and the coefficients statistically significant at the 90% level. Finally, the last column reports the difference between the main left and right-wing parties (PSOE and PP), which are also quite marked.

[Insert Table 5]

Additional results: population heterogeneity. Second, in the first four columns of Table 6 we present the results when dividing the sample according to two proxies of population heterogeneity. The first is an indicator of social polarization in terms of anti- (or pro-) development preferences. We proxy the size of the anti-development group by summing the respective proportions of homeowners, out-commuters and graduates, and that of the pro-development group by summing the respective proportions of renters, unemployed, and workers in the construction industry. These two variables are expressed in relation to the sample average (=100) and our indicator of social polarization is the absolute value of the difference between them. The higher the index the more dominant is one of the groups (either the anti- or the pro- growth one) and the more homogeneous is the population. Our expectation (recall the discussion in section two) is that the more homogeneous the population the more credible will be the promises the parties make to the median voter, fostering the convergence of policies enacted by right- and left-wing parties. Then, we repeat the RD analysis for the sub-samples of municipalities with social polarization indexes higher and lower than the median. The results are displayed in the first two columns of Table 6 and suggest that partisan policy differences are much greater in more polarized places, left-wing governments allowing 85% less land to be developed than right-wing parties (recall that this figure stood at 60% for the whole sample). In less polarized communities, the figure is around 35%, but it should be noted that the coefficient is not statistically significant. Panel (a) of Figure 4 displays the RD graph for both samples, illustrating the striking differences between less and more polarized communities.

[Insert Table 6]

[Insert Figure 4]

The second proxy of social heterogeneity is a measure of the fragmentation of the population between municipalities belonging to the same local area. For each local area we have computed a Hirschman-Herfindhal index of municipal population concentration[23]. A low index value is indicative of a high level of fragmentation, meaning that (for a given population size) the pool of municipalities from which to choose is larger. Our argument here is that fragmentation enhances residential choice facilitating the clustering of population groups with similar tastes, some of which create more homogeneous communities that in turn facilitate policy convergence. Thus, in this case, we expect that the greater the area's fragmentation, the smaller the differences will be between the policies enacted by right- and left-wing parties. The results obtained when dividing the sample between municipalities with values above and below the median value of this index are presented in the third and fourth columns of Table 5. We find that partisan differences are restricted to local areas displaying a low level of fragmentation. In this case, left-wing parties allow 81% less land to be developed than the amount developed by right-wing parties. The differences are much lower (around 30%) in the most fragmented areas but, again, the coefficients are not statistically significant. Panel (b) in Figure 4 provides a graphical display of these effects. Overall, the results of this analysis suggest that partisan differences in the drawing up of local land use policies tend to occur mainly in the more heterogeneous communities. This finding is similar to that reported by Ferreira and Gyourko (2009) who conclude that (in the case of fiscal policy) there are no partisan differences in suburban US communities.

Additional results: housing demand. As was argued in section two, in the case of land use policies, we expect partisan differences to occur only when there is some controversy regarding the desirability of allowing or preventing additional development. Clearly, this only occurs when a municipality experiences a substantial housing demand shock. To verify this intuition we divided our sample in two according to the housing construction growth rate experienced by the local area (here again we draw on the 109 AUDES urban areas plus the 50 provinces) during the previous term-of-office. It is our contention that if the area has grown considerably in the near past, local governments may well forecast that it is likely to grow in the future and, thus, start contemplating the expansion of the amount of developable land to accommodate their forecasts. Our results are presented in the last two columns of Table 6. Indeed, we find that the differences between left- and right-wing governments are more

[23] In this case, the definition of local area is the Local Labor Market (LLM), defined using commuting patterns. According to Boix and Galletto (2006), there are 802 LLMs. We computed the Hirschman-Herfindahl index for each of them. We did not use the 109 AUDES urban areas because they do not cover the whole of the Spanish territory, which means that the level of fragmentation for the non-urban portion is automatically set at its minimum level.

pronounced in rapidly growing areas. A left-wing government in one such area will allow 83% more development than a right-wing government located in a similar municipality. In slow-growing areas this number falls to around 37%. The coefficient for this group is statistically significant at the 90% level.

Obviously, the doubt remains as to whether this result is simply a reflection of the previous one regarding the effects of population heterogeneity. We believe this not to be the case as the correlation between the heterogeneity of the housing demand dummies is quite low (less than 5%, in absolute terms) and not statistically significant at any reasonable level[24]. Yet, we must admit that the results obtained when replicating the RD analysis across subsamples should not be extended far. Even if the dummies used to divide the sample in different ways do not appear to be correlated, a correlation might exist with any other variable having an effect on the differences in the behavior of right- and left-wing parties. Thus, the results of the heterogeneity analysis may reflect the explanation we have invoked or many other causes. However, the fact that the three analyses performed point in the expected direction is encouraging.

Validity and robustness. The validity of the RD design depends on certain assumptions. Firstly, agents should not be able to manipulate the forcing variable. There has been some concern in the literature about this possibility (see Folke and Snyder, 2011). Several factors might be behind this result: electoral fraud, differences in the capacity to mobilize resources during a closely contested campaign (see Caughey and Sekhon, 2011) and, in our case, differences in the capacity to broker coalition deals, either before or after the elections. The first factor can be completely dismissed in Spain, since there are no grounds whatsoever for concern about the possibility of electoral fraud in local elections. The second is equally implausible given the low amount of resources required to run a local campaign. Moreover, as Caughey and Sekhon (2011) note, the manipulation of the forcing variable is more feasible in a two-party system with very sophisticated polling systems, where the level of uncertainty regarding the election is greatly reduced. However, they claim that manipulation is less feasible in proportional electoral systems and in places where campaigning is not especially sophisticated. This description matches Spain's local elections perfectly. As for the last factor, we should stress that pre-electoral coalitions are extremely rare in Spain, as a result of the incentives generated by a system based on proportional representation. However, post-electoral coalitions do constitute a potential threat to our empirical strategy, but to avoid it we

