8-2017

Three Essays on the Effect of Representation on Governance

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Three Essays on the Effect of Representation on Governance

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
Economics

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by
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August 2017

Accepted by:
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Abstract

Recent research tests and finds support for the hypothesis that an increase in the number of elected representatives in local governments can reduce public expenditures by improving the oversight of the mayor by the council. This result suggests that a system of checks-and-balances is in place at the lowest level of governance in established democracies and is consistent with theories of the role of division-of-powers in improving government accountability. Given the relevance of this result for our understanding of political institutions, this dissertation presents three essays that: 1) test this hypothesis using different samples and alternative measures of government performance and 2) revisit the evidence from the existent literature. The first essay tests the hypothesis by implementing a Regression Discontinuity (RD) design using data from a large panel of local governments in Colombia, South America. I find that additional representatives decrease government expenditures on average; however, there is no evidence that this increase affects the oversight on the mayor. The results persist after accounting for the number of parties with elected representatives, indicating that the estimates are not driven by changes in the party composition. There is also no evidence that the reduction in municipal expenditures affects the provision of services such as potable water, student enrollment in elementary and high school education, and provision of health care to the low income population. Given the findings from the panel of municipal governments in Colombia, the second essay revisits the two empirical studies that report support for the hypothesis. A common feature of both studies is that they present their estimates of the effect of council size as coming from a RD specification. However, after examining the estimated equations, I show that they are inconsistent with a RD design because they do not incorporate information about the data generating process (i.e., discontinuities in the treatment assigning variable). The data from both studies is then used to estimate the effect of changes in the number of representatives using an appropriate RD specification. I find that the parameter estimates from the appropriate RD specification fail to reject the null hypothesis that

a change in the number of representatives does not affect the oversight of the manager/major by the council. The last essay provides an additional test for the hypothesis that an increase in the number representatives can increase the oversight of the executive by the council using a panel of municipal governments from Costa Rica. Although this panel is smaller than the one from Colombia, it better represents local governments in many developing countries where municipalities have a limited number of responsibilities with most services being provided through the central government. Using a RD design, I find no evidence that an increase in the number representatives has an impact on fiscal efforts or the allocation of municipal expenses. This is in spite of the fact that changes in the number of representatives lead to an increase in the number of parties in local councils.

Dedication

To God from whom I have received uncountable blessings and my parents who provided me with their love and support.

Acknowledgments

I am thankful to Howard Bodenhorn and Patrick Warren for their guidance and support during this journey. Our discussions substantially improved the quality of this document and helped me become a better researcher and writer. I am also indebted to William Dougan, Bob Tollison, Babur de los Santos, Raymond Sauer, Robert Fleck, Michael Makowsky, Ben Schwall, Barbara Ramirez, and participants at Clemson University's Public Economics workshop for valuable comments and discussion. The quality of this research is due to a large extent to their continuous feedback. Any remaining mistakes are my own.

I also thank Rossana Castellón and Karina Ugalde who went above and beyond their duty as family in helping me to collect the data for this project. Jairo Barreto, Magola Quintero, and personnel at Colombia's and Costa Rica's government agencies also provided valuable assistance in obtaining and understanding the data. I am also indebted to Per Pettersson-Lidbom and Sebastian Garmann for kindly sharing their data with me.

I am grateful for my family, roommates, classmates, and the St. Andrews community who made of my time at Clemson a wonderful experience.

Above all, I thank Maciel Ugalde for her love and support throughout my PhD. During these years she patiently listened to my research ideas, accompanied me many nights and weekends at the library, and provided feedback to multiple versions of these essays. I was blessed to share this journey with you ... *Caminante no hay camino, se hace camino al andar...Antonio Machado*

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Chapter 1

Do more representatives improve governance? Evidence from local governments in Colombia

1.1 Introduction

The notion that the number of elected representatives affects the size and the allocation of government funds features saliently in the economics and political science literature (Buchanan and Tullock, 1962; Weingast et al., 1981; McCormick and Tollison, 1981; Persson and Tabellini, 2002; Primo and Snyder, 2008). Specifically, in an effort to test theories of distributive politics, the majority of the empirical literature has focused on estimating the effect of the number of representatives on the size of government. However, the results from this literature are equivocal, with some studies finding a positive effect of the number of representatives on government expenditures (Gilligan and Matsusaka, 2001; Baqir, 2002; Bradbury and Crain, 2001; Bradbury and Stephenson, 2003; Egger and Koethenbuerger, 2010), some finding a negative effect (Pettersson-Lidbom, 2012; Garmann, 2015), and others finding no effect (Baskaran, 2013).

Pettersson-Lidbom (2012) and Garmann (2015), for example, find evidence suggesting that an increase in the number of representatives reduces government expenditures by increasing the oversight of the executive. Their results are based on local governments in Finland and the German

State of Hesse where the number of representatives is allocated as a step-function of population. Using a Regression Discontinuity (RD) design, both authors found that an increase in the number of representatives reduces public expenditures in those categories where the executive (e.g., manager or mayor) has more discretion.

Their results might have implications for improving the accountability of public officials in local governments, as they suggest that an increase in the number or diversity of representatives in local councils may strengthen the division of power between the executive and the council. This paper further tests this hypothesis by estimating the causal effect of an increase in the number of representatives on public expenditures, fiscal efforts, the probability that the executive faces prosecution, and the quality of public services at local governments.

I use data from municipalities in Colombia, which are administered by a council of representatives and a mayor, because local governments in developing countries are often considered as dysfunctional due to corruption or to low levels of human capital. Moreover, Colombian municipalities are an ideal subject for testing my hypothesis because (a) there is a strong division of power between the mayor and the council, and (b) the municipalities provide or assist in the provision of basic services such as potable water, elementary education, and health care. Additionally, these governments rely on intergovernmental grants from the central government which has been shown to be conducive of lower levels of accountability relative to circumstances when a high proportion of the revenue is generated from local taxes.

A central concern in estimating the causal effect of the number of representatives on government outcomes is the possibility of omitted variable bias. For instance, unmeasured voter preferences might affect political institutions (e.g., size of political bodies) as well as government policies and outcomes (e.g., government expenditures and type of services provided) (Acemoglu, 2005). Another concern is the possibility of reverse causality since a larger public sector may require a larger number of representatives due to an increase in the complexity of public finances (Pettersson-Lidbom, 2012).

This paper addresses both of these concerns in the following ways. First, the data come from a large panel of 985 Colombian sub-national governments (municipalities) over the period 1998-2014. Because for the most of Colombia's history municipalities had little independence from the central government, the political and administrative organization evolved in a similar manner across municipalities limiting the possibility of time-invariant institutional characteristics driving the results. Second, it exploits the fact that the number of representatives in Colombian municipalities is determined using a step-function of population and implements a Regression Discontinuity (RD) design to estimate the effect of the number of representatives using municipalities in the neighborhood of the population thresholds.[1]

My results indicate a negative effect of an increase in the number of representatives on government spending. Specifically, I find that municipalities to the right of a population threshold with two additional representatives have average total expenditures that are approximately eight percent lower than those of municipalities to the left of a population threshold. This result is consistent with the findings of Pettersson-Lidbom (2012) and Garmann (2015), and runs against the common-pool problem and pork-barrel spending hypotheses where an increase in the number of representatives leads to higher levels of spending (Weingast et al., 1981).

More importantly, I do not find evidence supporting the hypothesis that an increase in the number of representatives improves the oversight of the mayor by the council. While I find some evidence that municipalities to the right of the population thresholds spend less in categories of expenditures where the mayor has more discretion, these expenditures are too small a fraction of the budget to explain the reduction in overall expenditures. Additionally, I find no evidence that the increase in representatives affects the probability that the mayor faces disciplinary prosecution. However, this result is consistent with both a case where more representatives do not lead to greater oversight of the mayor and a long-run equilibrium where mayors adjust their behavior to greater oversight by the council.

I also find that the reduction in municipal expenditures is driven by a decrease in revenues from intergovernmental transfers and not by higher fiscal efforts or a reduction in the municipal debt. When examining the effect of an increase in the number of representatives on the different sources of intergovernmental grants, I find no evidence that the reduction in total revenues is driven by just one source. The fact that no single source of transfer accounts for the reduction in total revenues lends credibility to the RD design because it suggests that the effect is not due to confounded treatments. For example, if I observed that the reduction in total revenues was driven by a reduction in revenues from natural resource royalties or a reduction in central government transfers for operating expenditures, it would imply that not only council size but perhaps the policy determining the allocation of these resources was also changing at the population thresholds. Rather, the

[1] Other studies relying on the use of population thresholds to identify the effect of number of representatives include Egger and Koethenbuerger (2010), Pettersson-Lidbom (2012), Garmann (2015), and Cepaluni and Mignozzetti (2015).

results suggest that the mechanism driving the reduction in expenditures might be a decrease in the council's ability to capture funds from other government branches, for instance, if an increase in the number of representatives leads to higher coordination or decision-making costs.

To test if the reduction in expenditures affects the provision of public services, I estimate the effect of the increase in the number of representatives on measures of quality of water, student enrollment in elementary school and high school, and coverage of health care for the low-income population. In particular, there are no clear theoretical predictions for whether more representatives should improve the quality of public services. Weingast et al. (1981) hypothesize that an increase in the number of representatives would lead to projects of a larger than optimal scale. This could worsen the provision of public services for the general population if funds are diverted from non-distributive programs or services to programs targeting a particular constituency.[2] However, if an increase in the number of representatives strengthens the oversight on the executive (Pettersson-Lidbom, 2012), additional representatives could increase transparency and efficiency in the use of public funds.

My findings indicate that although municipalities with two additional representatives have expected lower total expenditures, they are no different in terms of the quality of public services. This result contrasts with recent findings by Cepaluni and Mignozzetti (2015), who found that an increase in the number of representatives in Brazilian municipalities has a positive effect on student test scores and a negative effect on infant mortality.[3]

Finally, I provide some evidence of the mechanism driving the results. Because Colombia uses a proportional representation electoral rule to elect council members, both the number of decision makers and the party composition of the council change with an increase in the number of representatives.[4] As suggested by Acharya et al. (2016), we can think of changes in the number of parties with representation or in the diversity of the council as intermediate outcomes that stem from a change in the number of elected representatives. Thus, the average treatment effect from an increase in the number of council members could be affected by intermediate variable bias if there are unobserved factors correlated with the party composition of the council and the outcome variables.

[2]Here I use the term non-distributive programs to refer to programs or services available to any citizen who might fall in a specific category, for instance, programs of health care or education for the low income population (Weingast et al., 1981).

[3]Cepaluni and Mignozzetti (2015) exploit the introduction of a population rule for the assignment of local representatives in Brazilian municipalities to implement a RDD and estimate the effect of number of representatives on health and education outcomes, and on government audits.

[4]As indicated by Cepaluni and Mignozzetti (2015), other factors like the diversity of the council or the quality of elected officials could also change if the increase in the number of representatives leads to greater electoral competition.

Using a two-step estimation procedure introduced by Acharya et al. (2016), I show that the results are robust when controlling for the number of parties on the council. This evidence confirms that factors other than party composition, like the number of decision makers, could be the mechanism driving the results.

Additionally, this paper also contributes to a larger literature looking at the performance of decentralization reforms in developing countries. Empirical studies conducted by Faguet (2012) and Loboguerrero (2008) looking at the effect of decentralization reforms in Bolivia and Colombia find heterogeneous effects from these reforms on the quality of public services. These authors suggest that the effectiveness of decentralization might be contingent on the quality of local governments. If an increase in the number of representatives leads to better oversight of the mayor by the council, we would expect the performance of decentralization reforms to vary with the number of representatives. However, I find no evidence that an increase in the number of representatives affects measures of quality of water, student enrollment, and health care coverage, all of which are administrative responsibilities assigned to Colombian municipalities as part of a large decentralization program after 1994. Thus, changes in the number of representatives do not seem to have an effect on the outcomes of the decentralization reforms implemented over the last twenty years in Colombia.

The paper is organized as follows; the next section provides detailed information about the organization of local governments in Colombia, the role of municipal councils, and the budget process. This is followed by a discussion of the data and relevant summary statistics. I then present a detailed analysis of the validity of the RD design, the estimated equation, and the results. Finally, I discuss the implications of my findings and avenues for future research.

1.2 Background Information on Colombia

Colombia has two tiers of subnational governments, with the first tier being comprised of *departamentos*, which are similar to US states. The second tier is comprised of municipalities, which are similar to US counties. There are a total of thirty-two *departamentos* subsequently divided into 1,126 municipalities (see Figure 1.1). Both *departamentos* and municipalities are administered by an executive and a deliberative assembly that mimic the roles of the president and legislature at the national level. At the municipal level, the executive is represented by a mayor and the deliberative assembly by a municipal council. Both the mayor and the council are elected every four years by popular vote.[5]

This paper exploits the fact that the size of the municipal councils is determined using a step-function of population to obtain an exogenous source of variation in the degree of representation in the municipalities. Table 1.1 reports the population thresholds as well as the number of council members associated with each threshold. I conduct my analysis restricting the sample to municipalities in the neighborhood of the first four population thresholds (with a population below sixty-five thousand) because most municipalities are concentrated at the bottom of the population distribution and because additional policy changes take place at other population thresholds.[6] I further elaborate on the identification strategy in Section 1.4.

The rest of this section discusses the role of Colombian municipalities in the provision of services and the role of municipal councils in the municipal governments. In comparison to other developing countries, Colombian municipalities enjoy a high level of political, fiscal, and administrative decentralization, all of which makes them a good subject for the analysis of the effect of the number of representatives.

1.2.1 Municipal government in Colombia

The development of municipal governments in Colombia has come as a result of a process of decentralization over the last thirty years.[7] In 1986 popular election of mayors and governors was introduced, and in the early 1990s the central government began to transfer the provision of services like education, health and potable water to municipalities and *departamentos*. The transfer of these responsibilities came with a system of intergovernmental grants to assist subnational governments in the provision of these services. Specifically, from 1993 to 2001 intergovernmental grants were primarily determined using poverty levels and population as criteria, creating minimal accountability among municipalities since transfers were not linked to performance. The system of grants was reformed in 2001 so that transfers would be linked to municipal performance in each particular sector (Clavijo, 2011; Sánchez and Pachón, 2013).

Under the current system, the role played by municipalities in the provision of services depends on administrative resources and past performance. Provided that municipalities meet certain

[5] Councils and mayors used to be elected for two-year periods prior to 1994 and for three-year periods between 1994 and 2003.

[6] As a robustness test I replicate the analysis restricting the sample to municipalities with a population below thirty thousand. The results are unchanged.

[7] Political decentralization preceded administrative decentralization (Falleti, 2005).

criteria, a central government agency extends a certification authorizing the municipality to independently provide a given service. Currently, municipalities can obtain certifications in the areas of education, health, and water and basic sanitation. In uncertified municipalities the *departamento* provides the service.

Table 1.2 describes the main differences in the responsibilities between certified and uncertified municipalities regarding the provision of education, health, and water. It also reports the share of municipalities, out of those with a population below sixty-five thousand, that are certified as of 2016. The stark difference in the number of municipalities certified in education and health versus those certified in potable water stems from the way in which certification is granted. Starting in 2007 all municipalities were automatically certified in the provision of potable water, and only non-compliant municipalities have been de-certified.[8] Certification in education and health has moved in the opposite direction, slowly granting certification as municipalities meet specific criteria.[9]

Thus, most municipalities in my sample are responsible for the provision of potable water, garbage collection and sewerage services, the administration of funds for subsidized health care, public health brigades and investment in projects related to the quality of education. Additionally, municipalities also provide other services like roads and fire protection (see Table 1.3).

1.2.2 The role of municipal councils

Municipal councils are responsible for overseeing the mayor. In particular, the law does not grant them any legislative powers, and most of their activities are related to approving the actions of the mayor. For instance, the mayor needs the approval of the council to establish contracts, change personnel, and pass the budget. Additionally, the council authorizes increases in the salary of the mayor and sets the rate for the property and the industry & commerce taxes. These taxes, along with the gasoline surcharge, represent approximately 90% of the tax revenues collected by local governments (Sánchez et al., 2012).

In addition to these responsibilities municipal councils have other attributes that, if exerted, would allow them to increase their oversight of the mayor. For instance, the council can ask the administration to provide periodic reports on the performance of municipal programs and projects.

[8] The certification for the provision of potable water did not exist prior to 2007. However, municipalities were the *de facto* providers.

[9] The processes for certification for the provision of education and health were formalized in 2001 and 2007, respectively. Before these reforms, *departamentos* were the *de facto* providers of these services.

The electoral process

Council members are elected *at-large* in single-district elections with a proportional representation system and, therefore, do not represent a geographic constituency within the municipality. This differs from traditional models studying the effect of size of legislatures which assume that geography is the basis for political organization and representation (Weingast et al., 1981; Primo and Snyder, 2008). The electoral system of Colombia also allows for council members, but not mayors, to run for reelection for two consecutive periods. Moreover, council members are elected from open-party lists, meaning that voters are able to allocate votes to specific candidates within a given party. These features of the Colombian electoral system increase the accountability of council members and are conducive for the formation of constituencies.

1.3 Data and Summary Statistics

The dataset is an unbalanced panel from 1998 to 2014.[10] Over this period there were an average of 1,087 municipalities in Colombia.[11] However, when restricting the sample to municipalities with a population below sixty-five thousand—those around the five, ten, twenty, and fifty thousand person thresholds as reported in Table 1.1—the sample includes 985 municipalities. Detailed information on the sources of the principal variables is reported in Table 1.4 and summary statistics for these variables are reported in Table 1.5.

As Table 1.5 shows, most municipal revenues come from intergovernmental transfers, and most expenditures are devoted to investment activities primarily involving the provision of public services (e.g., water and basic sanitation, investment in learning centers, subsidized healthcare, maintenance of roads, and public health brigades). Also, approximately fifty-four percent of municipality-year observations in the sample run an annual deficit. To finance a deficit, municipalities can borrow from financial institutions in the public sector or use resources available from past administrations.

The bottom of Table 1.5 reports summary statistics for the variables used to proxy for the quality of public services in each municipality. These variables include (a) an index of water quality,

[10] During this period there were five municipal elections during the years 1997, 2000, 2003, 2007 and 2011. Prior to 2003, mayors and council members served three-year terms.

[11] Between 1998 and 2014, thirty new municipalities were created as a result of divisions of existing municipalities. Thus, the fraction of municipalities experiencing fragmentation is too low to represent a concern.

(b) the share of low-income population with access to health-care,[12] and (c) enrollment in elementary education and high school. The water quality index ranges from one to one hundred, lower values indicating higher quality, and is available for the period 2007-2014. Enrollment rates are available for the period 2005-2012.[13]

The last variable in Table 1.5 is an indicator for whether the mayor of a municipality faces disciplinary prosecution by the *Procuraduría General de la Nación* (PGN), a central government watchdog agency that oversees the compliance of public officials with a general disciplinary code. I use this variable as a proxy for the amount of oversight exerted by the council on the mayor since investigations by the PGN can be triggered by tip-offs and audit results, among other reasons. Information on mayor prosecution is available for each administration for the period 2001-2015.[14]

Number of representatives and municipal outcomes

Table 1.6 reports mean values of the outcome variables for councils of different sizes. The top panel illustrates the problem with computing simple OLS parameter estimates of the effect of the number of representatives on municipal outcomes. Because the number of representatives increases with population, mean values for councils of different sizes reflect also differences in the sizes of the municipalities. Thus, more representatives are associated with higher levels of expenditures, tax revenues, and debt. In terms of public services, larger municipalities have on average lower levels of infant mortality, better quality of water, and lower levels of health-care coverage for the low-income population. Finally, more representatives are associated with a more diverse council, with more parties obtaining representation and a lower probability that the mayor or council members belong to the two traditional parties.

1.4 Validity of RD Design and Estimated Equation

1.4.1 Validity of the RD Design

There is increasing research using population thresholds to study the effect of institutional features (for a recent review of the literature see Eggers et al., 2015). This surge in the use of

[12]The low-income population is defined by Colombia's health ministry using Colombia's proxy-mean-tested system SISBEN.

[13]Enrollment is defined as the share of students enrolled out of the target population. The target population includes children ages 6-10 for elementary school and ages 11-14 for high school.

[14]The data were collected and kindly provided by Luis Martínez. See Martınez (2016) for a detailed description of the data and how they were collected.

population-threshold Regression Discontinuity (RD) designs is due to complications in applying traditional methods to the study of institutions. Specifically, institutional features are often time-invariant, making it difficult to apply panel methods or to identify one or more valid instruments (Acemoglu, 2005). Population thresholds provide, then, an appealing alternative since under specific circumstances they are a quasi-natural experiment for the variable of interest.

However, as pointed out by Eggers et al. (2015), population-threshold RDDs are susceptible to confounded treatments because population thresholds are often used to allocate more than one policy treatment. For instance, Eggers et al. (2015) found that population thresholds used at sub-national governments in Germany, France, and Italy allocate up to twenty, nine, and five different policies, respectively. Thus, a traditional RDD would simply estimate the combined effect of the policies changing at the threshold. Additionally, the existence of multiple treatments exacerbates the problem of strategic sorting. That is, if the salaries of public officials or the transfers that local governments receive from the central government change at the population thresholds, public officials will find it in their best interest to manipulate the population estimates in order to receive or avoid treatment, provided certain proximity to the threshold.[15] These concerns with confounded treatments and strategic sorting are not a problem in the sample of Colombian municipalities as the evidence below will explain.

Confounded treatments

Detecting whether a treatment is confounded with another is a matter of searching legal documents for mentions of population thresholds (Eggers et al., 2015). In particular, council size in Colombian municipalities could be confounded with transfers from the central government and the *departamentos*, limits in the salary of the mayor and honoraria paid to council members, electoral rules, restrictions in the use of funds, access to credit, and the responsibilities of the municipal governments. I have thoroughly reviewed the laws regulating the operation of municipal governments in all of these dimensions and did not find other treatments allocated using the population thresholds at five, ten, twenty, and fifty thousand people (see Table 1.1).[16] I refer the interested reader to Appendix A for a thorough discussion of the operation of local governments in Colombia.

Sorting

When examining sorting around the population thresholds, it is important to remember that

[15]As pointed out by Eggers et al. (2015), this could be done by fraud, selective precision, or selective recruitment.

[16]Since 2001 municipalities with a population of more than one hundred thousand people automatically obtained certification for the provision of education (Brutti, 2015).

for the RD design to be valid, municipalities must be unable to precisely manipulate the population estimates used to allocate council size (Lee and Lemieux, 2010). Thus, I begin by examining the process for generating the population estimates in Colombia.

In Colombia, population estimates are built on the National Census, which is conducted by a central government agency, the *Departamento Administrativo Nacional de Estadistica* (DANE), approximately every ten years. For the period of my sample, the population projections were constructed using information from the 1985, 1993 and 2005 censuses. In particular, after each census, the DANE updates and builds population estimates for the next ten or twenty years. These estimates are updated until the next census and, therefore, are not affected by annual statistics for births and deaths.[17]

However, the DANE does not determine the number of council members to be elected as this is done by another central government agency, the *Registraduria Nacional del Estado Civil*. The DANE reports the population estimates to the *Registraduria*, which then issues the number of council seats to be contested in each municipality according to the population thresholds in Table 1.1. Then, each electoral year, the *Registraduria* issues official letters stating the population estimates that it received from the DANE and the number of council seats corresponding with those figures for each municipality. Copies of these letters were obtained for the elections of 1997, 2000, 2003, 2007, and 2011, with their population figures serving as the running variable in the RD design.[18]

The fact that municipal populations are estimated by a centralized agency should reduce the probability of sorting (Eggers et al., 2015). To formally test for sorting in the data, I follow Lee and Lemieux (2010) and test for discontinuities in the aggregate distribution of the assignment variable. The rationale is simple: if municipalities have imprecise control over population figures, we should not observe discontinuities in the assignment variable around the cutoff. I begin by looking at histograms of the assignment variable. Figure 1.3 reports frequency histograms for the population figures obtained from the *Registraduria* for each of the population thresholds at five, ten, and twenty thousand people.[19] The histograms show the distribution of the distance (in terms of population) between each municipality and the threshold for municipalities in a ten percent window around each

[17]This was the case for censuses prior to 2005. The population projections from the 2005 census were built adjusting for births, deaths and migration. However, because annual data on these variables are limited at the local level, national estimates of fertility rate and life expectancy were use instead.

[18]The population estimates used to assign council seats in 2011 were the same as those used in 2007. This was the result of a disagreement between the *Registraduria* and the DANE. The running variable is the variable allocating treatment.

[19]The results for the fifty thousand people threshold are very similar to those for the twenty thousand people and therefore are omitted for the sake of brevity. The results are available upon request.

cutoff. While the histograms for the five and twenty thousand person thresholds show no evidence of discontinuities, the histogram for the ten thousand person threshold suggests some clustering to the right of the cutoff.

A formal test for discontinuities in the assignment variable is proposed by McCrary (2008). The test involves two steps. First, histograms of the distance from each observation to the threshold are obtained separately for observations to the left and right of the cutoff. Second, a local linear regression is estimated on each side using the midpoints of each bin as the explanatory variable and the frequency of each bin as the dependent variable. The parameter of interest is then the log difference in the predicted densities to the left and right of the cutoff. Eggers et al. (2015) corrects the McCrary test to account for the fact that the running variable is discrete.[20]

The results of the McCrary test are reported in the left panels of Table 1.7 and Figure 1.4. Consistent with the histograms, there is no evidence of a discontinuity in the running variable around the ten thousand person threshold. However, a careful examination of the data reveals that this discontinuity is not the product of selective sorting by the municipalities but a result of the process used to generate the population figures. Specifically, the population estimates used during the 1997, 2000, and 2003 elections were based on projections built from the 1993 census. These projections were made using the population growth observed during the last two censuses as proxies for the growth municipalities would experience in the future.

The right hand panels of Table 1.7 and Figure 1.4 report results of the McCrary test using the population estimates for the year from which the 1993 Census projections were built. As seen in Figure 1.4, there is a slight discontinuity around the ten thousand person threshold. Subsequent tests for the population estimates for each year of the population projections reveal that the discontinuity increases over time. To address the possibility that these changes are driven by the rate of growth used in building the population projections, I test for differences in the rate of population growth between municipalities to the right and the left of the threshold.

Figure 1.5 reports sample means of the growth in the population estimates for municipalities to the left and the right of the ten thousand person threshold. Specifically, panel (a) reports the growth in the running variable from the estimates used in the 1997 election to those used during the election in year 2000. Similarly, panels (b) and (c) examine the growth between the 2000 and 2003 elections, and the 2003 and 2007 elections. The plots show that the growth rate did not change

[20] I am thankful to Andy Eggers for sharing his code.

discontinuously around the threshold. These results provide evidence that the discontinuity in the assignment variable around the ten thousand person threshold is not the result of sorting by the municipalities or manipulation of population estimates by the government agencies. Rather, the discontinuity is the result of both, the population estimates from the 1993 census and the growth rate in population between the 1985 and 1993 census.

Specifically, there is no reason to believe that the population estimates of the 1993 census were subjected to sorting by the municipalities since municipal governments had nothing to gain from having more than ten thousand people and did not participate in the collection of the data. On the other hand, while it is possible that differences in the growth rate in population estimates between the 1985 and 1993 censuses reflect systematic differences between municipalities, there is no evidence that the population estimates of municipalities to the left and right of the ten thousand person threshold were growing at different rates.

Inspecting baseline covariates

An additional test of the validity of the RD design inspects for discontinuities of the baseline covariates at the thresholds by (a) analyzing RD plots for each of the covariates, and (b) replacing each of the covariates as the dependent variable in the main specification (introduced below) and computing the parameter estimates of the RD coefficient for each. Figure 1.6 and Table 1.8 report the RD plots and the RD parameter estimates, respectively.

The RD plots in Figure 1.6 pool observations from a fifteen percent window around the five, ten, twenty, and fifty thousand person thresholds. It is important to partial out the threshold fixed effects to make the observations comparable. The graphs report local means for a series of non-overlapping bins over the support of the running variable. These bins were computed using the quantile spacing (QS) scheme developed by Calonico et al. (2015). Overall, the local means do not suggest discontinuities in the local covariates at the threshold. There is some evidence of a jump in the local mean for the area of the municipalities, but the standard errors are large.

Table 1.8 reports the parameter estimates of the RD coefficient in Equation 1.1 (see below) on each of the baseline covariates. Overall, there is no evidence of a discontinuity at the threshold on all but one of the covariates. Specifically, there is a positive and statistically significant estimate of the RD coefficient on the area of the municipalities. However, this coefficient is not robust to (a) the inclusion of *departamento* fixed effects, suggesting that some *departamentos* with large municipalities could be driving the result, and (b) reducing the sample to the last three (out of five) administrations observed in the sample, supporting the idea that observed differences in area might be driven by results from the 1993 Census for a few *departamentos*.

1.4.2 Estimated equation

The main identification strategy is based on a sharp Regression Discontinuity (RD) design and exploits the fact that council size in Colombian municipalities is solely determined using a step-function of population (see Table 1.1). Because the analysis exploits multiple thresholds and because the assignment variable is discrete and reported in coarse intervals, I adopt the following parametric specification

$$y_{it} = \delta right_{it} + \sum_{d=1}^{3} \alpha_d D_{dit} + \sum_{d=1}^{3} \gamma_d f_d(pop_{it}) D_{dit} + \sum_{d=1}^{3} \rho_d f_d(pop_{it}) D_{dit} right_{it} + \mathbf{X_{it}} \boldsymbol{\theta} + \lambda_{dt} + u_{it} \tag{1.1}$$

define y_{it} as the outcome of interest for municipality i in year t. The indicator variables D_{dit} take a value of 1 if the threshold d is the nearest threshold to municipality i in year t; $right_{it}$ is an indicator variable for whether a municipality lies to the right of its nearest threshold, and $f_d(pop_{it})$ is a polynomial in population distance from municipality i to its nearest threshold—where pop_{it} is the natural log difference between the population of municipality i and the population at the threshold. In my preferred specification I consider four thresholds d at five, ten, twenty, and fifty thousand people. To avoid double counting municipalities in a given year, I consider only observations within a given window around each threshold. For instance, using a twenty-five percent window, the five thousand person threshold is the nearest threshold to municipalities with a population greater than 3,250 (5000*0.75) but lower than 6,250 (5000*1.25) people.

The parameter δ in Equation 1.1 estimates the local average treatment effect of having two additional representatives for municipalities to the right relative to those on the left of a population threshold. Because the parametric functional form uses observations away from the discontinuity, identification of Equation 1.1 requires additional assumptions about the conditional expected functions $E[u_{it}|pop_{it}]$ and $E[\delta_i|pop_{it}]$ than those described in Hahn et al. (2001). Specifically, it requires these conditional expected functions to be continuous and differentiable over their entire domains and not just at the discontinuity (Chen and Van der Klaauw, 2008).

The estimation follows Lee and Lemieux (2010) and evaluates the validity of the aforementioned assumptions by testing (a) whether optimizing agents have imprecise control over the assignment variable and (b) whether the observed baseline covariates do not change discontinuously at the thresholds. Section 1.4.1 provided evidence that municipalities do not have control over the population figures.

Additionally, while municipality fixed effects could be included in Equation 1.1, these are unnecessary for identification and might increase the variance of the RD estimator if there is little within-unit variation (Lee and Lemieux, 2010). Since the number of municipalities undergoing a change in council size is small in my sample (except for the elections of 2007), Equation 1.1 treats the data as a pooled-cross-section. However, because municipalities and *departamentos* operate together in the provision of several services, *departamento*-year fixed effects are included in Equation 1.1 (λ_{dt}) to difference out time and *departamento* specific shocks to the outcome variable. Municipality characteristics ($\mathbf{X_{it}}$) are included as controls to reduce the sampling variation in the estimates (Lee and Lemieux, 2010).

To account for the within-individual correlation of the errors over time, standard errors are clustered by municipality (Lee and Lemieux, 2010; Bertrand et al., 2004). However, because of the discrete nature of the running variable, standard errors were also clustered by the running variable (Lee and Card, 2008) and by municipality and the running variable (Cameron et al., 2012). These results are available upon request.

1.5 Results

1.5.1 Effect of council size on government spending, fiscal effort, and debt

Equation 1.1 is used to estimate the effect of the number of representatives on government expenditures and to test for their effect on the regulatory activity of municipal councils using one of the few regulatory powers available to councils, the determination of the property tax rate. Equation 1.1 is also used to test for the effect of the number of representatives on fiscal effort and fiscal sustainability using total tax revenues to proxy for fiscal effort and total debt and the occurrence of annual deficits as measures of fiscal sustainability. Parameter estimates are reported in Table 1.9.

The first column of Table 1.9 indicates the dependent variable used in each regression and the subsequent columns report parameter estimates when restricting the sample to observations within a window around the population thresholds. The rationale for narrowing the sample to observations close to the threshold is to relax the requirements imposed on the function $f_d(pop_i)$ (Angrist and Pischke, 2008). All dependent variables are expressed in natural log with the exception of the indicator variable for deficits and the property tax rate. All regressions include controls for geographic and demographic characteristics, the presence of armed conflict, poverty levels prior to the implementation of intergovernmental transfers, an indicator variable for irregular elections, and *departamento*-year fixed effects.[21]

The main result from Table 1.9 is a negative, statistically significant, and economically meaningful effect of council size on municipal expenditures. Municipalities located immediately to the right of the population thresholds have municipal expenditures between five to ten percent lower than their counterparts immediately to the left of the threshold, the only difference being that municipalities to the right have two additional representatives than those to the left of the thresholds. The estimate is robust to restricting the sample to observations on different windows around the cutoff and seems to be driven by a reduction in municipal revenues. Regarding the legislative activity of the council, there is no evidence that the number of representatives has an effect on the effective property tax rate.[22] Similarly, no evidence is found of an effect of the number of representatives on government debt or the probability that the municipality runs a deficit.

What drives the reduction in expenditures?

The negative effect of number of representatives on municipal expenditures is relatively new to the literature and calls for careful examination. In particular, Pettersson-Lidbom (2012) and Garmann (2015) also identify a negative effect of council size on government spending when studying municipalities in Finland and Germany. They find that the drop in municipal expenditures is driven by a reduction in the categories of expenditures where the mayor has more discretion, interpreting the results as evidence that an increase in the number of representatives increases the oversight of the council on the mayor.[23] However, they do not discuss if the reduction in expenditures translates

[21]Ceballos (2005) documents that during the elections of 2003, armed groups in certain municipalities intimidated the citizenry and the candidates running as to lower electoral participation. This was a response to the measures undertaken by president Alvaro Uribe against guerrilla groups.

[22]Following Iregui et al. (2004) I define the effective property tax rate as the ratio between property tax revenues and the recorded value of all properties in the municipality. The information on municipal property values comes from the Geographic Institute Agustin Codazzi, which is the entity responsible for updating the property values in most municipalities in Colombia. I am thankful to Luis Martínez and Fabio Sánchez for sharing these data with me.

[23]There are, however, some discrepancies in the results. The municipalities in Finland examined by Pettersson-Lidbom (2012) have a manager-council system where the manager is appointed by the council. Garmann (2015), on the other hand, is able to study the effect of representatives under both a manager-council and mayor-council system

in lower tax rates or lower debt.

Table 1.10 reports parameter estimates of the RD coefficient on categories of expenditures and sources of revenues. I first examine the effect of the number of representatives on personnel expenditures at the city hall since the mayor has some discretion on hiring decisions and the wages paid to the personnel. Consistent with Pettersson-Lidbom (2012) and Garmann (2015), there is a negative effect of council size on personnel expenditures, supporting the hypothesis that a larger council might exert more oversight on the mayor. However, the effect is too small to alone drive the reduction in overall expenditures reported in the first row of Table 1.9 (personnel expenditures amount to seven percent of overall expenses in the average municipality).[24]

When examining the reduction in expenditures by categories of expenses, mainly operation vs. capital, most of the reduction is driven by a decrease in investment-related expenditures which include all expenses related with the provision of municipal services (e.g., education, health, water). Unfortunately, there is no good data on the break-down of municipal expenditures that would allow me to pinpoint the categories affected the most.

Moreover, from Table 1.9 it is clear that the reduction in expenses is a result of a decrease in municipal revenues and not of municipalities running fewer deficits or paying-off debt. The estimates in Table 1.9 also indicate that the reduction in revenues is not driven by lower fiscal efforts. Thus, I examine the effect of the number of representatives on the different categories of intergovernmental grants that municipalities receive from the central government. The last four rows of Table 1.10 report parameter estimates of the RD coefficient on total central government transfers for operating and investment expenditures, royalties from the extraction of natural resources, and total transfers received from the *Sistema General de Participaciones* (SGP), which is the main source of intergovernmental grants and includes transfers for the provision of education, health, water and basic sanitation among other services.

Overall, there is no evidence of a single source of intergovernmental transfers driving the reduction in revenues. I interpret the lack of a statistically significant effect of the number of representatives on fiscal efforts and intergovernmental grants as evidence that the decrease in revenues is driven by a decrease in the ability of the council to capture funds from the central government.

since municipalities in the German State of Hesse gradually transitioned from one system into the other over the period in his sample. Contrary to Pettersson-Lidbom (2012), Garmann (2015) only finds an effect of the number of representatives in municipalities with a mayor-council system.

[24]The information on personnel expenditures is available only for the period 2002-2010. Also, the parameter estimates are only significant when using a first order polynomial for $f_d(pop_{it})$.

The fact that no single source drives the reduction of revenues lends credibility to the hypothesis that the effect is not driven by a confounded treatment.

1.5.2 Effect of council size on the provision of public services and mayor accountability

As described in Section 1.2.1 and reported in Table 1.2, most municipalities in the sample are responsible for the provision of water and basic sanitation, and the administration of subsidized health-care for low-income people. Thus, I use the water quality index and the share of low-income population with access to health-care in each municipality as my preferred measures of the quality of public services. Parameter estimates for the effect of the number of representatives on these variables are reported in the first and second rows of Table 1.11. There is no evidence that an increase in the number of representatives has an effect on water quality or the share of poor population with access to health-care.

Additionally, rows three and four of Table 1.11 report parameter estimates of the effect of the number of representatives on the enrollment in elementary school and high school. Because municipal governments fund investment projects to improve school infrastructure, it is plausible that improvements in these services would be reflected in higher enrollment rates. However, there is no evidence that this is the case.

A final test is conducted for the hypothesis that an increase in the number of representatives causes an increase in oversight of the mayor by the council. The last row in Table 1.11 reports parameter estimates for the effect of the number of representatives on the probability that the mayor faces a disciplinary prosecution by the PGN. The estimate is negative and robust across window sizes, but is never statistically significant. This result is consistent with a world where the number of representatives has no effect on mayor oversight and with a long-run equilibrium where mayors adjust their behavior to higher oversight from an increase in the number of representatives.

1.5.3 The potential reasons why the number of representatives affects governance

The economics and political science literature presents different hypotheses for why the number of representatives would have an effect on government performance. One possibility is that the number of representatives in the political body itself has an effect on governance. For instance, an increase in the number of representatives could increase decision-making costs (Buchanan and Tullock, 1962) or facilitate oversight of the mayor (Pettersson-Lidbom, 2012). Alternatively, it could be that a change in the number of representatives affects the number of constituencies that have political representation (Weingast et al., 1981). If there is a common pool of resources, an increase in the number of constituencies could increase government expenditures depending on the voting rule of the political body and the procedures for drafting and approving the budget as well as the government's ability to issue debt. Additionally, an increase in the size of political bodies could affect the diversity and quality of elected officials by increasing political competition (see Cepaluni and Mignozzetti, 2015).