[24] The two heterogeneity variables are negatively correlated; thus, there is greater polarization where there is less fragmentation. The correlation coefficient is around -0.05, although it is not statistically significant.

have worked with ideologically linked blocs of parties rather than with actual coalitions. In any case, to further dissipate any suspicions regarding the possible manipulation of the forcing variable, in Annex A we present the histogram of the distance for both seats and votes. The figures suggest that there is no apparent discontinuity at the threshold. We also present a more formal test (McCrary, 2008) showing that the density of the forcing variable is continuous at the threshold. Secondly, no other variables that might influence the outcome analyzed should present a similar jump at the discontinuity. In Annex A, also, we report the results of discontinuity tests which show that none of the pre-determined covariates is affected by the discontinuity.

We performed a number of additional analyses in order to demonstrate that our findings are not influenced by any particular methodological decision. These results are presented in Table A.2 in Annex A. First, we repeated the analysis but this time we eliminated from the sample those municipalities with at least one seat allocated to a local party. The results were virtually unchanged (see column (i)). Second, we undertook the analysis using only those municipalities in which the two main parties obtained most of the votes, i.e., a situation that resembled a bipartisan system. Here, the discontinuity was greater than before (see column (ii), Panel (c)), but the estimated effect was very similar. Third, we restricted the sample to include just coalition governments, so as to show that the discontinuity is not an artifact created by the fact that our sample contains more majority governments than coalitions. Here the jump was around 50%, which is lower than the 70% reported for the whole sample (see columns (iii), Panel (c)). However, the treatment effect is of the same magnitude (see Panel (b)). Finally, we repeated the analysis using an alternative measure for the voting distance needed to win or lose a majority of seats. So far the distance used has been computed on the assumption that the votes won/lost come/go from/to abstentions. Now we adopt a measure that assumes that these votes might come/go not only from abstentions but also from the other ideological bloc (see Annex B). The results were again unchanged.

6. Conclusion

This paper has analyzed whether the party controlling local government has an influence on a municipality's land use policies. In so doing, we have drawn on a new database containing information about the amount of land converted from a rural to urban use by Spanish municipalities in the period 2003-2007. To identify the effect of the country's political parties we have used a close-election regression discontinuity design, amended to account for the specific institutional traits of Spain's local political system (i.e., proportional representation

and the existence of government coalitions). Our method has involved the comparison of governments controlled by left-wing and right-wing parties that are close to holding a one seat majority in the council, while controlling for a function of the distance in terms of number of votes to losing or winning a majority. Our results suggest that left-wing governments have a considerable influence on land use policies. Left-wing governments that are close to winning-losing power allow 65% less land to be developed than comparable right-wing governments. The effects of left-wing parties are particularly pronounced in more heterogeneous communities and in places facing greater housing construction growth rates. It would seem to be the case that it was in these places that the conflict between pro- and anti-growth groups was most pronounced during this period and the consensus regarding the desirability of urban development most difficult to achieve.

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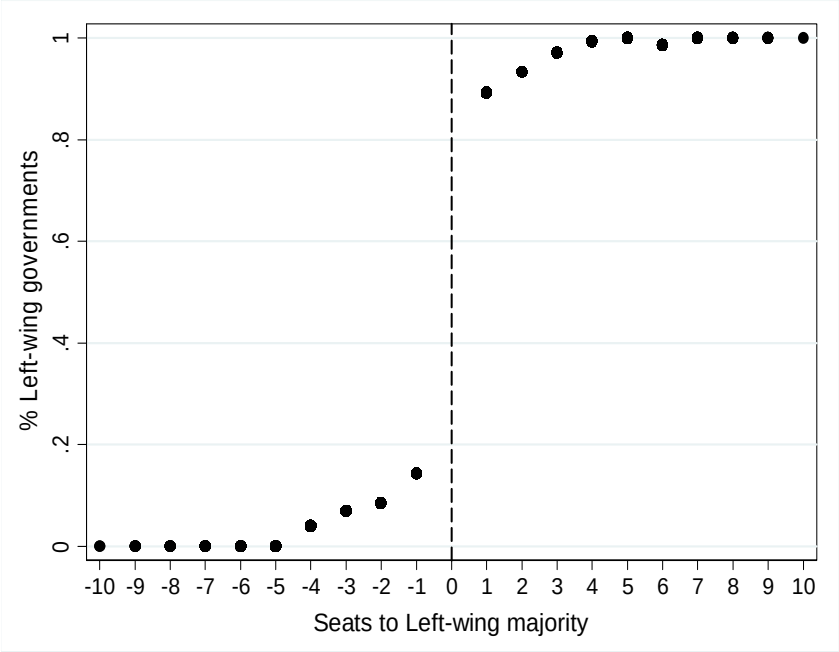
Figure 1