In Colombia, where representatives are not elected from geographic constituencies but in single-district elections, the effect of the number of representatives could operate through changes in the number of parties or political factions that have representation on the council. For instance, because Colombia uses a proportional-representation electoral system, an increase in the size of the council is likely to increase the number of small parties that gain representation (Reilly et al., 2005). I test for this possibility using the following measures of political composition: (a) the number of parties with at least one seat on the council, (b) a Herfindahl-Hirschman index (HHI) calculated with the share of council seats held by different parties, (c) the share of seats occupied by Colombia's two traditional parties, and (d) the share of council seats occupied by the party of the mayor. The last variable is meant to capture the support enjoyed by the mayor on the council. Thus, an increase in the number of representatives could increase (decrease) the support for the mayor on the council, making it easier (harder) for the mayor to implement her desired policies.[25]

The top panel in Table 1.12 reports parameter estimates of the RD coefficient of Equation 1.1 on the different measures of council composition. I find that, on average, municipalities in the right hand side of the population thresholds have between 0.2 to 0.4 more parties represented on the council than municipalities immediately to the left of the population threshold. That is, at least one of five municipalities would gain an extra party when crossing the threshold.

Because the number of parties on the council is a posttreatment variable realized after the

[25] *A priori* it is not clear whether an increase in council size would increase or decrease the support for the mayor. For instance, if an increase in council size leads to smaller parties gaining representation and these parties establish a coalition with the party of the mayor, then an increase in the number of parties could strengthen the support for the mayor on the council (see Cepaluni and Mignozzetti, 2015). Unfortunately, I lack information on the coalitions of political parties in Colombia. Instead, although imperfect, I use the share of seats occupied by the mayor's party.

number of representatives to be elected is determined, the effect on municipal expenditures reported in Table 1.9 could be driven by either a change in the number of representatives or parties on the council. As documented by Acharya et al. (2016), this is a common challenge in the empirical literature where we are interested in whether the causal effect of a treatment remains after controlling for factors that are realized after the treatment and which could have an effect on the outcome of interest. In particular, simply adding number of parties as a control in Equation 1.1 could lead to biased parameter estimates if the posttreatment is endogenous and related to the outcome in non-causal ways (Acharya et al., 2016). To account for this, the sequential g-esimator introduced by Acharya et al. (2016) is implemented. The estimator yields the Controlled Direct Effect (CDE) of the treatment which in my sample corresponds to the causal effect of a change in the number of representatives when fixing the number of parties on the council to a particular level.

CDE of a change in the number of representatives

The sequential g-estimator is a two-stage procedure. In the first stage, the outcome variable is regressed on the treatment, the mediator or posttreatment variable of interest, pretreatment controls, and other posttreatment controls. The second stage uses the parameter estimate for the mediator from the first stage to demediate the outcome and regresses the demediated outcome on the treatment and pretreatment controls. Thus, the first stage estimates Equation 1.1 with the number of parties in the council as an additional control. In the second stage, the outcome variable is demediated using the parameter estimate for the number of parties and is used as the new dependent variable in Equation 1.1.[26]

Table 1.13 reports the parameter estimates of the RD coefficient for the second stage regressions of the main outcomes of interest. Overall, conditioning on the number of parties in the council does not affect the results, suggesting that a mechanism other that changes on the number of parties in the council is at work. Given that the reduction in revenues is not driven by a particular source and anecdotal evidence documenting that larger councils seem to elicit more disagreement among council members and between council members and the mayor, the evidence presented here suggests that an increase in coordination and decision-making costs could be a mechanism driving the results.

[26] I define all geographic variables as pretreatment controls, and measures of population composition and violence as posttreatment controls.

1.6 Discussion and Concluding Remarks

This paper uses a Regression Discontinuity design to estimate the causal effect of the number of elected representatives on different dimensions of governance for a panel of Colombian municipalities over the period 1998-2014. The results indicate that an increase in the number of representatives (a) causes an average reduction in total expenditures of approximately eight percent for municipalities near the population thresholds; (b) has no effect on municipal measures of quality of water, access to health care by the low-income population, and student enrollment; and (c) has no effect on the probability that mayors face disciplinary prosecution by a central government agency.

The lack of evidence of an effect of the number of representatives on the observed measures of quality of public services suggests that municipalities might cut expenditures in areas of spending that do not directly affect the quality of these services (e.g., expenditures on administrative personnel) or on categories of expenditures unobserved in the sample (e.g., quality of roads, maintenance of public buildings, execution of social programs). While the data do not allow for distinguishing between these two possibilities, there is some evidence that municipalities with additional representatives cut expenditures on personnel in the city hall.

Moreover, decreases in municipal expenditures are driven by reductions in the amount of intergovernmental transfers received by municipal governments. However, no single source of transfers seems to independently account for the reduction in revenues, suggesting that municipalities are obtaining fewer transfers but not in a systematic way. This result is consistent with Buchanan and Tullock's 1962 hypothesis that an increase in the number of representatives increases the decision-making and coordination costs of the council.

Thus, for the literature focusing on the effects of legislature size, number of representatives, or the "law of 1/n", this paper implies that the effect of additional representation seems to be context-dependent, as suggested by other empirical studies (e.g., Pettersson-Lidbom, 2012; Garmann, 2015; Baskaran, 2013). This indication means that a fuller understanding of the interaction between electoral rules, voting rules in political bodies, and the degree of representation might enhance our ability to estimate the effect of the number of representatives on governance.

Also, given the recent wave of decentralization reforms among developing countries (Faguet, 2014, 2012; Falleti, 2005; Bardhan, 2002) and concerns about the ability of local governments to participate in the provision of public services without resources being captured by local elites (Bardhan, 2002), the results offer the following insights. First, the division of power between the mayor and a municipal council seems to be effective to some degree, in the sense that municipal councils play a role in the number of resources available to municipalities. Second, tax revenues seem to be unresponsive to changes in the number of representatives, a result that is consistent with previous findings (Sánchez and Pachón, 2013) that tax collection efforts are unresponsive to changes in the local political landscape. This finding is the more interesting for Colombia since municipal governments have some freedom in setting the rates for the main local taxes. Thus, we need a better understanding of the institutional factors that are conducive for fiscal efforts at the local level.[27] Third, the number of representatives might affect the ability of local governments to obtain resources from the central government. This outcome could be advantageous if the additional resources obtained by smaller governments are captured by the local elites.

[27]Several countries are trying to increase the fiscal independence of local governments to reduce pressure on the national budget. At the same time, empirical evidence suggests a higher return from public funds collected by local governments relative to those received as transfers from the central level (e.g., Martınez, 2016).

Table 1.1: Colombia's Population Thresholds.

Population Threshold	Council Seats	Share of Obs.	Share of National Population	No. obs in 1% window Left	Right
$\leq$ 5000	7	12.84	1.3	60	46
5001 - 10000	9	24.21	5.4	61	92
10001 - 20000	11	29.43	12.4	60	40
20001 - 50000	13	23.28	20.3	43	31
50001 - 100000	15	5.75	11.7	18	24
100001 - 250000	17	2.43	11.1	4	8
250000 - 1000000	19	1.78	21.6	0	0
$\geq$ 1000001	21	0.28	30.8		
Total				246	241

Note: Share of national population is computed as the average share of the national population in each category over the period 1997 - 2015.

Table 1.2: Role of Municipal Governments in the provision of education, health, and potable water

Area	Certified (%)	Role if Certified	Role if Uncertified
Education	2	(i) Administration of learning centers: hire and evaluate personnel, allocate personnel and funds across schools, etc. (ii) Investment in infrastructure of learning centers.	(i) Investment in infrastructure of learning centers.
Health	35.55	(i) Provision of health services (through regulated state companies) (ii) Identification of low income population for subsidized health care (iii) Management of funds for subsidized health care (iv) Investment on programs of public health.	(i) Identification of low income population for subsidized health care (ii) Management of funds for subsidized health care (iii) Investment on programs of public health.
Potable Water & Sanitation	85.92	Administration of intergovernmental grant for potable water and basic sanitation	Their *departamento* administers the intergovernmental grant for potable water and basic sanitation.

Note: Sample includes municipalities with a population below sixty-five thousand. The share corresponds to the average for the period 2014-2016 and was obtained from the National Department of Planning (DNP).

Table 1.3: Responsibilities in the control and provision of goods and services across levels of government

Type of Expenditure	Policy & Control	Provision
National Defense	C	C
International Relations	C	C
International Trade	C	C
Monetary and Financial Policy	C	C
Social Security	C	C, D, M
Railroads and Airports	C	C, M
Natural Resources	C	C, D, M
Environmental Protection	C, D, M	C, D, M
Education	C, D, M	C, D, M
Health	C, D, M	C, D, M
Social Help	C, D, M	C, D, M
Police	C, D, M	C, D, M
Water and Sewer	C, D, M	C, D, M
Fire protection	M	M
Parks and Recreation	C, D, M	C, D, M
National Roads	C	C
Departamento Roads	D	D
Inter-*Departamento* Roads	D	D
Municipal Roads	M	M

Note: C - Central Government, D - *Departamento* Governments, M - Municipal Governments
Source: Taken from Sánchez and Zenteno (2011)

Table 1.4: Data Sources

Variable	Source
Public Finances of Municipalities	*Departamento Nacional de Planeacion* (national department of planning), *Contraloria General* (office of the comptroller general), and CEDE database
Geographic information of municipalities	CEDE database
Property values	Geographic institute Agustin Codazzi
Electoral Data	*Registraduria Civil de Colombia* (Colombia civil registry office) and CEDE database
Water quality index	Superintendency of public services
School enrollment	*Ministerio de educacion de Colombia* (Colombia's department of education)
Subsidized health-care coverage for low income population	*Minsiterio de salud de Colombia* (Colombia's health department)
Migration due to armed conflict	*Unidad de victimas Colombia* (Colombia's office of victims)
Mayor prosecutions	Martınez (2016)

Note: Data on property values were kindly provided by Luis Martinez (Martınez, 2016) and Fabio Sanchez (Sánchez and Pachón, 2013). The database from the *Centro de Estudios de Desarrollo Economico* (CEDE) is available at http://datoscede.uniandes.edu.co.

Table 1.5: Summary statistics for main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Geographic & Demographic Variables					
Share of urban population	15787	39.26	21.43	1.7	98.3
Population (thousands)	15787	16.05	13.29	0.7	101.2
Lost population due to guerrilla (0, 1)	15787	0.60	0.49	0.0	1.0
Area (km^2)	985	729.81	2149.71	15.0	41653.0
Dist. to local capital (km)	985	80.59	54.83	0.0	376.1
Public finances					
Deficit (0, 1)	15787	0.54	0.50	0.0	1.0
Debt (0, 1)	15787	0.76	0.43	0.0	1.0
Debt (share of revenues)	13235	6.77	10.08	-3.6	269.0
Investment (share of expenses)	13235	81.86	8.78	0.0	100.0
Operating exp. (share non-earmarked rev.)	13228	66.98	27.65	0.0	953.0
Own Revenues (share revenues)	13235	21.57	22.32	0.0	100.0
Transfers (share revenues)	13235	72.65	17.73	3.7	100.0
Fiscal Index	13231	60.05	8.70	11.4	94.2
Total Revenues (millions 2008 COP)	15787	9057.71	9857.21	137.5	323336.8
Total Expenditures (millions 2008 COP)	15787	9413.20	17414.91	2.2	1762977.0
Political Variables					
HHI of parties in the council	15787	0.38	0.18	0.1	1.0
No. parties in the council	15787	4.00	1.58	1.0	10.0
Mayor from traditional parties (0, 1)	14626	0.50	0.50	0.0	1.0
Share of seats to traditional parties	15787	49.90	28.47	0.0	100.0
Share of seats to mayor's party	14626	38.51	24.91	0.0	100.0
No. of representatives	15787	10.55	2.15	7.0	15.0
Quality of public services					
Water quality index	7267	26.08	23.07	0.0	100.0
Poor with subsidized health-care	15787	89.90	28.57	0.0	313.0
Enrollment elementary	7695	86.32	13.58	8.3	100.0
Enrollment high school	7695	58.96	18.46	0.0	100.0
Infant Mortality Rate	8651	22.12	8.18	8.7	64.1
Mayor prosecuted (0, 1)	3811	0.15	0.36	0.0	1.0

Note: The sample includes all municipalities with a population below sixty-five thousand for the period 1998-2014. However, some variables are not available for all years in the sample. Specifically, infant mortality and enrollment rates are available from 2005 to 2012, the water quality index is available from 2007 to 2014, and information on mayor prosecutions are only available at the administration level for all administrations after the year 2000.

Table 1.6: Average values for main outcome variables by council size

Outcome	No. of Representatives				
	7	9	11	13	15
Public Finances					
Revenues*	3894.60	5428.08	8492.31	14640.07	28962.00
Expenditures*	3998.30	5609.56	8726.50	15386.23	29964.50
Tax Revenues*	302.71	544.40	1169.43	2398.33	8094.78
Debt*	128.90	300.11	498.11	1259.63	3111.80
Deficit (0, 1)	0.54	0.55	0.54	0.53	0.54
Transfers (share rev.)	77.56	74.97	72.98	68.39	60.21
Public Services					
Water quality index	25.97	28.23	27.62	23.25	13.02
Coverage health-care poor	112.03	96.75	84.83	78.94	75.62
Enrollment elementary	84.43	85.05	85.96	88.75	88.45
Enrollment high-school	62.62	59.08	56.41	58.76	66.67
Mayor prosecuted (0, 1)	0.10	0.15	0.16	0.18	0.27
Political Composition					
HHI	0.44	0.41	0.37	0.35	0.30
No. parties	3.13	3.51	4.08	4.67	5.77
Mayor from trad. party (0, 1)	0.52	0.53	0.47	0.49	0.43
Share seats trad. parties	52.19	53.35	47.77	48.30	46.84
Share seats mayor's party	43.42	41.29	37.19	35.82	28.72

Note: * indicates variables expressed in millions of 2008 Colombian pesos (COP). The sample includes all municipalities with a population below thirty thousand for the period 1998-2014. However, some variables are not available for all years in the sample.

Table 1.7: Summary of McCrary Test Results

	Running variable (1997-2007)			Population from 1993 Census		
Threshold	McCrary Test Statistic	Z-score/ P-value	N. Obs/ Window	McCrary Test Statistic	Z-score/ P-value	N. Obs/ Window
5,000	0.144	0.344	198	0.321	0.614	185
	(0.419)	0.419	500	(0.522)	0.539	2000
10,000	2.753**	2.558	165	0.604	0.716	193
	(1.077)	0.011	500	(0.844)	0.474	2000
20,000	-0.358	-0.563	123	-0.056	-0.096	168
	(0.636)	0.573	900	(0.582)	0.923	4000

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

Note: The left hand panel reports results for a pooled-dataset with the running variable for years 1997, 2000, 2003, and 2007. The right hand panel reports results of a McCrary test when using the population estimates from the year from which the 1993 Census projections were built.

Window size refers to the number of observations (+/-) included around the cutoff point. In particular, because the running variable is defined as distance from the threshold, the cutoff is centered at zero. Thus, a window size of 500 means that when conducting the test I only included municipalities with 500 people above or below the threshold.

Table 1.8: PARAMETER ESTIMATES OF THE RD COEFFICIENT FOR REGRESSIONS OF BASELINE COVARIATES

Dependent Variable	**Window Size**			
	25%	**20%**	**15%**	**10%**
ln(dist. local capital)	0.060	0.028	0.018	0.034
	(0.063)	(0.067)	(0.074)	(0.081)
	2,307	1,835	1,338	891
ln(dist. Bogota)	0.078	0.073	0.067	0.097
	(0.066)	(0.069)	(0.080)	(0.092)
	2,321	1,843	1,341	893
ln(altitude)	-0.189	-0.129	-0.026	-0.026
	(0.164)	(0.184)	(0.206)	(0.233)
	2,321	1,843	1,341	893
ln(area)	0.224**	0.221*	0.308**	0.333**
	(0.101)	(0.115)	(0.129)	(0.151)
	2,321	1,843	1,341	893
Poverty Index (1993)	-0.085	-1.836	-2.513	-0.841
	(1.833)	(2.006)	(2.239)	(2.598)
	2,320	1,842	1,340	892

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

Note: All regressions use a first order polynomial for the function $f(pop_{it})$; however, the results are robust to the use of a second order polynomial. Standard errors are clustered by municipality and reported in parentheses. The number of observations is reported beneath the standard errors. The data set includes municipalities with a population below sixty-five thousand people for the period 1998-2014.

Table 1.9: Parameter estimates of the RD coefficient for regressions of municipal governments' public finances

Dependent Variable	Window Size			
	25%	**20%**	**15%**	**10%**
ln(Total expenditures)	-0.048*	-0.081**	-0.083**	-0.107**
	(0.029)	(0.033)	(0.037)	(0.047)
	10,029	7,967	5,835	3,838
ln(Total revenues)	-0.041	-0.065*	-0.068*	-0.098**
	(0.029)	(0.034)	(0.038)	(0.047)
	10,029	7,967	5,835	3,838
ln(Tax revenues)	-0.035	-0.064	-0.103	-0.133
	(0.064)	(0.070)	(0.080)	(0.102)
	9,501	7,557	5,533	3,636
Property tax rate	0.001	-0.013	-0.028	-0.042
	(0.017)	(0.018)	(0.021)	(0.026)
	7,070	5,640	4,140	2,735
Deficit (0,1)	-0.028	-0.044*	-0.046	-0.004
	(0.022)	(0.025)	(0.029)	(0.038)
	10,380	8,270	6,078	3,989
ln(Accumulated debt)	0.123	0.729	0.619	1.249
	(0.613)	(0.688)	(0.772)	(1.009)
	9,129	7,275	5,375	3,523

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

Note: All regressions use a first order polynomial for the function $f(pop_{it})$; however, the results are robust to the use of a second order polynomial. Standard errors are clustered by municipality and reported in parentheses. The number of observations is reported beneath the standard errors. The data set includes municipalities with a population below sixty-five thousand people for the period 1998-2014.

Controls included: area and altitude of the municipality, distance to Bogota and distance to the capital of the *departamento*, indicator variables for whether the municipality lost or gained population due to armed conflict, share of urban population, share of population living in poverty as of 1993, indicator variable for administrations elected under irregularities, and *departamento*-year fixed effects.

Table 1.10: Parameter estimates of the RD coefficient for regressions of expenditure categories and sources of revenues

Dependent Variable	**Window Size**			
	25%	**20%**	**15%**	**10%**
Expenditure Categories				
Personnel Expenses City Hall	-0.050	-0.080*	-0.089*	-0.103*
	(0.036)	(0.041)	(0.045)	(0.056)
	5,470	4,356	3,182	2,101
Capital expenses	-0.060**	-0.089**	-0.081**	-0.096*
	(0.030)	(0.035)	(0.038)	(0.049)
	10,009	7,951	5,821	3,828
Revenue Sources				
CG transfers for operation	-0.002	-0.012	-0.028	0.009
	(0.024)	(0.027)	(0.036)	(0.044)
	9,112	7,240	5,285	3,486
Royalties	-0.025	0.031	-0.122	-0.182
	(0.172)	(0.193)	(0.230)	(0.312)
	4,694	3,747	2,751	1,797
CG transfers for investment	0.005	-0.005	-0.013	-0.016
	(0.016)	(0.019)	(0.021)	(0.025)
	9,260	7,349	5,369	3,537
SGP program transfers	-0.007	-0.018	-0.023	-0.009
	(0.014)	(0.016)	(0.017)	(0.022)
	7,314	5,816	4,267	2,808

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

Note: All dependent variables are expressed in natural log. All regressions use a first order polynomial for the function $f_d(pop_{it})$. Standard errors are clustered by municipality and reported in parentheses. The number of observations is reported beneath the standard errors. The data set includes municipalities with a population below sixty-five thousand people for the period 1998-2014.

Controls included: area and altitude of the municipality, distance to Bogota and distance to the capital of the *departamento*, indicator variables for whether the municipality lost or gained population due to armed conflict, share of urban population, share of population living in poverty as of 1993, indicator variable for administrations elected under irregularities, and *departamento*-year fixed effects.

Table 1.11: PARAMETER ESTIMATES OF THE RD COEFFICIENT FOR REGRESSIONS OF QUALITY OF SERVICES AND MAYOR PROSECUTIONS

Dependent Variable	**Window Size**			
	25%	**20%**	**15%**	**10%**
Water quality index	-0.011	-0.125	-0.151	0.010
	(0.099)	(0.114)	(0.144)	(0.186)
	4,602	3,686	2,736	1,765
Coverage health care	0.009	-0.002	0.007	0.019
	(0.016)	(0.018)	(0.022)	(0.028)
	10,389	8,276	6,083	3,993
Enrollment elmn. edu.	0.043**	0.037	0.034	0.057
	(0.020)	(0.023)	(0.028)	(0.037)
	4,899	3,900	2,866	1,870
Enrollment H.S. edu	0.018	0.014	-0.011	0.050
	(0.030)	(0.033)	(0.042)	(0.060)
	4,899	3,900	2,866	1,870
Mayor prosecuted (0, 1)	-0.042	-0.083*	-0.061	-0.084
	(0.033)	(0.042)	(0.050)	(0.071)
	2,273	1,682	1,158	687

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

All dependent variables with the exception of mayor prosecutions are expressed in natural logs. Dependent variables include water quality index measured in a scale from 1 to 100 (higher values reflect lower quality), low income population with access to health-care, enrollment in public elementary schools and high-schools, and an indicator for whether the mayor received a disciplinary prosecution by a central government watchdog agency (*Procuraduria General*).

Controls included: area and altitude of the municipality, distance to Bogota and distance to capital of the *departamento*, indicator variables for whether the municipality lost or gained population due to armed conflict, share of urban population, share of population living in poverty as of 1993, and *departamento*-year fixed effects. All regressions use a first order polynomial for $f_d(pop_{it})$, a second order polynomial yielded similar results. Parameter estimates for the RD coefficient on the probability of preosecuting the mayor correspond to the average marginal effects from a logit model.

Standard errors are clustered by municipality and reported in parentheses. Number of observations is reported beneath standard errors. Panel includes municipalities with a population below sixty-five thousand people.

Table 1.12: Parameter estimates of the RD coefficient for regressions of measures of council composition

Dependent Variable	Window Size 25%	20%	15%	10%
No. Parties	0.256**	0.240*	0.317**	0.426**
	(0.116)	(0.132)	(0.156)	(0.204)
	8,655	6,884	5,072	3,327
HH index	-0.006	-0.001	-0.009	-0.016
	(0.012)	(0.013)	(0.016)	(0.022)
	8,655	6,884	5,072	3,327
Share seats	1.535	4.459**	5.433**	3.004
trad. parties	(1.941)	(2.190)	(2.716)	(3.440)
	8,655	6,884	5,072	3,327
Share seats	2.343	1.583	0.764	-3.147
mayor's party	(2.001)	(2.332)	(2.827)	(3.722)
	7,977	6,379	4,719	3,096

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

Controls included: area and altitude of the municipality, distance to Bogota and distance to capital of the *departamento*, indicator variables for whether the municipality lost or gained population due to armed conflict, share of urban population, share of population living in poverty as of 1993, and *departamento*-year fixed effects. All regressions use a quadratic functional form for $k(pop_{it})$, higher order polynomial yielded similar results.

Standard errors are clustered by municipality and reported in parentheses. Number of observations is reported beneath standard errors. Panel includes municipalities with a population below sixty-five thousand people.

Table 1.13: Parameter estimates of the Control Direct Effect of an increase in the number of representatives on main outcome variables

Dependent Variable	Window Size			
	25%	**20%**	**15%**	**10%**
ln(Total expenditures)	-0.048*	-0.079**	-0.079**	-0.114**
	(0.028)	(0.034)	(0.037)	(0.048)
ln(Total revenues)	-0.043	-0.065*	-0.068*	-0.107**
	(0.028)	(0.034)	(0.038)	(0.048)
Water quality index	-0.011	-0.133	-0.187	-0.021
	(0.104)	(0.115)	(0.147)	(0.193)
Coverage health care	0.013	0.018	0.029	0.047
	(0.011)	(0.014)	(0.019)	(0.030)
Enrollment elmn. edu.	0.048**	0.048*	0.045	0.072*
	(0.021)	(0.024)	(0.030)	(0.041)
Enrollment H.S. edu	0.029	0.041	0.027	0.065
	(0.034)	(0.038)	(0.044)	(0.065)
Mayor prosecuted (0, 1)	-0.035	-0.061*	-0.047	-0.065
	(0.031)	(0.034)	(0.045)	(0.057)

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

Parameter estimates from a second stage regression of demediated dependent variables on an indicator variable for municipalities at the right of the population threshold, a first order polynomial for $f_d(pop_{it})$, indicator variables for the nearest threshold, and pretreatment controls. Standard errors reported in parentheses were bootstrapped and account for the panel nature of the data.

Figure 1.1: Colombia's Municipalities

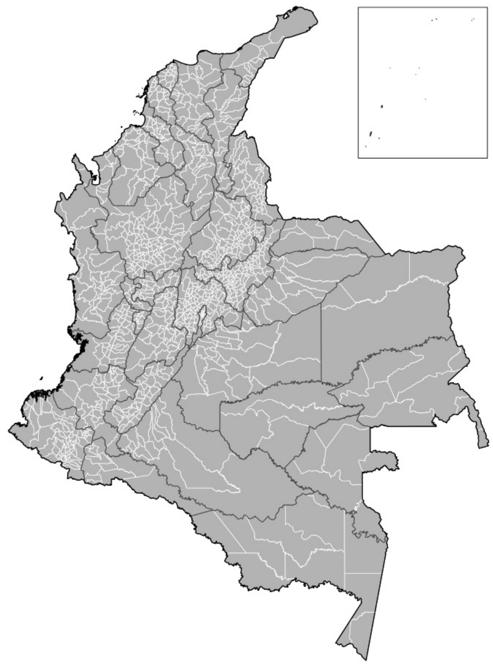
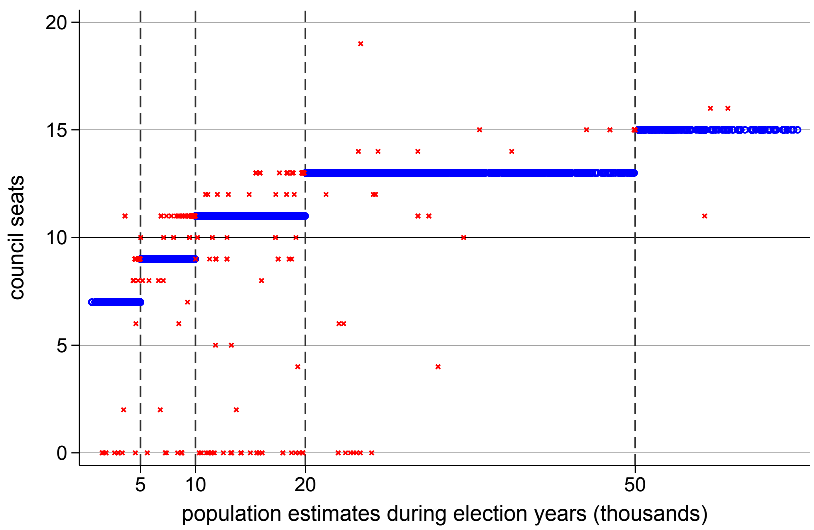
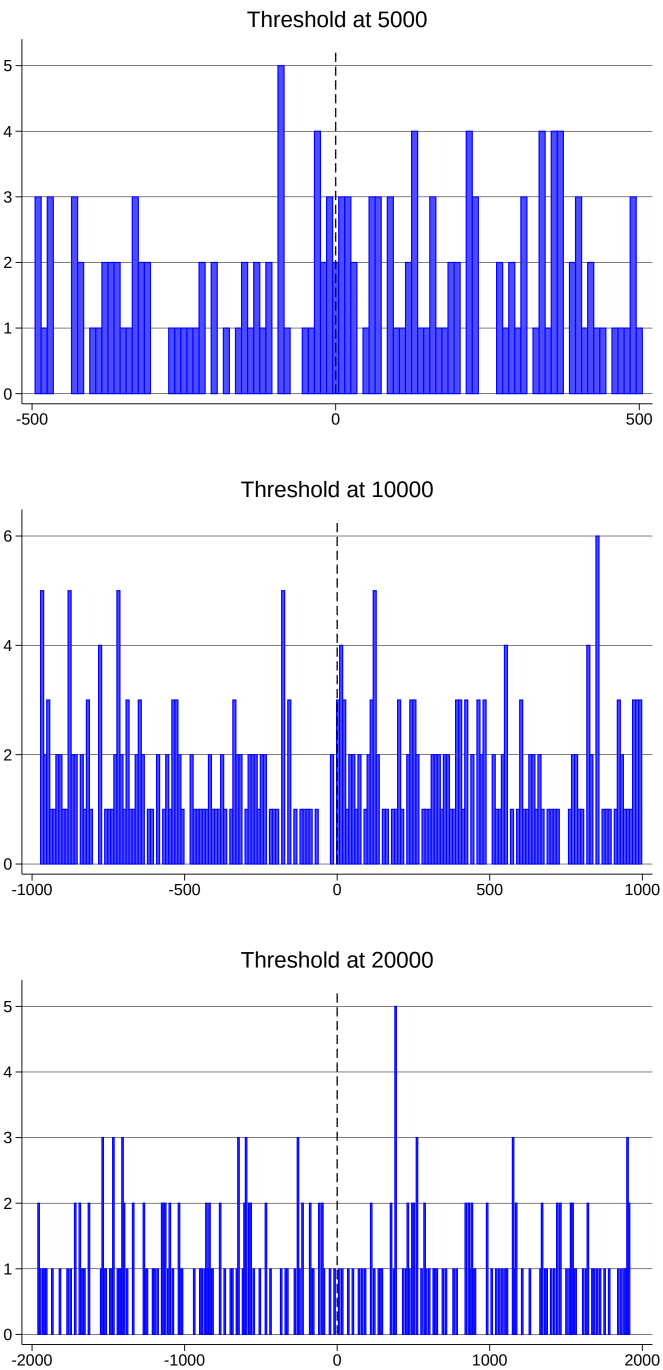


Figure 1.2: Reported Council Seats



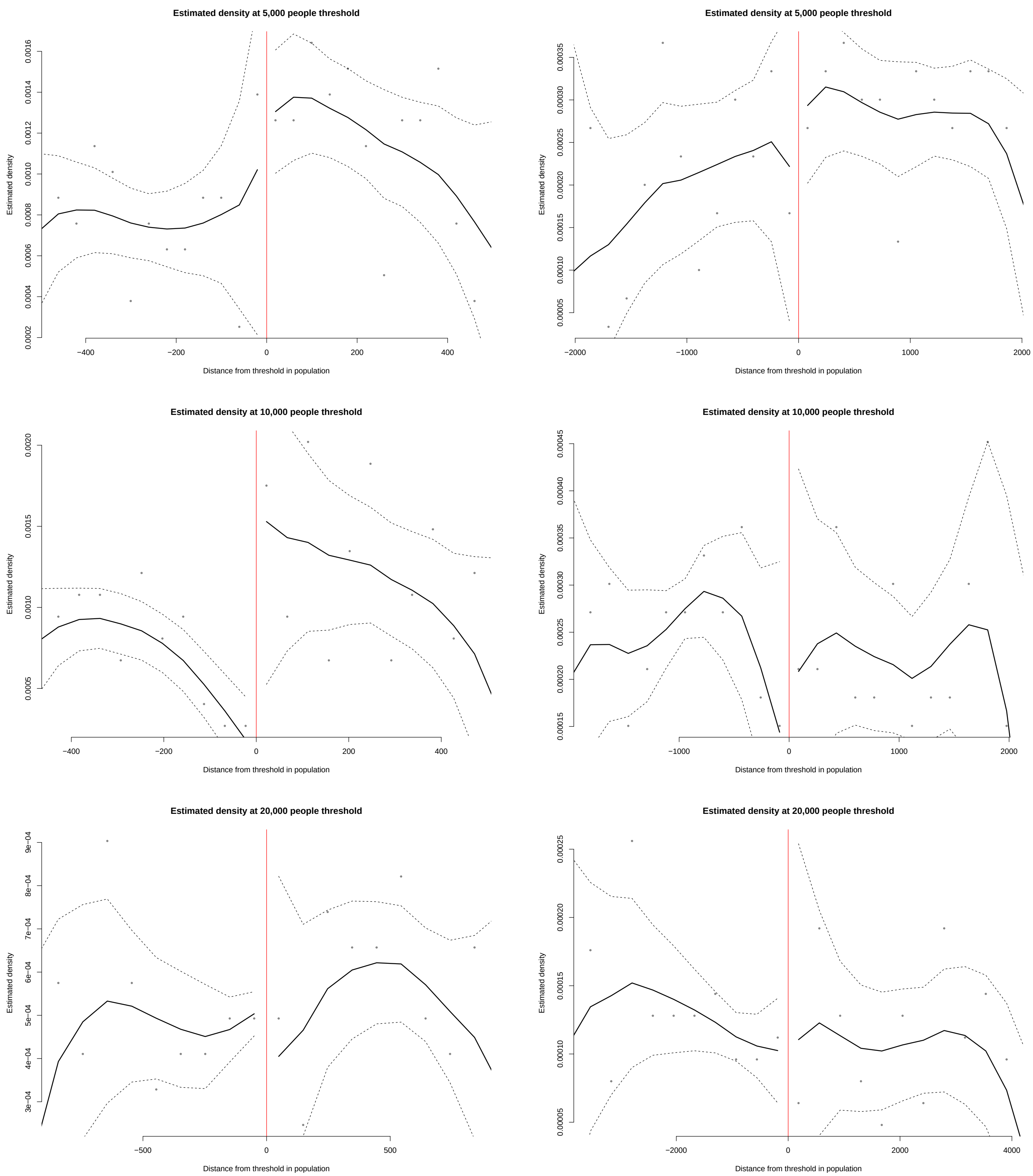
Note: Municipality-year observations for the elections conducted in 1997, 2000, 2003, 2007 and 2011. I compared the number of council seats to be contested in each municipality, as issued by the central government before the elections, with the number of council members elected in each municipality. The observations with the x markers correspond to municipality-year observations that lack information on electoral results or that have a number of elected members that differs from the number of seats that were to be contested.

Figure 1.3: Population Thresholds, Colombia



Note: Frequency histograms of the running variable for the five, ten, and twenty thousand people thresholds using observations in a twenty percent window around the cutoff value. The running variable is expressed as the population distance from each municipality to its nearest threshold.

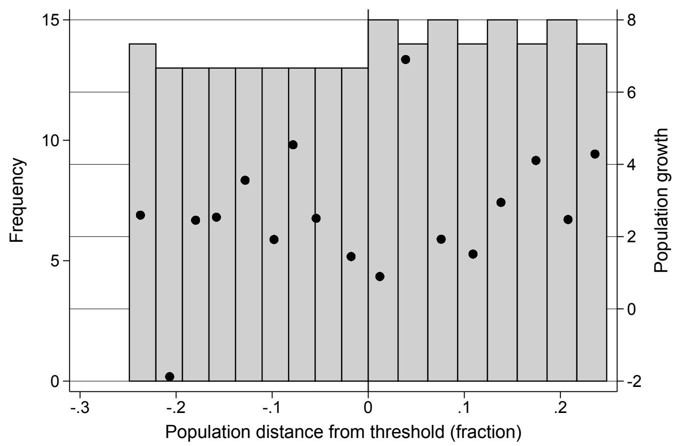
Figure 1.4: McCrary Tests of the Running Variable



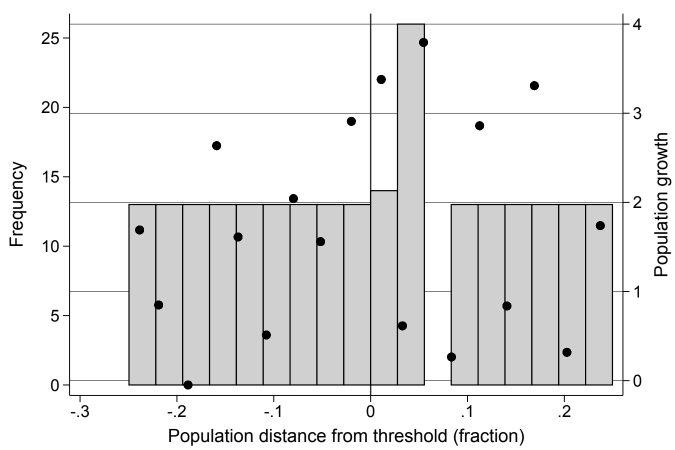
Note: The left hand panel reports results for a pooled-dataset with the running variable for years 1997, 2000, 2003, and 2007. The right hand panel reports results of a McCrary test when using the population estimates from the year from which the 1993 Census projections were built.

Figure 1.5: Local average plots for population growth around the ten thousand people threshold for different electoral periods

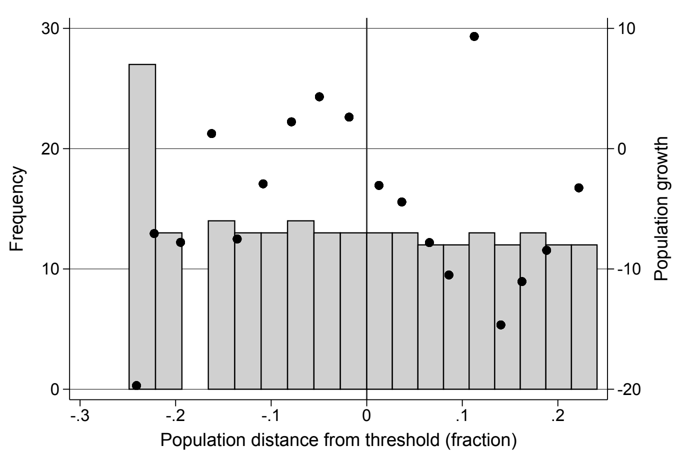
(a) From 1997 to 2000



(b) From 2000 to 2003



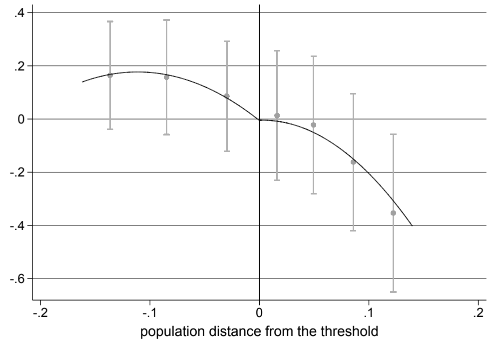
(c) From 2003 to 2007



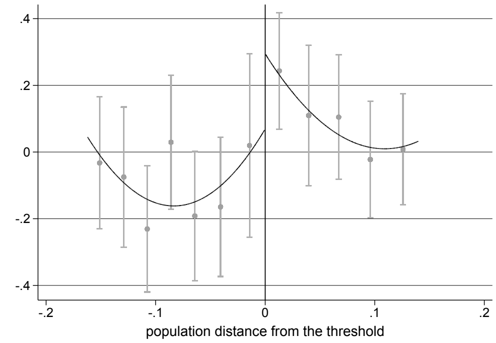
Note: Panels (a), (b), and (c) examine the growth in population estimates used to allocate council seats between the elections held in 1997 and 2000, 2000 and 2003, and 2003 and 2007; for municipalities in a 25% around the ten thousand people threshold. The graphs report sample means of population growth constructed over non-overlapping regions of the population distance between municipalities and the cutoff. The bins are chosen using Calonico et al. (2014a) mimicking-variance quantile-spaced method to better reflect the underlying variability in the data.