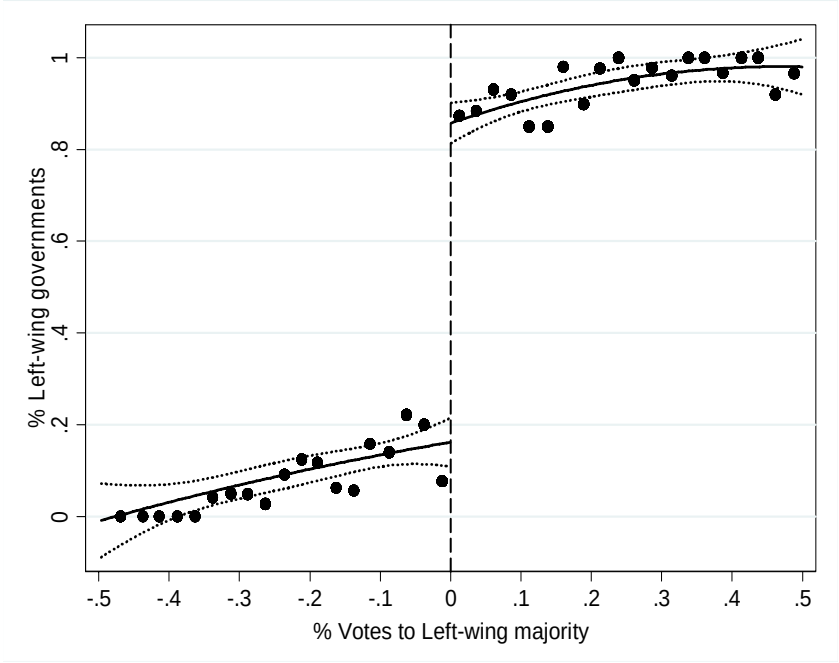
% Left-wing governments vs. Seats to left-wing majority.



Notes: (1) % Left-wing government = proportion of local governments with a left-wing mayor. Seats to left-wing majority = number of seats needed for the left-wing bloc to win (if -) or lose a majority of seats (if +).

Figure 2

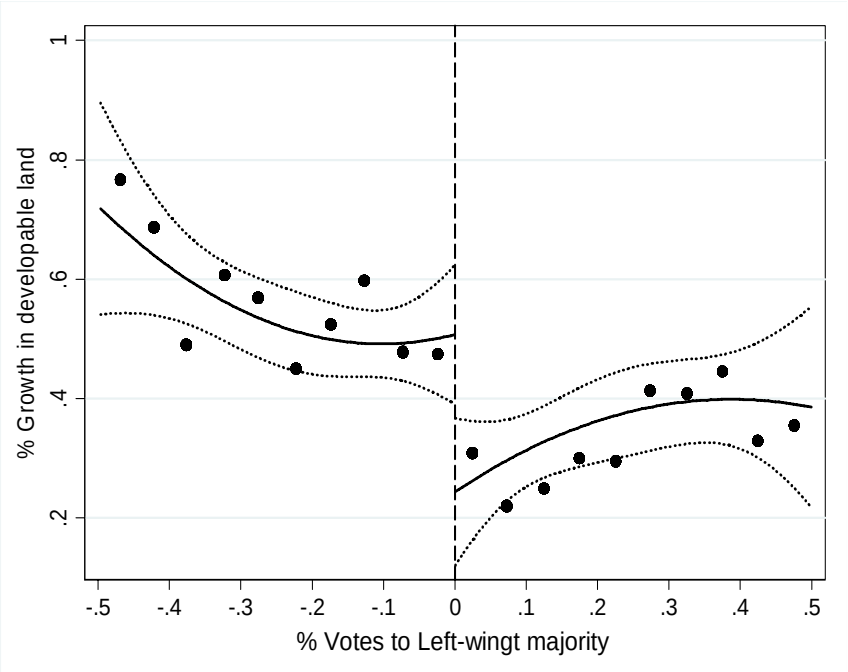
% Left-wing governments vs. % Votes to left-wing majority.



Notes: (1) % Votes to left-wing majority = % of votes that the left-wing bloc should lose (if +) or win (if -) to obtain one seat less or more than the right-wing bloc. (2) Dots = Bin averages. Bin size = 0.025 (2.5% of the vote), selected using the bin test (Lee and Lemieux, 2011). (3) Black line = 2nd order polynomial. (4) Dotted lines = 95% confidence interval.

Figure 3

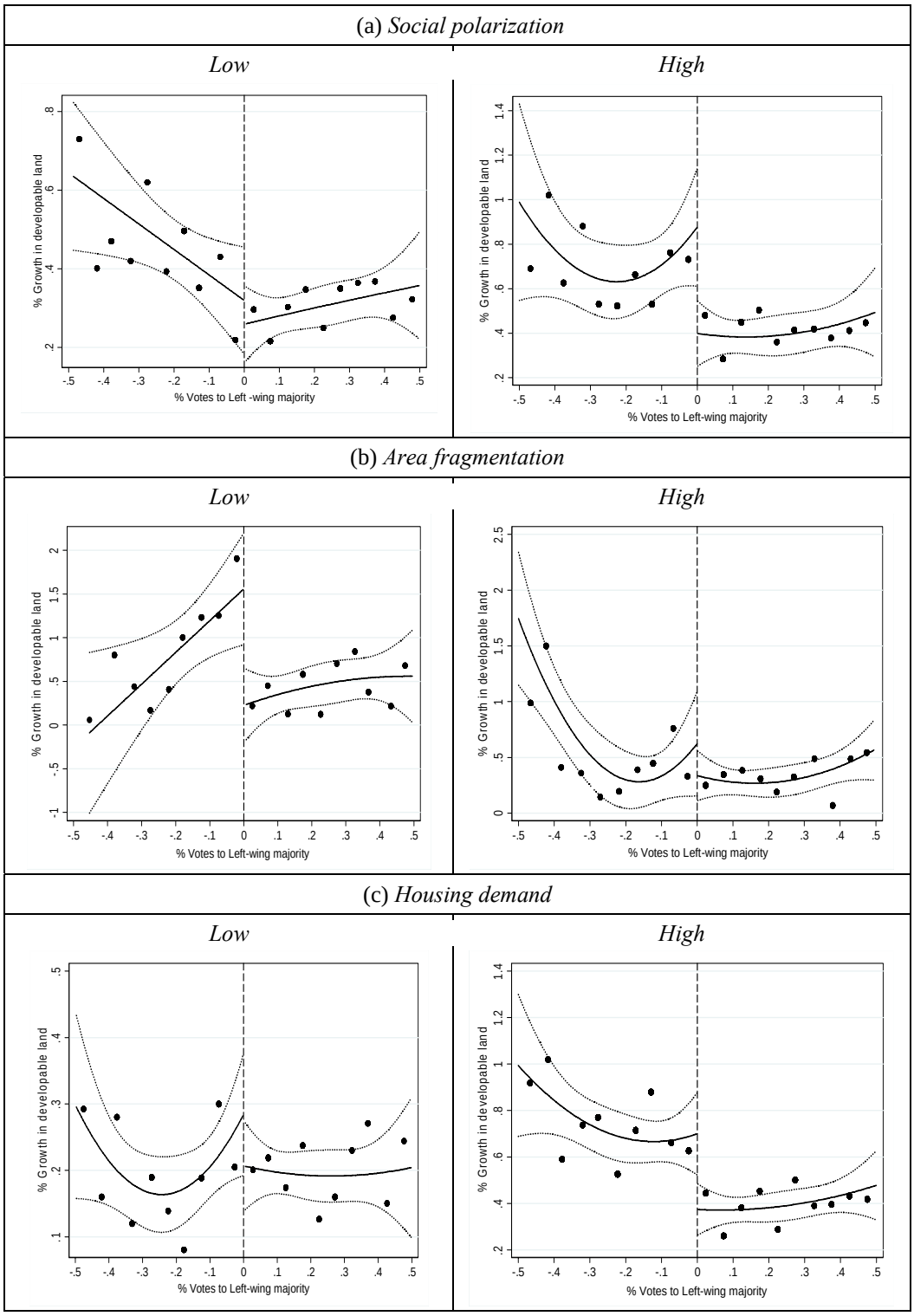
% Growth in developable land vs. % Votes to left-wing majority.