Figure 1.6: Balance Checks on Baseline covariates

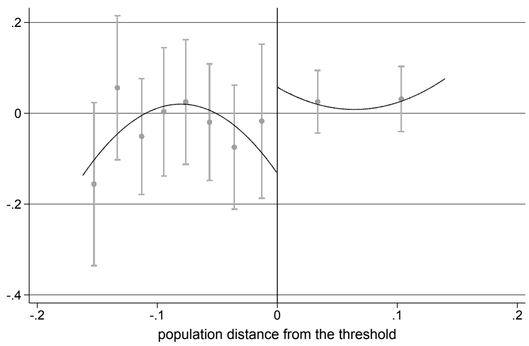
(a) ln(altitude)



(b) ln(area)

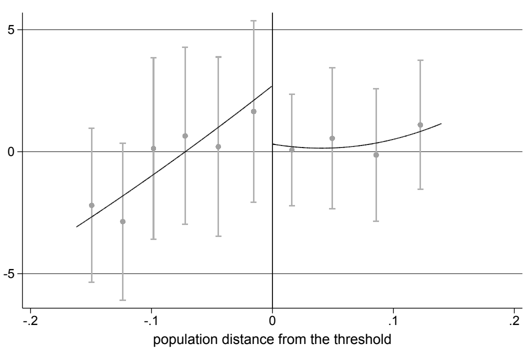


(c) ln(distance to capital)

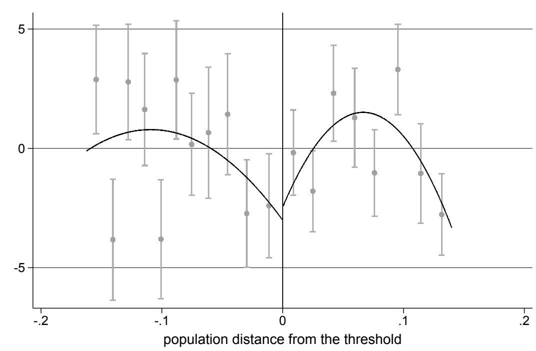


(d) ln(distance to Bogota)

(e) Poverty Index in 1993



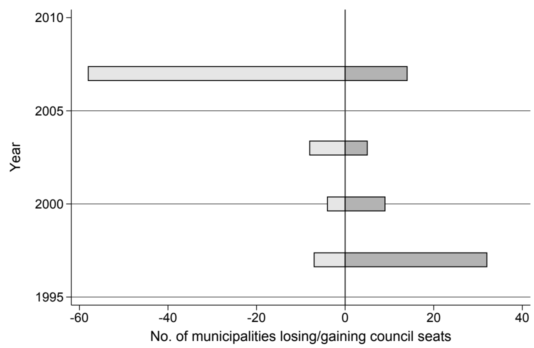
(f) Share Urban Population



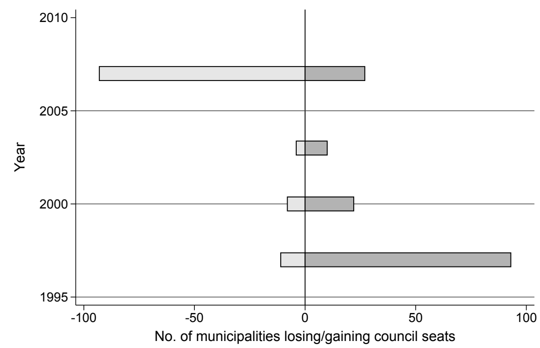
Note: Plots report average values for each covariate within non-overlapping bins to the left and the right of a population threshold. Threshold fixed effects have been partialled out to pool together the observations around the thresholds at five, ten, twenty, and fifty thousand people. The running variable is expressed as the difference in the natural log of a municipality's population and the natural log of the population at the threshold. Bins are computed using the quantile spaced (QS) partitioning scheme introduced by (Calonico et al., 2015).

Figure 1.7: Number of municipalities that lose & gain seats

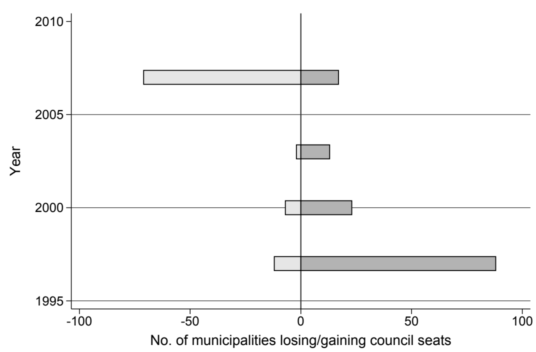
(a) Five thousand people threshold



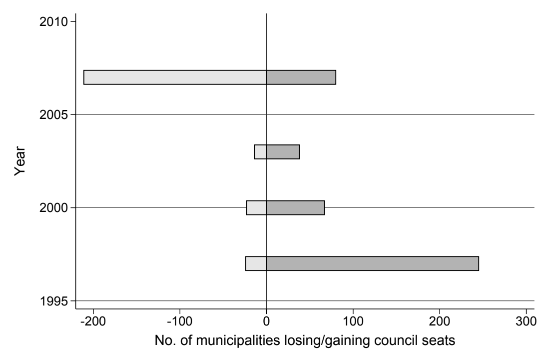
(b) Ten thousand people threshold



(c) Twenty thousand people threshold



(d) All thresholds



Note: Panel (d) refers to the combined changes across the five, ten, and twenty thousand people thresholds.

Chapter 2

Do local representatives constrain the executive? Revisiting the evidence from European municipalities

Thirteen men...will not produce the vigilance of one man multiplied by thirteen; but rather the vigilance of one man divided by thirteen.

2.1 Introduction

Recent studies by Pettersson-Lidbom (2012) and Garmann (2015) found evidence challenging the notion that political bodies with a larger number of representatives choose higher levels of public spending, a proposition known as the *law of 1/n* in the public finance literature (Weingast et al., 1981). Moreover, both studies suggest that a reduction in municipal expenditures is driven by greater oversight of the executive by the council. That is, an increase in the number of elected representatives leads to higher accountability of appointed managers in Finland and elected managers in Germany. The fact that the same result is found in two different institutional systems is of particular interest. In Finland, Pettersson-Lidbom (2012) looks at municipalities with council-manager systems, in which the council appoints a manager to administrate the municipality and has the authority to remove her from office. In Germany, Garmann (2015) looks at municipalities with a council-mayor system where both the mayor and the council are elected by the popular vote and the council does not have the authority to remove the mayor from office.

In the case of Finland, the fact that an increase in council members leads to lower expenditures is unexpected because a council-manager system shares many institutional similarities with the model proposed by Weingast et al. (1981), which is often seen as predicting a positive association between the number of decision makers and total spending (Primo and Snyder, 2008). For instance, Finnish municipalities enjoy substantial fiscal powers and administrative responsibilities, most of them vested in the council. In addition, council members are elected in single-district elections through open-party lists, meaning that candidates might be held accountable by their constituency.[1]

Conversely, the fact that an increase in the number of representatives improves the accountability of the mayor in German municipalities suggests that the number of representatives, or the composition of the council, can be used to strengthen the division of power between executive and legislative bodies in some settings. This division would, of course, depend on the rules used to elect representatives, the party system, and the voting rules in the council. In summary, both results open new lines of research into the mechanisms at play in the administration of local governments.

A common feature of both studies is that they present their estimates of the effect of council size as coming from a Regression Discontinuity (RD) specification, making the results appealing because RD designs provide a closer approximation to a randomized design than other evaluation strategies such as IV's (Lee and Lemieux (2010)). In particular, because of the characteristics of their data (e.g., limited number of observations, a discrete running variable, and multiple population thresholds), both researchers suggest the use of a parametric model that exploits the discontinuities in the data while accounting for its limitations. However, after examining the estimated equations by Pettersson-Lidbom (2012) and Garmann (2015), I show that they do not yield the same parameter estimates as those obtained from standard RD specifications. Moreover, their estimated equations are inappropriate because they do not account for the data generating process of the treatment being

[1]Nonetheless, Primo and Snyder (2008) have shown that Weingast et al.'s (1981) model is also consistent with a negative relation between the number of decision makers and total spending.

examined and lead to the use of artificial variation in the estimation of the parameter estimates.

Because they do not employ standard RD designs, the data from Pettersson-Lidbom (2012) and Garmann (2015) are used to estimate the effect of changes in the number of representatives using an appropriate RD specification. Estimates from Pettersson-Lidbom (2012) and Garmann (2015) are different from those obtained from the RD design. For the sample of Finnish municipalities, the RD estimates are sometimes similar in magnitude to those found by Pettersson-Lidbom (2012). However, the RD estimates are not statistically significant and are less robust to changes in the degree of the polynomial of the running variable. For the sample of German municipalities, the RD estimates are different in magnitude to those obtained by Garmann (2015). In particular, the magnitude of the estimates for the sub-sample of elected managers is largely susceptible to the degree of the functional form chosen for the assignment variable.

The paper is organized as follows. The next section provides basic background information about the operation of municipal governments in Finland and Hesse, and summarizes the empirical results from Pettersson-Lidbom (2012) and Garmann (2015). Because that discussion is necessarily brief, interested readers are referred to the original papers. Section Three examines the models estimated by Pettersson-Lidbom (2012) and Garmann (2015), showing that their specifications are not consistent with an RD design. Section Four reviews the traditional RD design and how it has been extended in the literature to take into account situations where (i) the assignment of treatment occurs at multiple values of the running variable and (ii) the running variable has non-continuous support. Section Five implements RD designs for both samples, comparing the results with those obtained by Pettersson-Lidbom (2012) and Garmann (2015). Section Six concludes.

2.2 Municipal Governments in Finland and Germany

2.2.1 Operation of municipal governments in Finland

Pettersson-Lidbom's 2012 sample includes 391 Finnish municipal governments over the period 1977 to 2002.[2] These governments provide such services as education, day care, and care for the elderly. Municipalities also enjoy substantial fiscal independence as they can set their own proportional income tax rate, have no limits on borrowing, and receive only a fifth of their revenues

[2]Although Pettersson-Lidbom (2012) uses information from both Finnish and Swedish municipalities, I restrict my analysis to his results from Finland because these are the more robust.

from intergovernmental transfers (Pettersson-Lidbom, 2012). Finnish municipal governments operate under a council-manager system. The council is a body of representatives elected every four years by popular vote in at-large elections. Its size is determined using a discontinuous function of population; the population thresholds are reported in Table 2.1. The manager, who is appointed by the council, is responsible for the administration and financial management of the municipality.

2.2.2 Effect of Council Size in Finland

Pettersson-Lidbom (2012) identifies the effect of council size using the following equation:

$$ln(y_{it}) = \alpha + \beta ln(C_{it}) + f(pop_{it}) + \lambda_t + \gamma_i + \varepsilon_{it} \quad (2.1)$$

where the outcome variable y_{it} is expressed in per-capita terms, C_{it} is the number of council members, $f(pop_{it})$ is a polynomial of the running variable, and λ_t and γ_i are year and municipality fixed effects, respectively. Pettersson-Lidbom (2012) describes Equation 2.1 as a fixed-effect approach combined with a RDD set up. Table 2.3 reports the main results from Pettersson-Lidbom (2012), with Column (2) listing the parameter estimate for β from a regression without $f(pop_{it})$ and without municipality fixed effects, while Column (3) reports the parameter estimates obtained after including municipality fixed effects. Columns (4), (5), and (6) correspond to parameter estimates of β obtained from Equation 2.1 when including a first, second, and third order polynomial for the population in the municipality. Rows two to five in Table 2.3 report the parameter estimates of β obtained from Equation 2.1 when restricting the sample to municipality-year observations within a window around the thresholds.[3]

The results from Table 2.3 suggest a negative, statistically significant, and economically relevant effect of council size on municipality per capita expenditures. Specifically, a one percent increase in council size is associated with a 0.07 percent decrease in expected per capita expenditures. Because the changes in council size in the sample are between 20 to 30 percent, the average effect from crossing a threshold is a decrease in per capita expenditures between 1.4 and 2.1 percent.

2.2.3 Operation of Municipal Governments in Hesse, Germany

Garmann (2015) uses a sample of 426 municipalities in the German State of Hesse over the

[3]Angrist and Pischke (2008) suggest that narrowing the sample to observations close to the threshold reduces the possibility of a specification error.

period 1985-2000. Similar to Finnish municipalities, these local governments also enjoy substantial fiscal and administrative independence. For instance, they administer elementary schools and are responsible for the maintenance of roads and economic promotion. These governments also have the autonomy to set three tax rates: a property tax, a tax on business profits, and a tax on agricultural land.

Additionally, the data from Hesse have the advantage of observing municipalities over two regimes. Prior to 1993 all municipalities operated under a council-manager regime where the council was elected in at-large elections every four years by popular vote and the manager was subsequently appointed by the council. Under this regime, the manager had no voting or veto powers over the council's decisions and could be removed from office by the council. Thus, the role of the manager was to implement the decisions made by the council, with some discretion for daily administrative tasks and hiring or dismissing of public employees. However, from 1993-1999 municipalities gradually transitioned from a council-manager to a council-mayor system of governance, the main difference being that the manager is now elected by popular vote and cannot be dismissed by the council. In addition, the size of the council has always been determined using a discontinuous function of population. Table 2.2 reports the population cutoffs and the associated council sizes; in particular, Garmann (2015) restricts his analysis to those municipalities with a population below twenty-five thousand.

2.2.4 Effect of Council Size in Hesse, Germany

To estimate the differential effect of council size between municipalities with an appointed and an elected manager, Garmann (2015) uses the following equation:

$$y_{it} = \alpha + \beta C_{it} + \gamma C_{it} D_{it} + \delta' \boldsymbol{X_{it}} + \rho D_{it} + f(pop_{it}) + f(pop_{it}) D_{it} + \lambda_t + \varepsilon_{it} \tag{2.2}$$

where y_{it} denotes the outcome variable of interest, C_{it} refers to the size of the council, $f(pop_{it})$ is a polynomial of the running variable or treatment-determining covariate, $\boldsymbol{X_{it}}$ is a vector of control variables, λ_t are year fixed effects, and D_{it} is an indicator variable equal to one if the manager is elected in the municipality and zero otherwise. In particular, the parameter estimates for β and $\beta + \gamma$ are interpreted as the effects of council size in municipalities with an appointed and an elected manager, respectively.

Tables 2.4 and 2.5 replicate the results from Garmann (2015) for the effect of council size on municipal total expenditures and material spending, respectively. Upper panels in the tables report parameter estimates for the effect of council size in municipalities where the manager is appointed (β) while the lower panels report similar estimates for municipalities where the manager is elected ($\beta+\gamma$). The columns report estimates for Equation 2.2 when omitting the running variable (referred to as OLS estimates) and when using a third, fourth, and fifth order polynomial for $f(pop_{it})$ (referred to as RDD estimates). Similarly, the first column indicates for each row whether the estimates were obtained using all municipalities with a population below twenty-five thousand or only those with a population within a twenty-five, twenty, and ten percent window around the thresholds.

The estimates from Tables 2.4 and 2.5 indicate that the effect of council size on municipal expenditures is more salient during the period when the managers are elected than when they are appointed, both in terms of magnitude and statistical significance. Garmann (2015) interprets this result as evidence that the effect of council size is a response to agency problems between the council and the manager, with the agency problems being exacerbated once the manager is elected and not appointed by the council. Further support for this argument is drawn from the fact that the reduction in municipal expenditures is driven by reductions in material and personnel spending, both of which are categories of expenditures where the administration enjoys more discretion.[4] Specifically, when the manager is elected an additional council member is associated with a 0.9 and 1.4 percent decrease in total and material spending, respectively. Since the municipalities in the sample gain between six to eight council members when crossing the thresholds, the results suggest that municipalities undergoing a change in council size on average experience a drop in total and material spending of at least 5.4 and 8.4 percent, respectively.

2.3 Discussion of the Results from Finland and Hesse

2.3.1 Examining the Results from Finland

Pettersson-Lidbom (2012) describes Equation 2.1 as a fixed-effect approach combined with a RDD set up. In particular, he refers to its results, when omitting population as a covariate, as the

[4] Garmann (2015) also estimates the effect of council size on capital spending and multipliers for the local tax rates determined by the council, finding no evidence of a council size effect on these outcomes.

results from a pure fixed effect (FE) regression (see Column 2 in Table 2.3) and to the results when including population covariates as coming from an RD specification (Columns 4-6 in Table 2.3). However, in this section I show that Pettersson-Lidbom's (2012) results in Table 2.3 are estimated from an unobserved effects panel data model and should not be interpreted as coming from an RD specification.

I begin by reviewing the assumptions under which FE estimation is desirable.[5] If the true population regression function is given by

$$E[ln(y_{it})|C_{it}, pop_{it}, \boldsymbol{X_{it}}, a_i] = \alpha + \beta ln(C_{it}) + \gamma pop_{it} + \delta' \boldsymbol{X_{it}} + a_i \tag{2.3}$$

where a_i is a time-invariant unobserved random variable that its believed to be correlated with the other covariates, then FE estimation provides a way to consistently estimate the parameters β, γ, and δ from Equation 2.3. This is typically done using the within transformation: averaging the regression equation over all time periods and subtracting it from the original equation. The transformed regression equation corresponds to

$$\begin{aligned}(ln(y_{it}) - \overline{ln(y_i)}) =& \beta(ln(C_{it}) - \overline{ln(C_i)}) + \gamma(pop_{it} - \overline{pop_i}) \\ &+ \delta'(\mathbf{X_{it}} - \overline{\mathbf{X_i}}) + (\lambda_t - \overline{\lambda}) + (\varepsilon_{it} - \overline{\varepsilon_i})\end{aligned} \tag{2.4}$$

where $\overline{ln(y_i)}$, $\overline{ln(C_i)}$), $\overline{pop_i}$, and $\overline{\mathbf{X_i}}$ are population averages for each of the variables in the model taken over all periods T. Equation 2.4 cannot be interpreted as an RD specification because the central idea behind an RD design is to exploit available information about the process determining treatment (Angrist and Pischke, 2008), which in the case of Finland is the fact that council size is a discontinuous function of population. While Equation 2.4 rightfully controls for the size of population, since changes in council size are determined by the change in population experienced by a municipality, it does not account for the fact that the researcher knows precisely how these changes are determined.

Adding higher order terms for $(pop_{it} - \overline{pop_i})$ to Equation 2.4 is not consistent with an RD design. In parametric applications of an RD design, higher order terms for the running or assignment variable are included to guarantee that the conditional expected function $E[ln(y_{it})|pop_{it}]$ is not misspecified since identification relies on comparing this conditional expectation for values of pop_{it}

[5] I closely follow the discussion of panel data models by Wooldridge (2010).

immediately to the left and to the right of the threshold (see Lee and Card, 2008; Angrist and Pischke, 2008). In Equation 2.4, higher order terms for $(pop_{it} - \overline{pop_i})$ are meant as controls so that there are no unobserved time-varying factors correlated with the treatment of interest $ln(C_{it})$. However, including these terms is inefficient given the knowledge that (i) changes in C_{it} are completely determined by changes in population and (ii) the function relating changes in council size to changes in population for a given municipality is not a polynomial.[6] In particular, the use of Equation 2.4 might explain why the results from Pettersson-Lidbom (2012) in Table 2.3 are largely invariant to the use of higher order polynomials for population.

Having established that the parameter estimates from Equation 2.1 are not consistent with an RD design, it is worth pointing out that the choice of using FE estimation to identify the effect of council size might be defended on certain grounds. As suggested by Pettersson-Lidbom (2012), the fact that there are few observations in the neighborhood of the population thresholds prevents the implementation of an RD design using non-parametric methods. As discussed in Section 3.4, this leaves the researcher with the choice of implementing a parametric RDD which uses extrapolation from observations away from the discontinuity (Lee and Lemieux, 2010). Under these circumstances, estimation of the effect of council size using standard regression methods might seem appealing. However, these methods are necessarily less efficient because they do not make use of the information about the data generating process for the treatment of interest. More importantly, the average treatment effect estimated from Equation 2.1 is not the same as the one obtained from RD designs which represent the ATE for the subpopulation in the neighborhood of the discontinuity.[7]

2.3.2 Examining the Results from Hesse, Germany

Garmann (2015) refers to Equation 2.2 as a combination of a regression discontinuity design with a difference-in-differences approach. However, he acknowledges that his model is different from current difference-in-discontinuities designs used to address the presence of confounded treatments in traditional RD designs (Grembi et al., 2012).

In particular, because all variables in Equation 2.2 are interacted with the indicator variable

[6] This would be a discontinuous function where changes in council size occur only if the absolute value of the change in population experienced by a municipality is greater than the absolute value of the population distance between the municipality and its nearest threshold.

[7] Moreover, as indicated by Lee and Lemieux (2010), the ATE from RD designs can be interpreted more generally as a weighted ATE where the weights correspond to the ex-ante probabilities that the value of the assignment variable for an individual will be in the neighborhood of the threshold.

D_{it}, the model is equivalent to estimating a separate equation of the following form for each regime[8]

$$y_{it} = \alpha + \beta C_{it} + \delta' \boldsymbol{X_{it}} + f(pop_{it}) + \lambda_t + \varepsilon_{it} \tag{2.5}$$

where all variables are defined as in Section 2.2.4. Thus, although Garmann (2015) refers to the parameter β in Equation 2.5 as the RD effect of council size on municipal expenditures, careful inspection makes clear that the parameter β is different from the parameter τ in Equation 2.7. Specifically, the Frisch-Waugh-Lovell (FWL) theorem shows that the linear regression model in Equation 2.5 can be re-specified as

$$\hat{\mu_{it}} = \delta + \theta \hat{u_{it}} + \epsilon_{it} \tag{2.6}$$

where $\hat{\mu_{it}}$ and $\hat{u_{it}}$ are OLS residuals from regressions of y_{it} and C_{it} on the other covariates, and where the OLS parameter estimate for θ is the same as the one for β from Equation 2.5.[9]

Equation 2.6 indicates that the variation used to estimate the effect of council size is artificial; that is, it comes from using the wrong functional form for population. To exemplify this, imagine that the only covariate used in Equation 2.5 is a polynomial for population, Equation 2.6 would then be estimated using the residuals from regressing municipal expenditures and council size on this polynomial. In particular, since the actual relationship between council size and population is known to be a step function, the residuals $\hat{u_{it}}$ represent an artificial variation—the result of mis-specifying the relationship between council size and population.

Figure 2.1 shows plots for the observed values of council size as a function of population along with values for $\hat{u_{it}}$ from regressions using a first and third degree polynomial of population. It is evident that both functions provide a poor fit for the true relationship between council size and population, which we know is a step function. This analysis explains why the results from Garmann (2015) reported in Tables 2.4 and 2.5 are largely insensitive to the use of higher order polynomials. Notice that the vertical distance between the predicted and observed values for council size in Figure 2.5 would be used in Equation 2.6 to estimate the effect of council size on expenditures. However, since this variation is generated from fitting the wrong functional form for the relation between council size and population, it is unclear how the parameter θ should be interpreted. For

[8]Although the sociodemographic variables in Equation 2.2 are not interacted with the indicator variable D_{it}, Garmann's 2015 results are unaffected by the exclusion of those interactions

[9]See page 62 in Davidson and MacKinnon (2004).

this reason, Lee and Lemieux (2010) argue that an RDD should be seen as a data generating process, not as a method, since it is the knowledge about this process that determines the estimation method to be used.

2.4 Conducting a RD Design When Treatment Is Assigned at Multiple Thresholds and the Running Variable Has Limited Support

Tables 2.1 and 2.2 report the population thresholds used in Finland and Hesse to allocate the number of representatives. In both cases, the data generating process is consistent with a sharp Regression Discontinuity (RD) design, with the number of representatives changing discontinuously at each of the population thresholds. However, contrary to traditional RD designs, in both data sets treatment is assigned at multiple thresholds and the assignment or running variable is discrete and reported in coarse intervals. To show how these features of the data affect the estimation of the Average Treatment Effect (ATE), a review of the traditional RD design is useful as well as how it has been extended in the literature to address with these limitations.[10]

RDD in a Simple Cross-section

Define y_i as the outcome of interest for subject i. Assume subjects are exposed to treatment whenever a continuous variable x crosses some threshold c, such that $D_i = D(x_i) = 1[x_i \geq c]$, where D_i is an indicator variable equal to one if subject i is treated. We can then estimate the treatment effect using the following model

$$y_i = \alpha + \tau D_i + \beta_l(x_i - c) + \beta_r(x_i - c)D + \varepsilon_i \tag{2.7}$$

where the running variable x_i is centered at the threshold such that τ is the difference between the intercepts of two linear regressions, one to the left and one to the right of the threshold. Equation 2.7 implicitly assumes that the relation between the running variable x_i and the outcome of interest is linear, which can result in biased estimates of the treatment effect because the goal is to estimate the parameters at the threshold (Lee and Lemieux, 2010). Hahn et al. (2001) show that the assumption of a linear model is unnecessary and that the treatment effect can be estimated non-parametrically

[10] My discussion follows closely Lee and Lemieux (2010) and Hahn et al. (2001).

under the assumptions that $E[y_i(1)|x]$ and $E[y_i(0)|x]$ are continuous at c, where $y_i(1)$ and $y_i(0)$ represent the potential outcomes for subject i with and without treatment, respectively.

While recent applications of RD designs estimate the treatment effect using local linear regression as suggested by Hahn et al. (2001), the characteristics of the data used by Pettersson-Lidbom (2012) and Garmann (2015) prevent the use of nonparametric methods because their running variables are discrete and reported at coarse intervals, meaning that there are few municipalities in the neighborhood of the population cutoffs. As Lee and Card (2008) show, when the running variable presents these characteristics the treatment effect is not non-parametrically identified, proposing a procedure for statistical inference under a parametric model. In the simplest case, they propose estimating the following model

$$y_i = \alpha + \tau D_i + f(\tilde{x}_i) + Df(\tilde{x}_i) + \varepsilon_i \tag{2.8}$$

where $\tilde{x}_i = x_i - c$ so that the threshold is set at 0 and $f(\cdot)$ is a polynomial of the running variable (i.e. $f(\cdot) = \tilde{x} + \tilde{x}^2 + \tilde{x}^3$). To address the concern that the parametric functional form might be mis-specified, Lee and Card (2008) suggest modeling the deviations of the true conditional means from the parametric function as random specification errors with unknown variance. Specifically, they show that under the assumption that the specification errors to the left and the right of the threshold are the same, OLS estimators with standard errors clustered at the individual values of the running variable will be consistent.

The Panel Nature of the Data

Lee and Lemieux (2010) suggest a simple extension to Equation 2.8 to take into account the fact that the same units are observed over time; that is, they propose estimating

$$y_{it} = \alpha + \tau D_{it} + f(\tilde{x}_{it}) + Df(\tilde{x}_{it}) + \lambda_t + \gamma_i + \varepsilon_{it} \tag{2.9}$$

where t indicates the time period. Equation 2.9 can be estimated as a pooled cross-section (omitting the municipality fixed effects γ_i) or as a panel (with municipality fixed effects γ_i). While including municipality fixed effects would control for time-invariant omitted variables, this is not a concern for identification in an RD design because treatment in the neighborhood of the threshold should be uncorrelated with municipality-specific characteristics. Moreover, if there is little within-unit variation in treatment, the use of municipality fixed effects can increase the variance of the RD estimator (Lee and Lemieux, 2010).

Multiple Thresholds

Equation 2.9 estimates the ATE from a single treatment. I now discuss the different approaches used in the literature to account for circumstances when a treatment is assigned at different levels in the support of the running variable. Ideally, the simplest way to account for this is to estimate a separate treatment effect for each threshold since there is no reason to believe that the treatment effect across thresholds is the same. However, because of data limitations, researchers in many instances pool observations from different thresholds (Eggers et al., 2015) or estimate a polynomial of the running variable on each side of the thresholds but restrict the effect of the treatment to be the same (Dell et al., 2015). With the first approach, we partial out threshold fixed effects and compute parameter estimates for a model similar to Equation 2.9. Under the second approach, we estimate the following model:

$$y_{it} = \tau D_{it} + \sum_{c=1}^{C} \alpha_c H_{cit} + \sum_{c=1}^{C} \gamma_c f_c(\tilde{x}_{it}) H_{cit} + \sum_{c=1}^{C} \rho_c f_c(\tilde{x}_{it}) H_{cit} D_{it} + \lambda_t + u_{it} \tag{2.10}$$

where H_{cit} is an indicator variable equal to one if threshold c is the nearest threshold to municipality i in year t, and $f_c(\tilde{x}_{it})$ is a polynomial of the population difference between municipality i and its nearest threshold c.

Alternatively, Tukiainen and Lyytikäinen (2013) suggest estimating a parametric model that allows for the treatment effect to be different at each threshold. Their equation is given by

$$\begin{aligned} y_{it} &= \beta_1 + \beta_2 Group2_{it} + ... + \beta_n GroupN_{it} + f(x_{it}) \\ &\quad + Group2_{it} f(x_{it} - c_1) + ... + GroupN_{it} f(x_{it} - c_{n-1}) + \lambda_t + u_{it} \end{aligned} \tag{2.11}$$

where $Group2$ and $GroupN$ are indicator variables for observations crossing the first and last thresholds. For instance, given the population thresholds for Finnish municipalities reported in Table 2.1, $Group2$ would be equal to one for municipalities with a population greater than two thousand. Notice that the indicator variables overlap with one another so that the parameters β can be interpreted as the ATE from an increase in the treatment variable. Similarly, to allow for a different functional form of the running variable at different levels of treatment, the group dummies are interacted with the polynomial for population $f(\cdot)$, with population being normalized at zero for that threshold. For instance, the $Group2$ dummy is interacted with $f(x_{it} - 2001)$ since the cutoff between the first and second groups is a population of 2001.

The next section implements RD designs for the samples from Finland and Hesse using Equations 2.8, 2.10, and 2.11. A limitation of the existing literature is that there are no clear criteria for choosing among these models; because of this, I use the results from the different regressions in combination with RD plots to make inferences about the effects of changes in council size at the population discontinuities.

2.5 Estimating the Effect of Council Size in Finnish and German Municipalities Using an RDD

2.5.1 Graphical Evidence: RD plots

RD plots, a standard tool in RD designs, are usually presented as preliminary evidence of the effect being studied. Moreover, because the construction of RD plots involves choices regarding the number of bins, the partitioning scheme for constructing them, and a polynomial regression to smooth the graph, the researcher has some discretion in how to build a graph to accentuate or attenuate a discontinuity. Thus, to guard against biases in the construction of the RD plots, I use the STATA command introduced by Calonico et al. (2014b) for standardizing the graphical evidence presented here. In particular, I chose their quantile-spaced partitioning scheme (Calonico et al., 2015) which takes into account the sparsity of the data and defines bins containing approximately the same number of observations.

Figure 2.2 reports RD plots for the first five population thresholds in Finland. This sample includes municipalities with a population below forty-five thousand to guarantee some observations in the neighborhood of the thresholds. This figure shows that for the thresholds at 2001, 8001, and 15001, some evidence of a discontinuity exists, and for the threshold at 4001, there seems to be a discontinuity in municipal expenditures but in the opposite direction of the effect found by Pettersson-Lidbom (2012). There is also evidence of a discontinuity at the threshold of 30001 people, but there is too much variation in the right side of the threshold to argue that this discontinuity is due to the change in council size.

Figures 2.3 and 2.4 report RD plots for German municipality-year observations where the manager was appointed and elected, respectively. I follow Garmann (2015) and restrict the sample to municipalities with a population below twenty-five thousand due to the low number of observations at higher population thresholds (see Table 2.2). These two are somewhat consistent with the results from Garmann (2015) in that there is some evidence of discontinuities but only in the sample for elected managers. Specifically, we observe discontinuities at the thresholds of 3001 and 10001 people. However, only the evidence from the 10001 threshold seems reliable since there are several discontinuities at the left of the 3001 threshold that suggest the observed discontinuity at this threshold is not being caused by a change in council size.

2.5.2 RD Parameter Estimates

This section computes RD parameter estimates for the effect of council size using the equations described in Section 3.4. First, observations from the different thresholds are pooled to estimate Equation 2.9. To do this, the running variable is defined as the percent distance from a municipality's population to the population value at the cutoff, using the cutoff value for the nearest threshold to the municipality. This allows all thresholds to be pooled to have a single indicator variable for whether municipalities lie to the right or the left of a threshold. Because pooling observations from different regions from the support of the running variable may increase the variance of the outcome variable (Eggers et al., 2015), threshold and year fixed effects are subtracted from every observation. Specifically, in the sample of Finnish municipalities, observations are pooled from the thresholds at two, four, eight, fifteen, and thirty thousand people. In the sample of German municipalities, observations are pooled from the thresholds at three, five, and ten thousand people.[11]

Finnish Municipalities

The estimates from Pettersson-Lidbom (2012) indicated that an increase in council size would cause a decrease in municipal per capita expenditures between 1.4 and 2.1 percent. Looking at the RD estimates in Table 2.6, from regressions including controls for population composition and wealth of the municipality, I notice that several of the estimates lie within the range suggested by Pettersson-Lidbom (2012), specifically those from regressions without higher order terms for the running variable. However, these estimates are largely susceptible to the degree of the polynomial

[11] Higher thresholds are omitted due to the low number of observations around the cutoffs (see Figure 2.5).

used for the running variable and to the size of the window around the population thresholds. Moreover, none of the estimates are statistically significant.

Table 2.7 reports RD estimates similar to those from Table 2.6 when allowing for a more flexible functional form for the running variable (see Equation 2.10). Looking at the estimates in the second row, those from regressions with controls and $ln(expenditures)$ as the dependent variable, I notice that these estimates are more robust than those from Table 2.6 and still range within the estimates found by Pettersson-Lidbom (2012). However, none of the estimates are statistically significant, and their magnitude still changes with the polynomial used for the random variable.

Table 2.8 reports parameter estimates for the effect of council size using Equation 2.11, which allows for the effect of the treatment to be different at each threshold. Notice that the results from this specification are substantially different from the estimates obtained when pooling all thresholds. For instance, the effect of a change in council size on $ln(expenditures)$ is positive at the first two thresholds, inconsistent at the third threshold, and mostly negative at the last two thresholds. In particular, the estimates at the fifteen and thirty thousand person thresholds are statistically significant for specifications without higher order polynomials for the running variable. However, the magnitude of the estimates is too large to be plausible, suggesting that an increase in council size from 35 to 43 representatives leads to a 30 percentage point decrease on expenditures, perhaps the result of the small sample size in the neighborhood of these thresholds (see Figure 2.5).

Municipalities from Hesse

I now turn to the RD estimates for the sample of municipalities from Hesse. Recall that Garmann (2015) found a negative effect of council size on material spending between 5.4 and 8.4 percent in municipalities with elected managers. Similar to the discussion for Finland, I look first at the RD estimates obtained from Equation 2.8, which are reported in Table 2.9. Specifically, the last row in the table reports the RD estimates on material spending in municipalities with elected mayors. Consistent with Garmann (2015), all RD estimates are negative. However, most of the estimates are not statistically significant, and for a given window size, they are not robust to changes in the degree of polynomial used for the running variable.

The RD estimates for Equation 2.10 are reported in Table 2.10. Recall that these estimates are similar to those from Equation 2.8 except that the specification allows for a more flexible functional form for the running variable. Nonetheless, the estimates in the last row of this table are similar to those from the last row in Table 2.9. The estimates are consistently negative, with half being statistically significant. However, the estimates are not robust to the degree of polynomial used for the running variable and in some cases report an effect of council size twice as large as the one found by Garmann (2015).

Table 2.11 reports the RD estimates for Equation 2.11. The lower panel reports the effect on material spending from a change in the number of representatives at the three, five, and ten thousand person thresholds. Similar to the case of Finnish municipalities, these estimates are too large to be plausible. For instance, an increase from 15 to 23 representatives causes a decrease in material spending of approximately 45.8 percentage points. Moreover, almost half of the estimates are not statistically significant, and their magnitude remains susceptible to the degree of polynomial for the running variable.

2.6 Conclusion

This paper tests the hypothesis that an increase in the number of representatives in local governments leads to better oversight of the executive by the council. The analysis builds on those conducted by Pettersson-Lidbom (2012) and Garmann (2015), who used data from municipal governments in Finland and the German State of Hesse to estimate the effect of changes in council size on municipal public finances. In particular, they used Fixed Effects and OLS estimators to obtain estimates of the effect of council size.

However, since the size of municipal councils in Finland and Hesse is determined using a discontinuous function of population, estimating the effect of council size using an RD design is a more efficient approach because it incorporates the information of the data generating process. Thus, RD estimates are obtained for the effect of a change in council size for the sample of municipalities in Finland and Germany previously studied by Pettersson-Lidbom (2012) and Garmann (2015).

These RD estimates fail to reject the null hypothesis that the effect of council size on municipal expenditures is zero, a result in contrast with those from Pettersson-Lidbom (2012) and Garmann (2015), both of whom found a negative and statistically significant effect of council size on total expenditures. I reconcile these differences by showing that (a) the OLS estimator used by Garmann (2015) is inappropriate because it estimates the effect of council size using artificial variation generated by modeling the relation between council size and population using the wrong functional form and (b) the FE estimator used by Pettersson-Lidbom (2012) is inefficient because it addresses the concern that time-invariant omitted variables might be correlated with the treatment of interest. However, in an RD design the zero-conditional mean assumption is trivially satisfied. Moreover, Pettersson-Lidbom (2012) also uses the wrong functional form to model the relation between within-municipality variation in council size and within-municipality variation in population.

The discussion presented here suggests several areas for future research. First, more research is needed on how to address situations in empirical work where the data generating process is consistent with an RDD but treatment is assigned at multiple thresholds, sample size is small, and when the running variable has no continued support. For instance, recent work addressing some of these issues includes Eggers et al. (2015), Cattaneo et al. (2016), and Bertanha (2016). Second, to the best of my knowledge, only Lee and Lemieux (2010) raise the subject that RD designs are closer to a data generating process than to an estimation method. In light of this suggestion, more research is needed to determine if other estimators can be used to estimate the effect of treatment outside the traditional parametric and non-parametric RD specifications when the data generating process is an RD design.

Table 2.1: Finland's Population Thresholds.

Population Threshold	Council Seats	Share of Municipalities (%)
$\leq$ 2,000	17	12.53
2,001 - 4,000	21	28.64
4,001 - 8,000	27	29.67
8,001 - 15,000	35	18.41
15,001 - 30,000	43	7.42
30,001 - 60,000	51	1.02
60,001 - 120,000	59	1.28
120,001 - 250,000	67	0.77
250,0001 - 400,000	75	0
$\geq$ 400,001	85	0.26

Note: Taken from Pettersson-Lidbom (2012).

Table 2.2: Hesse's Population Thresholds.

Population Threshold	Council Seats	Share of Municipalities (%)
$\leq$ 3,000	15	8.86
3,001 - 5,000	23	20.36
5,001 - 10,000	31	33.86
10,001 - 25,000	37	29.40
25,001 - 50,000	45	4.58
50,001 - 100,000	59	1.64
100,001 - 250,000	71	0.70
250,001 - 500,000	81	0.23
500,0001 - 1,000,000	93	0.23
$\geq$ 1000,000,001	105	0

Note: Taken from Garmann (2015).

Table 2.3: Replicating Pettersson-Lidbom's (2012) Results

	(2)	(3)	(4)	(5)	(6)	
Window	OLS	FE		RDD		No. Obs
			f(pop)=1st	f(pop)=2nd	f(pop)=3rd	
All Obs	0.210***	-0.199***	-0.166***	-0.148***	-0.079**	10,166
	(0.023)	(0.040)	(0.040)	(0.042)	(0.039)	
25%			-0.073*	-0.087**	-0.084**	7,208
			(0.039)	(0.038)	(0.037)	
10%			-0.072**	-0.077**	-0.069*	2,849
			(0.036)	(0.037)	(0.039)	
5%			-0.100**	-0.100**	-0.101**	1,536
			(0.045)	(0.045)	(0.044)	
2.5%			-0.095	-0.095	-0.092	778
			(0.071)	(0.072)	(0.070)	

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

Std. errors clustered by municipality. The dependent variable in all regressions corresponds to per capita expenditures in natural log. All regressions include controls for municipality wealth, age composition of the population, and year fixed effects.