Notes: (1) Dots = Bin averages; Bin size = 0.025 (2.5% of the vote), selected using the bin test (Lee and Lemieux, 2011). (2) Black line = 2nd order polynomial. (3) Dotted lines = 95% confidence interval.

Figure 4

% Growth in developable land vs. % Votes to left-wing majority: Population heterogeneity and housing demand



Notes: See Figure 3 and Table 6.

Table 1
Definitions and sources of the variables

	Definition	*Sources*
Δ*u*	[(Built-up land + Vacant land, end of term) – (Built-up + Vacant land, beginning of term) / Built-up land, beginning of term] × 100	DCG, Dirección General del Catastro (2007): "Estadísticas sobre ordenanzas fiscales del Impuesto sobre Bienes Inmuebles", http://www. catastro.meh.es / esp/estadisticas1. asp#menu1. (Built-up land = 'superficie edificada', Vacant land = 'superficie de solares')
% Vacant land	[Vacant land, beginning of term) / Built-up land, beginning of term] × 100	
% Open Land	[Total land area of the municipality - Built-up land beginning of term/ Built-up land, beginning of term] × 100	INE (www.ine.es) & DCG, Dirección General del Catastro (2007)
d*Left*	Dummy = 1 if the mayor belongs to a party classified as left-wing (PSOE, ERC, IU, IC, BNG, PA, PAR, etc.)	Ministerio del Interior, *Base Histórica de Resultados Electorales*, http://www. elecciones.mir.es/MIR/jsp /resultados index.htm. & El País (2003): 'Anuario Estadístico'
d(*Left>Right*)	Dummy = 1 if the parties classified as left-wing have more seats in the local council than those classified as right-wing	
% Votes to left-wing majority	% of Votes needed by the left-wing bloc to either lose the last seat they hold or to win an additional seat (see Annex 2 for a detailed explanation of the method used in the computation)	
d*Urban*	Dummy = 1 if municipality belongs to an urban area	AUDES project: 109 urban areas defined using aerial photographs on the basis of geographical continuity (see www. audes.es),
d*Suburb*	Dummy = 1 if municipality belongs to an urban area but it is not the central city	
Amenity index	[Houses with problems related to: noise, dirt, crime, pollution, or lack of green space, as of 2001/ Houses in 2001] × 100	INE (www.ine.es), 2001 Census of Buildings
Road accessibility	[Houses with poor accessibility to roads, as of 2001/ Houses in 2001] × 100	
% *Aged* 25-40	[Residents aged 25 to 40 beginning of term/ Resident population beginning of term] × 100	INE (www.ine.es), 2001 Census of Population & 'Estadística de Variaciones Residenciales' (several years) La Caixa (2001): 'Anuario Económico de España'
% *Immigrants*	[Immigrants by nationality beginning of term × Regional growth rate by nationality during term/ Resident population beginning of term] × 100	
% *Out-commuters*	[Commuters in 2001/ Resident population in 2001] × 100	
% *Homeowners*	[Houses occupied by owner in 2001/ Houses in 2001] × 100	
% *Graduate*	[Residents with a higher education degree in 2001/ Resident population in 2001] × 100	
% *Unemployed*	[Residents which were unemployed, beginning of term/ Resident population, beginning of term] × 100	
Population size	Resident population, beginning of term	
Income per capita	Personal income, beginning of term / Resident population, beginning of term.	