Table 2.4: Replicating Garmann's (2015) results for the effect of council size on total expenditures

Sample	OLS	RDD			No. Obs.
		f(pop)=3rd	f(pop)=4th	f(pop)=5th	
Parameter estimates effect of council size when manager is appointed (β)					
All Obs	0.007***	-0.005	-0.006*	-0.006*	6,308
	(0.001)	(0.004)	(0.004)	(0.004)	
25%	0.003	-0.007*	-0.007*	-0.007	4,204
	(0.002)	(0.004)	(0.004)	(0.004)	
20%	0.003	-0.007*	-0.007*	-0.006	3,464
	(0.002)	(0.004)	(0.004)	(0.004)	
10%	0.002	-0.005	-0.006	-0.006	1,816
	(0.002)	(0.004)	(0.004)	(0.004)	
Parameter estimates effect of council size when manager is elected ($\beta + \gamma$)					
All Obs	0.0017	-0.008*	-0.01**	-0.0098**	6,308
	(0.0015)	(0.0042)	(0.0043)	(0.0043)	
25%	-0.0014	-0.0103**	-0.0099*	-0.0083	4,204
	(0.0017)	(0.0051)	(0.0054)	(0.0056)	
20%	-0.0011	-0.0093*	-0.0094*	-0.0077	3,464
	(0.0018)	(0.0053)	(0.0055)	(0.0056)	
10%	-0.0035	-0.0061	-0.0069	-0.0068	1,816
	(0.0025)	(0.0057)	(0.0059)	(0.0058)	

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

Std. errors clustered by municipality. The dependent variable in all regressions corresponds to per capita total expenditures in natural log. All regressions include year fixed effects and controls for the proportion of the population younger than fifteen and older than sixty-five.

Table 2.5: Replicating Garmann's (2015) results for the effect of council size on material spending

Sample	OLS		RDD		No. Obs.
		f(pop)=3rd	f(pop)=4th	f(pop)=5th	
Parameter estimates effect of council size when manager is appointed (β)					
All Obs	0.004**	-0.005	-0.006	-0.006	6,308
	(0.002)	(0.004)	(0.004)	(0.004)	
25%	0.000	-0.004	-0.004	-0.004	4,204
	(0.002)	(0.005)	(0.005)	(0.005)	
20%	0.001	-0.003	-0.003	-0.004	3,464
	(0.002)	(0.005)	(0.005)	(0.005)	
10%	0.003	-0.000	0.001	0.001	1,816
	(0.003)	(0.005)	(0.005)	(0.005)	
Parameter estimates effect of council size when manager is elected ($\beta + \gamma$)					
All Obs	-0.0018	-0.0135**	-0.0141**	-0.0137**	6,308
	(0.0019)	(0.0055)	(0.0059)	(0.0057)	
25%	-0.0031	-0.0168***	-0.015**	-0.0163**	4,204
	(0.0021)	(0.0062)	(0.0064)	(0.0066)	
20%	-0.0027	-0.0159**	-0.0147**	-0.0148**	3,464
	(0.0021)	(0.0064)	(0.0065)	(0.0065)	
10%	-0.0015	-0.013*	-0.0147**	-0.0146**	1,816
	(0.0029)	(0.0069)	(0.0067)	(0.0067)	

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

Std. errors clustered by municipality. The dependent variable in all regressions corresponds to per capita material spending in natural log. All regressions include year fixed effects and controls for the proportion of the population younger than fifteen and older than sixty-five.

Table 2.6: RDD PARAMETER ESTIMATES FOR FINNISH MUNICIPALITIES: POOLING ALL THRESHOLDS

Window	25%			15%		10%		5%	2.50%
Population polynomial	1st	2nd	3rd	1st	2nd	1st	2nd	1st	1st
				Dep. var: ln(expenditures)					
Without controls	-0.016	-0.014	0.015	-0.018	0.011	-0.004	-0.009	-0.016	-0.005
	(0.018)	(0.021)	(0.027)	(0.018)	(0.028)	(0.021)	(0.032)	(0.030)	(0.044)
With controls	-0.013	-0.014	0.006	-0.021	0.010	-0.006	-0.008	-0.017	-0.015
	(0.017)	(0.020)	(0.026)	(0.017)	(0.025)	(0.020)	(0.031)	(0.028)	(0.041)
Observations	7,078	7,078	7,078	4,108	4,108	2,826	2,826	1,520	794
				Dep. var: ln(operating expenditures)					
Without controls	-0.015	-0.014	0.011	-0.014	0.004	-0.006	-0.016	-0.019	-0.010
	(0.018)	(0.020)	(0.026)	(0.017)	(0.026)	(0.020)	(0.031)	(0.029)	(0.044)
With controls	-0.014	-0.016	0.004	-0.017	0.003	-0.007	-0.014	-0.020	-0.015
	(0.017)	(0.020)	(0.025)	(0.017)	(0.025)	(0.019)	(0.031)	(0.028)	(0.042)
Observations	7,020	7,020	7,020	4,098	4,098	2,820	2,820	1,516	790

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

All parameter estimates correspond to τ from equation 2.8. All regressions included threshold and year fixed effects. Controls included correspond measures of wealth and population composition of the municipalities taken from Pettersson-Lidbom (2012). Std. errors are clustered by municipality. I decided not to express the dependent variables in per capita terms (contrary to Pettersson-Lidbom (2012)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

Table 2.7: RDD parameter estimates for Finnish municipalities: pooling all thresholds & allowing for flexible functional form of the running variable

Window	25%		15%		10%		5%	2.50%
Population polynomial	1st	2nd	1st	2nd	1st	2nd	1st	1st
				Dep. var: ln(expenditures)				
Without controls	-0.018	-0.021	-0.020	0.007	-0.005	-0.010	-0.018	-0.012
	(0.018)	(0.021)	(0.018)	(0.027)	(0.021)	(0.033)	(0.029)	(0.044)
With controls	-0.016	-0.022	-0.023	0.006	-0.008	-0.010	-0.022	-0.021
	(0.017)	(0.020)	(0.017)	(0.025)	(0.020)	(0.031)	(0.028)	(0.041)
Observations	7,078	7,078	4,108	4,108	2,826	2,826	1,520	794
				Dep. var: ln(operating expenditures)				
Without controls	-0.017	-0.022	-0.017	-0.003	-0.009	-0.022	-0.023	-0.023
	(0.018)	(0.020)	(0.017)	(0.027)	(0.021)	(0.032)	(0.029)	(0.046)
With controls	-0.017	-0.024	-0.019	-0.004	-0.010	-0.022	-0.025	-0.027
	(0.017)	(0.020)	(0.017)	(0.025)	(0.019)	(0.031)	(0.028)	(0.044)
Observations	7,020	7,020	4,098	4,098	2,820	2,820	1,516	790

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

All parameter estimates correspond to τ from equation 2.10. All regressions included threshold and year fixed effects. Controls included correspond measures of wealth and population composition of the municipalities taken from Pettersson-Lidbom (2012). Std. errors are clustered by municipality. I decided not to express the dependent variables in per capita terms (contrary to Pettersson-Lidbom (2012)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

Table 2.8: RDD parameter estimates for Finnish municipalities: allowing the effect to be different across thresholds

Dep. Var	ln(expenditures)			ln(operating expenditures)		
Population polynomial	1st	2nd	3rd	1st	2nd	3rd
β_2 - from 17 to 21 seats	0.079	0.155	0.473**	0.103	0.145	0.453**
	(0.084)	(0.132)	(0.190)	(0.084)	(0.142)	(0.188)
β_3 - from 21 to 27 seats	0.046	0.246*	0.150	0.056	0.229*	0.287
	(0.058)	(0.149)	(0.271)	(0.054)	(0.136)	(0.242)
β_4 - from 27 to 35 seats	0.029	-0.266**	0.062	0.008	-0.236*	-0.019
	(0.053)	(0.133)	(0.196)	(0.055)	(0.132)	(0.185)
β_5 - from 35 to 43 seats	-0.309***	-0.108	0.955	-0.282**	-0.207	0.730
	(0.104)	(0.419)	(1.213)	(0.113)	(0.451)	(1.288)
β_6 - from 43 to 51 seats	-0.303***	-0.243	0.421	-0.320***	-0.277	0.349
	(0.056)	(0.215)	(0.656)	(0.062)	(0.225)	(0.650)
Observations	9,922	9,922	9,922	9,844	9,844	9,844

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

All parameter estimates correspond to those from equation 2.11. All regressions included threshold and year fixed effects. Controls included correspond measures of wealth and population composition of the municipalities taken from Pettersson-Lidbom (2012). Std. errors are clustered by municipality. I decided not to express the dependent variables in per capita terms (contrary to Pettersson-Lidbom (2012)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

Table 2.9: RDD parameter estimates for municipalities in the state of Hesse: pooling all Thresholds

Dependent Variable	25% wdw		20% wdw		10% wdw	
	f(pop)=1st	f(pop)=2nd	f(pop)=1st	f(pop)=2nd	f(pop)=1st	f(pop)=2nd
	Parameter estimates effect of council size when manager is appointed (β)					
ln(expenditures)	-0.019	-0.020	-0.016	-0.032	-0.043	0.038
	(0.0379)	(0.0573)	(0.0413)	(0.064)	(0.061)	(0.0854)
ln(personnel spending)	-0.025	-0.043	-0.035	-0.033	-0.034	0.000
	(0.0372)	(0.0571)	(0.0395)	(0.0652)	(0.0636)	(0.0956)
ln(material spending)	0.017	0.036	0.031	0.009	0.027	-0.007
	(0.0389)	(0.0559)	(0.0411)	(0.0616)	(0.0565)	(0.0892)
	Parameter estimates effect of council size when manager is elected ($\beta + \gamma$)					
ln(expenditures)	-0.0145	-0.0459	-0.0173	-0.0936	-0.0775	-0.0813
	(0.0056)	(0.0368)	(0.0072)	(0.1369)	(0.0984)	(0.0774)
ln(personnel spending)	0.00836	-0.0303	-0.0187	-0.0176	-0.0288	0.0175
	(0.0019)	(0.0161)	(0.0089)	(0.0048)	(0.013)	(0.0032)
ln(material spending)	-0.0306	-0.111**	-0.0492	-0.0922	-0.0895	-0.164*
	(0.0241)	(0.2204)	(0.0588)	(0.138)	(0.1417)	(0.3014)
Observations	4,060	4,060	3,464	3,464	1,816	1,816

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

Std. errors clustered by municipality. All regressions include threshold and year fixed effects to mean difference the dependent variable with its average value within thresholds and years. RDD parameter estimates for samples with appointed and elected managers were estimated jointly by interacting the covariates in equation 2.8 with an indicator equal to one for periods when the manager was elected and zero otherwise. I decided not to express the dependent variables in per capita terms (contrary to Garmann (2015)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

Table 2.10: RDD parameter estimates for municipalities in the state of Hesse: pooling all thresholds & allowing for flexible functional form of the running variable

Dependent Variable	25% wdw		20% wdw		10% wdw	
	f(pop)=1st	f(pop)=2nd	f(pop)=1st	f(pop)=2nd	f(pop)=1st	f(pop)=2nd
	Parameter estimates effect of council size when manager is appointed (β)					
ln(expenditures)	-0.026	-0.020	-0.019	-0.029	-0.043	0.036
	(0.033)	(0.041)	(0.033)	(0.045)	(0.041)	(0.059)
ln(personnel spending)	-0.028	-0.040	-0.037	-0.029	-0.032	0.007
	(0.032)	(0.039)	(0.032)	(0.042)	(0.039)	(0.062)
ln(material spending)	0.020	0.036	0.031	0.011	0.024	-0.003
	(0.036)	(0.043)	(0.037)	(0.048)	(0.044)	(0.069)
	Parameter estimates effect of council size when manager is elected ($\beta + \gamma$)					
ln(expenditures)	-0.016	-0.047	-0.02	-0.082	-0.078	-0.073
	(0.0373)	(0.054)	(0.0402)	(0.0608)	(0.0608)	(0.0847)
ln(personnel spending)	0.006	-0.038	-0.02	-0.017	-0.023	0.03
	(0.0375)	(0.0567)	(0.0397)	(0.0653)	(0.0657)	(0.0928)
ln(material spending)	-0.034	-0.114**	-0.056	-0.093	-0.093*	-0.154*
	(0.0385)	(0.0543)	(0.0403)	(0.0613)	(0.0556)	(0.0857)
Observations	4,060	4,060	3,464	3,464	1,816	1,816

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

Std. errors clustered by municipality. RDD parameter estimates for samples with appointed and elected managers were estimated jointly by interacting the covariates in equation 2.8 with an indicator equal to one for periods when the manager was elected and zero otherwise. I decided not to express the dependent variables in per capita terms (contrary to Garmann (2015)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

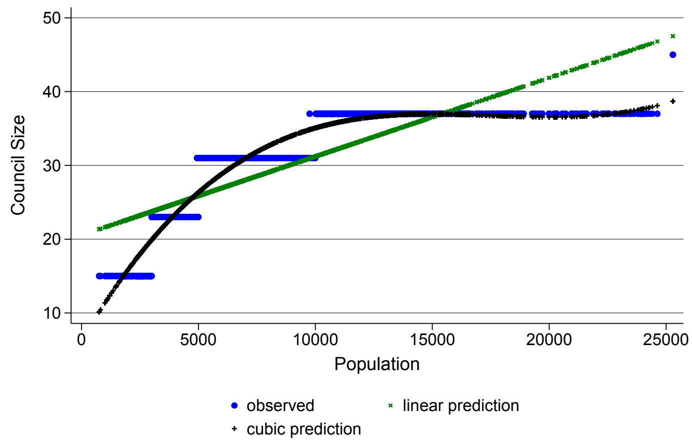
Table 2.11: RDD PARAMETER ESTIMATES FOR MUNICIPALITIES IN THE STATE OF HESSE: ALLOWING THE EFFECT TO BE DIFFERENT ACROSS THRESHOLDS

Dep. Var	ln(expenditures)			ln(material spending)		
Population polynomial	1st	2nd	3rd	1st	2nd	3rd
	Estimates effect of council size when manager is appointed (β)					
β_2 - from 15 to 23 seats	-0.018	0.121	0.966	-0.077	-0.151	0.198
	(0.125)	(0.334)	(0.778)	(0.111)	(0.333)	(0.750)
β_3 - from 23 to 31 seats	-0.083	-0.064	0.171	-0.037	0.077	-0.147
	(0.077)	(0.160)	(0.209)	(0.098)	(0.228)	(0.305)
β_4 - from 31 to 37 seats	-0.183*	-0.073	-2.192**	-0.235	0.278	-0.939
	(0.110)	(0.436)	(0.942)	(0.147)	(0.481)	(1.099)
Observations	4,238	4,238	4,238	4,238	4,238	4,238
	Estimates effect of council size when manager is elected ($\beta + \gamma$)					
β_2 - from 15 to 23 seats	0.031	-0.193	1.584	-0.458***	-0.773	1.083
	(0.134)	(0.458)	(1.392)	(0.165)	(0.557)	(1.445)
β_3 - from 23 to 31 seats	-0.091	-0.072	-0.011	-0.253**	-0.211**	-0.134**
	(0.091)	(0.097)	(0.061)	(0.116)	(0.100)	(0.061)
β_4 - from 31 to 37 seats	-0.223	-0.241	-2.171**	-0.241	-0.056	0.704
	(0.145)	(0.576)	(0.994)	(0.164)	(0.625)	(0.958)
Observations	2,070	2,070	2,070	2,070	2,070	2,070

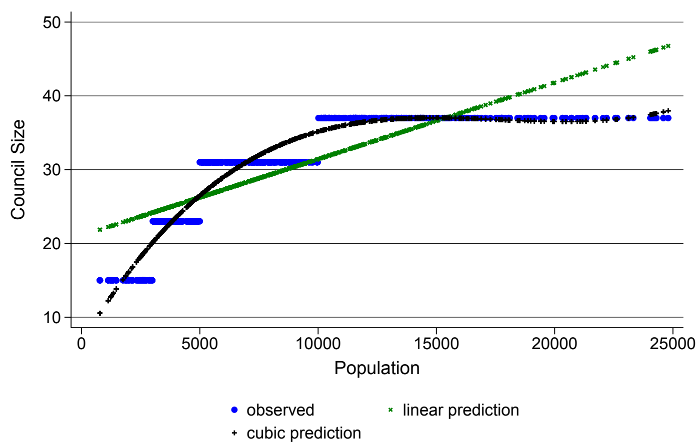
*** p<0.01, ** p<0.05, * p<0.1
Std. errors clustered by municipality. RDD parameter estimates for samples with appointed and elected managers were estimated separately. I decided not to express the dependent variables in per capita terms (contrary to Garmann (2015)) because of the polynomials for population included in the right hand side of the equation. However, the results are unaffected by the use of dependent variables in per capita terms, the main difference is that the estimates for population are not statistically significant when the dependent variable is expressed in per capita terms.

Figure 2.1: Observed and predicted values for a linear regression of Council Size on Population Estimates of German Municipalities

(a) Appointed managers

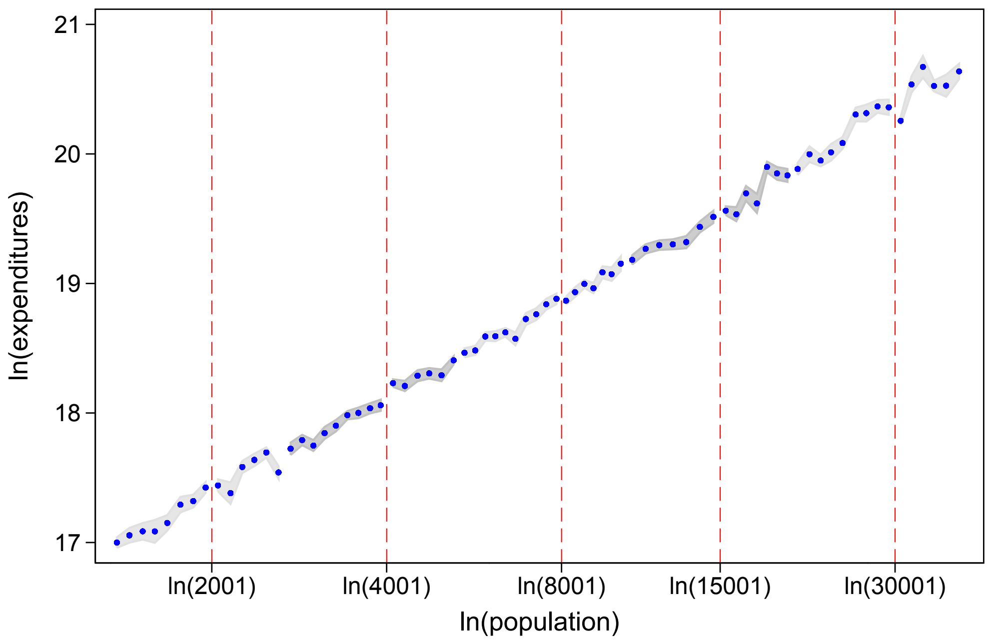


(b) Elected managers



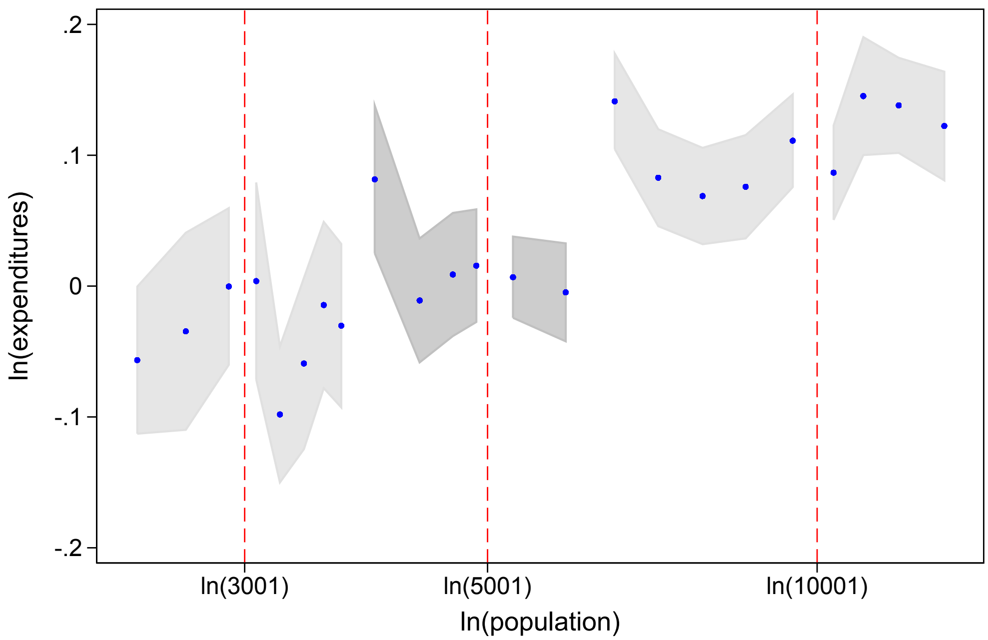
Note: Observations and predicted values reported in panel (a) correspond to the sample of municipality-year observations with an appointed manager. Those in panel (b) correspond to the sample of observations with an elected manager.