Table 2:

OLS *results*

	(i)	(ii)	(iii)	(iv)
d*Left*	-0.121 (0.044)***	-0.146 (0.045)***	-0.175 (0.067)***	-0.171 (0.085)**
% Vacant land	--.--	-0.632 (0.133)***	-0.655 (0.137)***	-0.674 (0.159)***
% Open land	--.--	0.075 (0.014)***	0.076 (0.013)***	0.079 (0.011)***
d*Urban*	--.--	0.081 (0.039)**	--.--	--.--
d*Suburb*	--.--	0.092 (0.041)***	0.163 (0.070)***	0.091 (0.035)***
d*Beach*	--.--	0.134 (0.050)***	0.126 (0.047)***	0.113 (0.046)**
Adj-R^2	0.043	0.092	0.148	0.142
F-est. (*all var.*)	7.33	19.57	4.96	3.93
[*p-value*]	[0.001]	[0.000]	[0.000]	[0.000]
F-est. (*main controls*)	--.--	23.09	21.32	16.44
[*p-value*]		[0.000]	[0.000]	[0.000]
F-est (*area effects*)	--.--	--.--	4.44	3.09
[*p-value*]			[0.000]	[0.000]
F-est (*additional controls*)	--.--	--.--	--.--	0.30
[*p-value*]				[0.112]
Main controls	NO	YES	YES	YES
Area effects	NO	NO	YES	YES
Additional controls	NO	NO	NO	YES
Num. Obs.	2112	2112	2112	2112

Notes: (1) Dependent variable: Δu, % increase in developable land over the term. (2) Robust standard errors in parenthesis, p-values in brackets; ***, ** & * = statistically significant at the 99%, 95% and 90% levels. (3) Additional controls: % *Aged* 25-40, %*Immigrants*, *Amenity index*, *Road accessibility*, %*Out-commuters*, %*Homeowners*, %*unemployed*, %*Graduate*, *Population size*, *Density* and *Income per capita.* (4) Area effects: dummies for each of the 109 AUDES urban areas and for each of Spain's 50 provinces.

Table 3:
Discontinuity in the probability of having a left-wing Government

	Two-sided polynomial				*Local regression*	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
d(*Left>Right*)	0.793***	0.754***	0.705***	0.694***	0.755***	0.727***
	(0.013)	(0.024)	(0.030)	(0.038)	(0.014)	(0.022)
AIC	970.36	647.39	640.95	649.77	--.--	--.--
Pol. Order	0	1	2	3	1	1
Bandwidth	100%	100%	100%	100%	25%	12.5%
Obs.	2112	2112	2112	2112	993	536

Notes: (1) Dependent variable is *dLeft*=1 if the mayor belongs to a left-wing party and 0 otherwise (see Table A.1 for definitions). (2) Explanatory variables: dummy equal to one if the left-wing bloc has more seats than the right-wing bloc (*d*(*Left>Right*)), and two-sided polynomial (or locally weighted regression) in the % *Votes to left-wing majority*. (3) Robust standard errors in parenthesis; ***= statistically significant at the 99% level. (4) AIC: Akaike information criterion.

Table 4:
Regression Discontinuity: main results

	Two-sided polynomial					*Local regression* (*Reduced form*)	
	Reduced form				2SLS		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Panel (a): *Without controls*							
d(*Left>Right*)	-0.191*	-0.214**	-0.222***	-0.201***	--.--	-0.204***	-0.210*
	(0.103)	(0.087)	(0.103)	(0.104)		(0.094)	(0.109)
d*Left*	--.--	--.--	--.--	--.--	-0.315**	--.--	--.--
					(0.146)		
AIC	7492.93	6870.61	6873.74	6876.73	--.--	--.--	--.--
Panel (b): *With controls*							
d(*Left>Right*)	-0.187***	-0.224***	-0.241***	-0.225***	--.--	-0.254***	-0.230**
	(0.061)	(0.085)	(0.102)	(0.067)		(0.093)	(0.107)
d*Left*	--.--	--.--	--.--	--.--	-0.349***	--.--	--.--
					(0.115)		
AIC	7382.42	6772.67	6769.79	6775.33	--.--	--.--	--.--
Pol. Order	0	1	2	3	2	1	1
Bandwidth	100%	100%	100%	100%	100%	25%	12.5%
Obs.	2112	2112	2112	2112	2112	993	536

Notes: (1) Dependent variable: Δu, % increase in developable land over the term. (2) 2SLS: *dLeft* as explanatory variable and *d*(*Left>Right*) as instrument. (3) Robust standard errors in parenthesis; ***= statistically significant at the 99% level. (4) AIC: Akaike information criterion.

Table 5:
Regression Discontinuity: within bloc differences

	(i) *CL vs. RR*	(ii) *CL vs. CR*	(iii) *LL vs. RR*	(iv) *LL vs. CR*	(v) *PSOE vs. PP*
RD-OLS	-0.326**	-0.043	-0.400**	-0.089*	-0.350**
	(0.153)	(0.226)	(0.189)	(0.055)	(0.141)
RD-2SLS	-0.403**	-0.054	-0.501**	-0.104*	-0.380**
	(0.198)	(0.257)	(0.244)	(0.058)	(0.184)
% *Decrease*	68.04	32.84	71.29	34.82	70.33
Obs.	913	502	450	245	880

Notes: (1) Dependent variable: *% Growth in developable land* (Δu). (2) RD estimates. 2nd order polynomial of votes to seat majority fitted at both sides of the threshold, with a 100% sample bandwidth. Main control variables included. (3) CL=Center-Left, RR=Right-Right, LL=Left-Left, and CR=Center-Right. (4) % Decrease = 2SLS coefficient divided by the value of the dependent variable at the -0.05 bin.

Table 6:
Regression Discontinuity: population heterogeneity and housing demand

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	(a) *Social polarization*		(b) *Area fragmentation*		(c) *Housing demand*	
	Low	*High*	*Low*	*High*	*Low*	*High*
RD-OLS	-0.062	-0.498***	-0.951***	-0.174	-0.088*	-0.362***
	(0.057)	(0.122)	(0.241)	(0.187)	(0.047)	(0.109)
RD-2SLS	-0.088	-0.681***	-1.219***	-0.223	-0.132*	-0.514***
	(0.076)	(0.104)	(0.358)	(0.259)	(0.075)	(0.155)
% *Decrease*	35.22	85.86	81.27	36.17	38.01	83.25

Notes: (1) *Demand shock:* % growth in housing construction in the area during the previous four years. (2) *Social fragmentation*: absolute value of the difference between per capita indexes (sample average = 100) of anti-growth populations groups (Homeowners + Out-commuters + Graduates) and pro-growth groups (Renters +Aged25-40 + Unemployed + Construction workers). (3) *Area fragmentation*: normalized Hirschman-Herfindhal index of population concentration across municipalities of the urban area. (5) See Table 5.

Annex A: Validity and robustness checks

Figure A.1

Discontinuity in the forcing variable. Vote histogram.

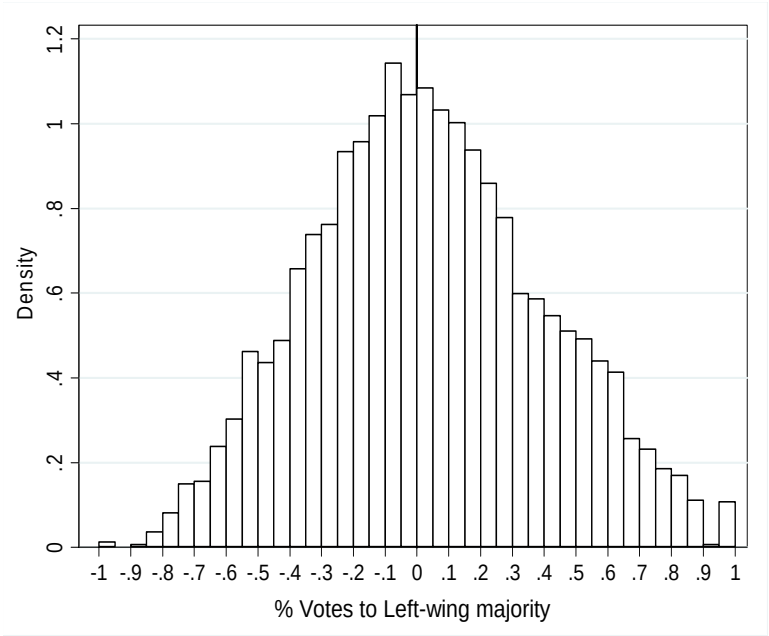
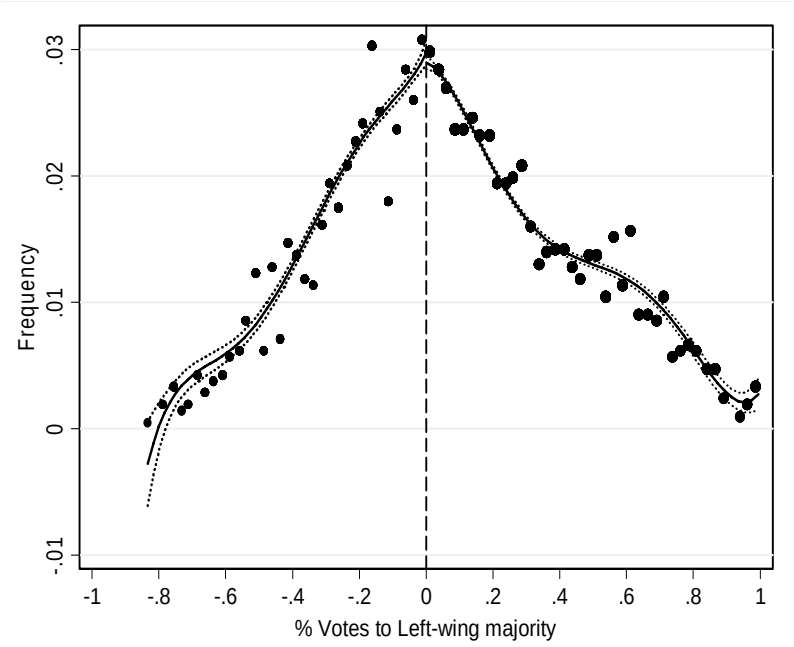


Figure A.2

Discontinuity in the forcing variable. McCrary test.



Notes: (1) Dots: Bin averages of the density of the forcing variable (% *Votes to left-wing majority*). (2) Lines: Local regression and 95% confidence intervals. See McCrary (2008).

Table A.1:
Discontinuity tests for the control variables

	Two-sided polynomial	*Local regression*		*Two-sided polynomial*	*Local regression*
Vacant land	-0.011 (0.053)	-0.008 (0.055)	*Road accessibility*	0.001 (0.023)	0.001 (0.031)
Open Land	0.003 (0.009)	0.005 (0.012)	% *Out-commuters*	0.021 (0.034)	0.025 (0.0.41)
Urban	0.008 (0.012)	0.008 (0.029)	% *Homeowners*	-0.011 (0.030)	-0.010 (0.051)
Suburb	0.003 (0.045)	0.004 (0.014)	% *Graduate*	-0.032 (0.130)	-0.040 (0.156)
% *Aged* 25-40	0.056 (0.066)	0.048 (0.110)	% *Unemployed*	0.015 (0.124)	0.017 (0.165)
% *Immigrants*	0.021 (0.070)	0.012 (0.081)	Log*(Population size*)	0.008 (0.012)	0.008 (0.029)
Amenity index	-0.112 (0.324)	-0.145 (0.521)	log(*Income per capita*)	-0.112 (0.212)	-0.192 (0.329)

Notes: (1) Two-sided polynomial: Optimal polynomial order selected with the AIC criterion with full sample bandwidth. (2) Local regression: locally weighted regression with optimal bandwidth (3). Robust standard errors.

Table A.2: *Robustness checks*

	No local parties (i)	*Two parties* (ii)	*Coalition governments* (iii)	*Alternative distance* (iv)
	Panel (a): *Reduced form*			
d(*Left>Right*)	-0.248 (0.105)***	-0.312 (0.110)***	-0.178 (0.085)**	-0.228 (0.089)***
	Panel (b): 2SLS			
d*Left*	-0.331 (0.135)***	-0.374 (0.152)***	-0.356 (0.175)**	-0.311 (0.114)***
Obs.	1436	980	774	2112
	Panel (c): *First stage*			
d(*Left>Right*)	0.749 (0.025)***	0.834 (0.031)***	0.501 (0.089)**	0.734 (0.031)***
Obs.	1436	980	774	2112

Notes: (1) See Tables 3 & 4. (2) All equations have been estimated with the 100% bandwidth, a second-order polynomial and the same controls as before. (2) No local parties = municipalities in which local parties hold seats are excluded from the analysis; Two parties = sample includes only municipalities in which the two main parties obtain more than 80% of the vote; Alternative distance = distance to change in seat majority computed allowing migration of votes between parties.

Annex B: Computing the % *Votes to Left-wing majority*

An example. The forcing variable for our RD design is the % *Votes to Left-wing majority*, defined as the minimum number of votes (expressed as a % of the total votes cast at the local elections) that needs to be subtracted from/added to left-wing parties in order for the left-wing bloc to lose/win a majority of seats in the local council. To compute this number we proceed in the following way. First, we assume that all parties can be classified into two ideological groups (left- or right-wing). Second, we identify the ideological bloc to which the incumbent belongs as the one which contains the party that holds the mayoralty. Third, we define a *Vote distance* variable (henceforth labeled as υ) as the minimum number of votes that needs to be subtracted from the incumbent's ideological bloc for that bloc to lose the majority of seats. We express this quantity as a % of the total votes cast at the local elections and call it % *Vote distance* (which is equal to υ/V, V being the total number of votes). Fourth, the % *Votes to Left-wing majority* is equal to this amount if the incumbent belongs to the left-wing bloc or equal to minus this amount if the incumbent belongs to the right-wing bloc.

Table B.1: *Example of how the vote distance is computed*

	Panel a) *Initial seat allocation*				*Panel b*) *Final seat allocation*			
Ideological blocs	*Opposition's bloc* (e.g., Right-wing)		*Incumbent's bloc* (e.g., Left-wing)		*Opposition's bloc* (e.g., Right-wing)		*Incumbent's bloc* (e.g., Left-wing)	
Parties)	P1	P2	P3	P4	P1	P2	P3	P4
Votes (v^i)	95	957	207	1116	95	957	152	820
Vote share (v^i/V)	0.04	0.40	0.09	0.47	0.05	0.47	0.08	0.41
Seats (s^i)	0	6	1	6	0	7	1	5
Seat share (α_i)			0.16	0.84				
	Panel c) *Seat allocation*							
Divisors	*Comparison numbers*							
1	95.00	957.00	207.00	1116.00	95.00	957.00	152.00	820.00
2	47.50	478.50	103.50	558.00	47.50	478.50	76.00	410.00
3	31.67	319.00	69.00	372.00	31.67	319.00	50.67	273.33
4	23.75	239.25	51.75	279.00	23.75	239.25	38.00	205.00
5	19.00	191.40	41.40	223.20	19.00	191.40	30.40	164.00
6	15.83	159.50	34.50	186.00	15.83	159.50	25.33	136.67
7	13.57	136.71	29.57	159.43	13.57	136.71	21.71	117.14
8	11.88	119.63	25.88	139.50	11.88	119.63	19.00	102.50
9	10.56	106.33	23.00	124.00	10.56	106.33	16.89	91.11
10	9.50	95.70	20.70	111.60	9.50	95.70	15.20	82.00
11	8.64	87.00	18.82	101.45	8.64	87.00	13.82	74.55
12	7.92	79.75	17.25	93.00	7.92	79.75	12.67	68.33
13	7.31	73.62	15.92	85.85	7.31	73.62	11.69	63.08
υ_i			55	296				
Vote distance (υ)			351					
% Vote dist. (υ/V)			14.67%					

The computation of the quantity υ is not straightforward. It requires studying the workings of the procedure used to allocate seats, the d'Hondt rule. As explained, under this rule the votes for each party are divided by 1, 2, 3, 4, etc. The resulting quotas or 'comparison numbers' are ranked and a fixed number of seats are then allocated on the basis of this ranking. Panel (a) in Table B.1 illustrates how the d'Hondt rule works with a hypothetical example comprising four parties (i=1 to 4), two from the incumbent's bloc (P3 and P4; let's assume they are left-wing parties) and two from the opposition bloc (P1 and P2; let's assume they are right-wing parties). The ideological bloc in

control of the local government received 1,323 votes, that is 56% of the votes cast at the municipal elections, and obtained 7 out of 13 seats (6 were won by P4 and 1 by P3), and so it holds the mayoralty. On the opposition side, all 6 seats went to party P2. In Panel c) we detail the procedure followed to allocate seats, showing the comparison numbers obtained after dividing the votes of each party by each divisor. The first seat is allocated to P4 with a comparison number of 1116, the second to P2 with a comparison number of 957, the third again to P4 with a comparison number of 558, and so on. The last seat to be allocated is the sixth seat to P2 (that is to the opposition bloc) with a comparison number of 159.50, which is slightly higher than the comparison number of the seventh seat of P4 (which would have been the eighth seat of the regional incumbent's bloc). Note that the seventh comparison number of P2 (the next seat that P2 and the opposition bloc would win) is 136.71, which is lower than the quotient of the sixth seat of P4, which is 186. Intuitively, in order for the opposition bloc to have a majority of seats, votes have to be added to the parties in this bloc (or subtracted from parties in the other bloc) to raise the first of these comparison numbers above the second one. In Panel (b) of Table B.1 we show a situation where this does in fact occur (the comparison numbers now being 136.71 vs 136.67). To move from the initial seat allocation in Panel (a), with the majority being held by the regional incumbent's ideological bloc, to the final seat allocation in Panel (b), with the majority now corresponding to the regional opposition, we have subtracted 351 votes from the incumbent's bloc, taking these votes from the parties in the bloc in proportion to their initial vote share (i.e., 55 are subtracted from P3 and 296 from P4). The *Vote distance* is thus 351 and the % *Vote distance* is the ratio between this number and the total number of votes, i.e., 14.67%. Since we have assumed that the incumbent belongs to the left-wing bloc this is also the value of our forcing variable, the % *Votes to Left-wing majority*.

Algebraic formulation. We have developed a procedure to compute the *Vote distance* (υ) for each of the municipalities in the sample. The Stata code is available upon request. Here is a simplified presentation of our formulation. Our procedure works (as in the above example) by subtracting votes from the parties belonging to the incumbent's ideological bloc. We start by making various assumptions regarding the migration of these votes. First, we assume that the votes lost by the incumbent's bloc are allocated amongst the parties belonging to this bloc in proportion to their initial vote share. Second, we assume that these votes either go: (i) to abstentions or (ii) both to abstentions and to the parties in the opposition bloc. We present the formulation for the first approach (votes going only to abstentions), but the formula used in the other approach is available upon request. Below we present the formulation used for the close election cases – i.e., cases where the seat margin is –1 or +1.[25]

Some notation and definitions are needed:

v_I^j & v_O^k: Votes for parties *j* and *k* from the incumbent's (*I*) and opposition (*O*) blocs, respectively.

[25]In the cases with a seat margin larger than one, the implementation of the formula follows several steps. Intuitively, we need to compute the number of votes required for the mayor's bloc to lose the last seat obtained, then the number of votes needed to lose the following seat, and so on until we reach the last seat to be lost after losing the majority. The total number of votes is the summation of the votes that have to be lost so as to lose each of the seats. The algebraic formulation of this more complex case is also available upon request.

α_I^j & α_O^k:	Share of votes for the *I* and *O* blocs going to parties *j* and *k.*
s_I^j & s_O^k:	Seats for parties *j* and *k* from the *I* and *O* blocs.
$c_I^j(s_I^j) = v_I^j / s_I^j$:	Comparison number for the 'last seat' won by party *j* from the *I* bloc.
$c_I^j(s_I^j + 1) = v_I^j / (s_I^j + 1)$:	Comparison number for the 'next seat' to be won by party *j* from the *I* bloc.
$c_I^{\min}(s_I) = \min_j \{c_I^j(s_I^j)\}$:	Smallest comparison number for the 'last seat' won by any party from the *I* bloc
$c_I^{\max}(s_I + 1) = \max_I \{c_I^j(s_I^j + 1)\}$:	Largest comparison number for the 'next seat' to be won by any party from the *I* bloc.
$c_O^k(s_O^k)$, $c_O^k(s_O^k + 1)$, $c_O^{\min}(s_O)$ and $c_O^{\max}(s_O + 1)$:	Corresponsing comparison numbers for the opposition bloc.

If a party belonging to the incumbent's bloc is to lose a seat and a party from the opposition bloc is to gain a seat, the comparison number of the party in the opposition bloc with respect to the next seat to be gained must be larger than the one for the last seat assigned to a party of the incumbent's bloc, once υ votes are subtracted from this party. The condition for the party of the opposition bloc winning a seat is:

$$c_I^{\min^*}(s_I) < c_O^{\max}(s_O + 1) \qquad [A.1]$$

where $c_I^{\min^*}(s_I)$ is the smallest comparison number for the last seat originally won by a party among the parties from the incumbent's bloc once υ votes have been subtracted to the party holding this last seat. Note that [A.1] can be rewritten as:

$$\frac{v_I^x - \upsilon^x}{s_I^x} < \frac{v_O^z}{s_O^z + 1} \qquad [A.2]$$

where party *x* is the one with the smallest comparison number for the last seat won by any party from the *I* bloc (i.e., $c_I^x(s_I) = v_I^x / s_I^x = c_I^{\min}(s_I)$) and party *z* is the one with the largest comparison number for the next seat to be won by any party from the opposition bloc (i.e., $c_O^z(s_O^z + 1) = v_O^z / (s_O^z + 1) = c_O^{\max}(s_O + 1)$). The votes to be subtracted from party *x* are indicated with υ^x and can be computed as:

$$\upsilon^x = (c_I^{\min}(s_I) - c_O^{\max}(s_O + 1)) s_I^x = ((v_I^x / s_I^x) - (v_O^z / s_O^z + 1)) s_I^x \qquad [A.3]$$

Intuitively, the number of votes that has to be subtracted to a party to lose the last seat won depends on the difference between the comparison number of this last seat and the comparison number of the seat to be won next by the opposition bloc. This difference is multiplied by the actual number of seats won by this party, which was the divisor number used to obtain that comparison number.

Now, if we assume that all the parties from the incumbent's bloc lose votes according to the votes originally obtained, the number of votes to be subtracted to the whole incumbent's bloc can be expressed as[26]:

[26] This is in fact a simplified version of the formula, since we need to verify that the seat lost by a party in the bloc in power really goes to a party in the other bloc and not to another party in the same bloc. If the seat goes to a party in the same bloc, an additional iteration is needed. Intuitively, we need to add the number of votes that have to be subtracted to move the seat from one party to another in the same bloc

$$\upsilon = \frac{\upsilon^x}{\alpha_I^x} + 1 \qquad [A.4]$$

where we have divided the quantity υ^x by the vote share of this party in its bloc (α_I^x). The intuitive idea here is that if the marginal party obtains a given extra number of votes the other parties in the bloc also obtain a vote increase, and the total vote increase for the ideological bloc should sum all these quantities. The +1 added to the formula is simply to ensure that we obtain a non-zero quantity.

plus the votes needed to move the seat to the other bloc. This problem only affects a very small proportion of cases, but the algorithm needs to take it into account so as to fit all possible cases. The exact formulation is quite cumbersome and is not included here, but it is available upon request from the authors together with the Stata code.

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