Figure 2.2: RD plots for Finland



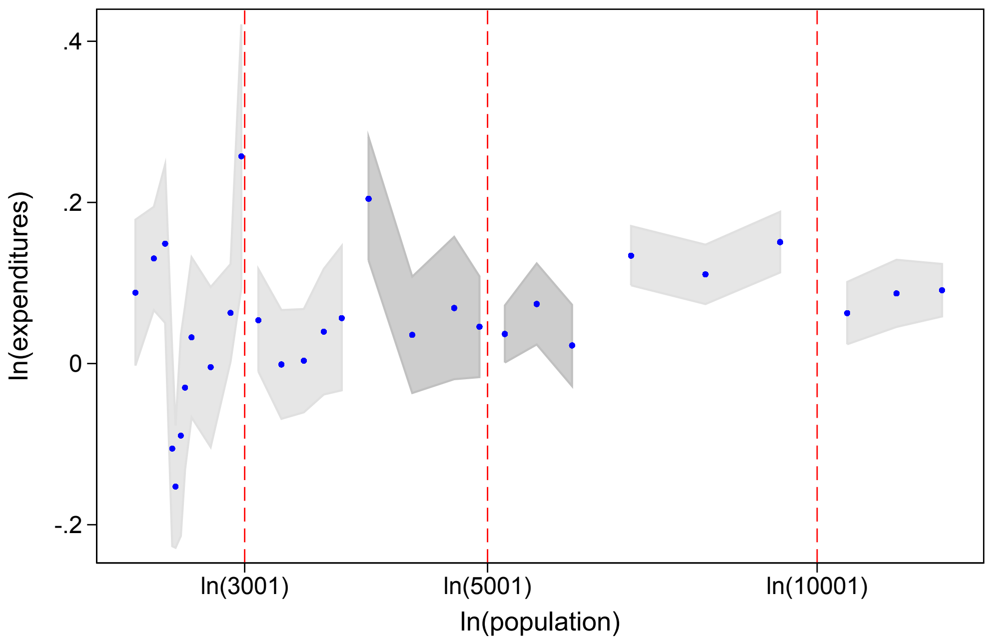
Note: Plots report average values for municipal expenditures within non-overlapping bins to the left and the right of a population threshold. Each RD plot was separately computed to avoid double-counting observations. Bins are computed using the quantile spaced (IMSE-QS) partitioning scheme introduced by Calonico et al. (2015)

Figure 2.3: RD plots for Hesse: Appointed Managers



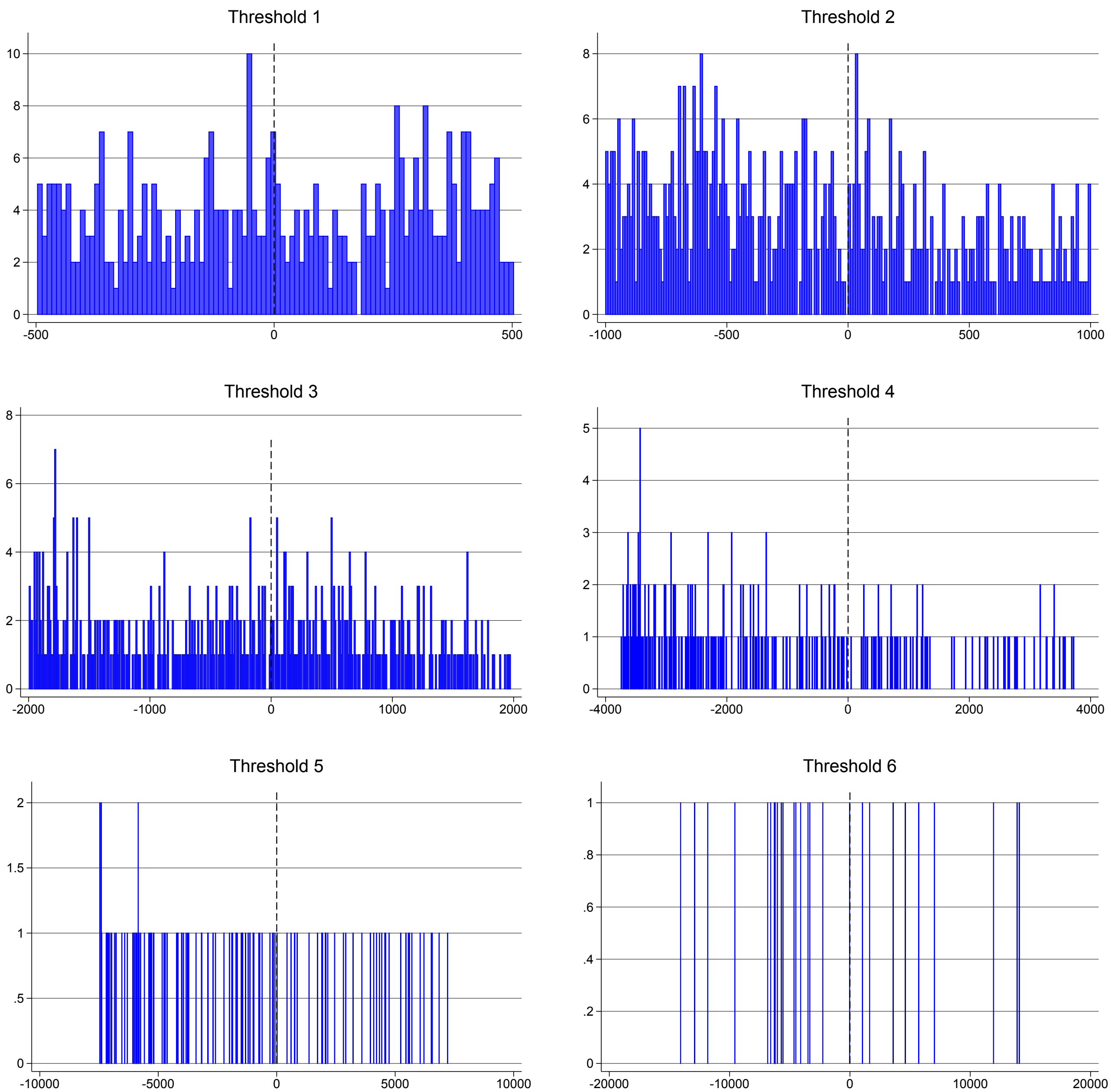
Note: Plots report average values for municipal expenditures within non-overlapping bins to the left and the right of a population threshold. Each RD plot was separately computed to avoid double-counting observations. Bins are computed using the quantile spaced (IMSE-QS) partitioning scheme introduced by Calonico et al. (2015)

Figure 2.4: RD plots for Hesse: Elected Managers



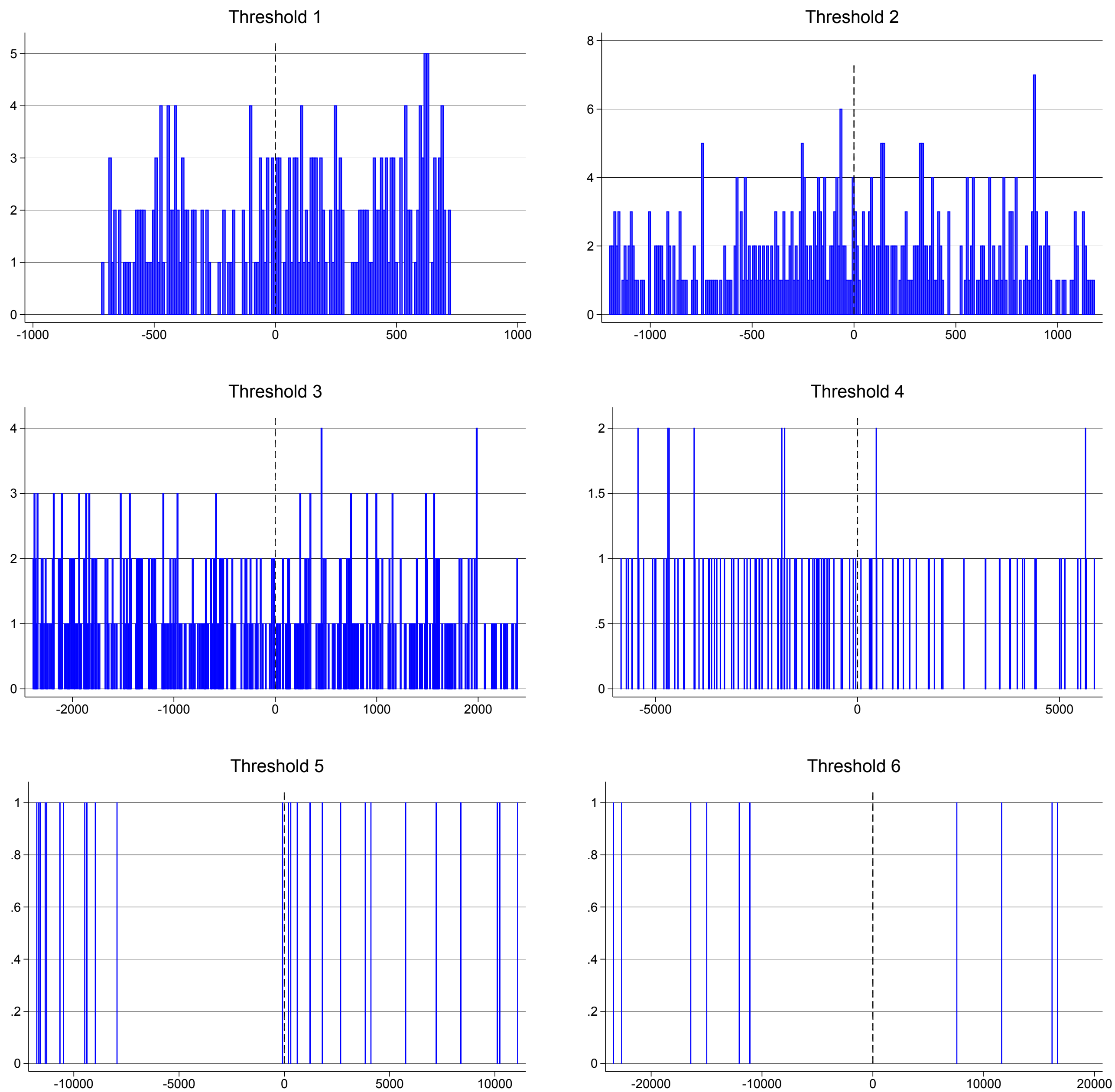
Note: Plots report average values for municipal expenditures within non-overlapping bins to the left and the right of a population threshold. Each RD plot was separately computed to avoid double-counting observations. Bins are computed using the quantile spaced (IMSE-QS) partitioning scheme introduced by Calonico et al. (2015)

Figure 2.5: Population Histograms for Finland



Note: Frequency histograms of the running variable for the two, four, eight, fifteen, thirty and sixty thousand people thresholds using observations in a twenty-five percent window around the cutoff value. The running variable is expressed as the population distance from each municipality to its nearest threshold.

Figure 2.6: Population Histograms for Hesse



Note: Frequency histograms of the running variable for the three, five, ten, twenty-five, fifty, and one-hundred thousand people thresholds using observations in a twenty-four percent window around the cutoff value. The running variable is expressed as the population distance from each municipality to its nearest threshold.

Chapter 3

The effect of changes in the number of elected representatives on public finances: Empirical evidence from Costa Rica

3.1 Introduction

The last three decades have seen a general trend towards decentralization, not only among developing countries but also in the developed world (Falleti, 2005; Faguet and Sánchez, 2014). Because in many cases this process entails the transfer of responsibilities such as the provision of education, health, water, transportation, and assistance to the poor from the central to the sub-national governments, a concern is whether local governments are able to handle these new responsibilities. Proponents of these reforms suggest that decentralization will increase transparency by bridging the gap between constituents and representatives. However, critics suggest that in countries with poor governance, this transfer of responsibilities might increase corruption because of the increased access to resources it affords the local elites (Bardhan, 2002).

Recent evidence suggests that the quality of local institutions is positively associated with the success of decentralization reforms

This paper focuses on a different channel that could be used to strengthen the accountability of local officials; namely, the division of power at the local level. Most local governments in developing countries are overseen by a mayor and a deliberative body of local representatives (referred to here as the council). It is possible that in proportional-representation electoral systems, an increase in the number of representatives might lead to an increase in the number of small parties that gain representation on the council (Reilly et al., 2005). To explore this possibility, this paper uses data from local governments in Costa Rica to estimate the effect of a change in the number of representatives on public finances. Costa Rican local governments are an interesting subject for testing this hypothesis because council members are elected through a proportional-representation system and through closed party lists so that citizens vote for parties, not individual candidates. For practical purposes this means that an increase in the number of representatives often increases the number of parties represented on the council.

In addition, the number of representatives in Costa Rican municipalities is determined using a discontinuous function of population. This allows for an implementation of a Regression Discontinuity (RD) design to estimate the effect of an increase in the number of representatives. An RD approach is particularly helpful when analyzing institutional variables, such as number of representatives, which do not vary much over time. It is also closer to a randomized designed than estimates obtained using instrumental variables or matching methods (Lee and Lemieux, 2010). However, the implementation of an RD design in this sample is susceptible to small sample problems due to the small number of municipalities in Costa Rica. To partially address this limitation, I use a parametric specification that uses observations from a broad window around the discontinuity.

Overall, there is no evidence that changes in the number of representatives affect tax collection efforts or the amount of expenditures on municipal services, investment projects, and the administration of the municipality. This could be the result of having outcome measures so broad that fail to capture the outcomes of the council, a small sample size that prevents identification, or that the decision-making process in the council is unaffected by the addition of members from different parties.[1]

The paper is organized as follows: the next section presents detailed information about the

[1] Anecdotal evidence from Costa Rica suggests that decisions made by the council require approval of a two-third majority and that representatives vote by parties. Both of these facts would suggest that even a single seat in the council could carry substantial weight in the decision-making process.

organization of local governments in Costa Rica, the role of municipal councils, and the budget process. Section 3.3 describes the data and provides summary statistics for the main variables. Section 3.4 introduces the estimation strategy and provides evidence that the estimation approach is appropriate for the sample. Section 3.5 reports and discusses the results, and Section 3.6 concludes.

3.2 Operation of Local Governments in Costa Rica

Costa Rica has a presidential form of government, with the president and the legislature being elected every four years by popular vote. For administrative purposes Costa Rica's territory is divided into seven provinces, which are then further subdivided into 81 *cantones* and 470 districts (see Figure 3.1). In addition to the central government there are subnational governments for each *canton*, referred to as municipalities and administered by a deliberative body denominated council and a mayor, both elected by popular vote. According to the municipal code established by Costa Rica's national legislature, the main roles of the municipal council are to review and evaluate the plan of government prepared by the mayor, approve the prices charged for municipal services, review the municipal budget presented by the mayor, and propose to the national assembly the passage of new laws of municipal interest.

Similarly, the mayor's responsibilities include attending to all council meetings (without the ability to vote), passing or vetoing the resolutions and agreements approved by the municipal council (with some exceptions), presenting to the council a plan of government at the beginning of his/her administration, presenting to the council every six months a report of approved expenditures, presenting to the council a proposal for the municipality's annual budget, assigning and removing the personnel of the municipality, and serving as the legal representative of the municipality.

Similar to other countries in Central America, Costa Rica has a strong central government and weak municipal governments. As Morales (2010) points out, spending by the central government in 2008 amounted to 15.7% of the national GDP, whereas spending by local governments amounted to 1.16% of the GDP. This is a sharp contrast with respect to more developed countries. For instance, according to Garmann (2015) spending by municipal governments in Germany amounts to one-third of the total government expenditures.

3.2.1 The Electoral Process

Municipal councils are elected through a proportional representation system with closed-party lists whereas mayors are elected using majority rule. Prior to 2002 mayors were appointed by municipal councils. This changed with a reform to the municipal code effectuated in 1998 and that came into effect in 2002. Among other things the reform allowed for the popular election of mayors. So far, there have been four elections for mayors during the years 2002, 2006, 2010, and 2016.[2]

A RD design is possible because the number of council seats in each municipality is assigned using a discontinuous function of population. Table 3.1 reports the number of council seats corresponding to each population threshold as well as the share of municipality-year observations with a given council size. The thresholds in table 3.1 are used to determine the number of council seats. Although population is a criterion for the amount of transfers each municipality receives from the central government, such transfers are not allocated based on population thresholds. This is relevant for the validity of my estimation strategy because the existence of multiple treatments at a given population threshold would require for the effect of one treatment to be untangled from the others.[3]

3.2.2 Municipal Revenues and Expenses

The main sources of revenue for municipal governments are taxes, payments from services provided (i.e., garbage collection), leases, credit, and transfers from the central government. The primary sources of tax revenue are the property tax (*Impuesto sobre bienes inmuebles*) and a patent tax on businesses, both of which are collected by municipalities.[4]

Most expenditures incurred by municipal governments fall into three categories: administrative expenses, communal services, and investments in infrastructure. According to Rojas (2008), the main services provided by municipalities are maintenance of streets and roads, garbage collection, maintenance of cemeteries and parks, administration of public markets, the maintenance of the

[2]Prior to 2016 the elections for mayors had not taken place at the same time as the elections for council members. In particular, council members were elected during the presidential and national legislature elections in the month of February whereas mayors were elected on the first Sunday of December. This meant that mayors took office a year after the council. Thus, the elections for municipal governments that were due in 2014 were canceled and re-scheduled for 2016. This was the result o a major reform that seek to divorce the election of municipal councils from the elections of the central government and to allow for mayors and municipal councils to be elected at the same time.

[3]See Ade and Freier (2011) for a discussion about the use of population thresholds on regression discontinuity designs.

[4]The property tax is currently computed as 0.25% of the value of a property. Moreover, out of the total revenues collected from the property tax the municipality must transfer 10% to the canton's education committee, 3% to the administrative committee of the national cadastre and 1% to Costa Rica's Internal Revenue Office (Ministerio de Hacienda).

sewage system, and the construction of sidewalks and roads.

3.2.3 The Budget Process

The budget process for municipal governments in Costa Rica can be thought of as having three stages. First, the mayor prepares a proposal of the budget. At this stage the mayor has freedom in proposing the size of the budget and the distribution of expenditures in different categories. However, the size of the budget should be consistent with expected revenue and proposed expenditures should follow the plan of government that the mayor presented at the beginning of her administration.

By the end of August the budget proposal is sent to the municipal council. The council then organizes a commission to review the budget (usually made up of council members and outside advisors) which can make adjustments to both the size of the budget and the distribution of expenditures. The amended budget must be approved by a majority of the council members by the end of September and then sent to the Government Auditing Office (*Contraloria General de la República*) for final approval.

Thus, the mayor has no veto powers over the changes made to the budget by the council. Also, anecdotal evidence suggests that most disagreements between the mayor and the council (or between council members) are related with the amount of expenditures in particular projects. This is consistent with the idea that council members try to incorporate projects for their constituents or a particular interest group. However, contrary to the traditional common pool problem, the council is not free to increase the size of the budget indiscriminately, since it would run the risk of having the Government Auditing Office reject the budget. In such a scenario, the municipality would have to implement the budget from the previous year.[5]

3.3 Data and Summary Statistics

Information about the expenditures of municipal governments was obtained from Costa Rica's Government Auditing Office (*Contraloría General de la República*) and is available for all 81 municipalities. The electoral data regarding the number of council seats in every municipality as well

[5] While municipalities can make adjustments to the budget after it has been approved by the Government Auditing Office, the number of adjustments is limited to four per year and each adjustment must also be approved by the Government Auditing Office.

as the results from municipal elections were obtained from Costa Rica's Tribunal Supremo Electoral (TSE) which is the entity responsible for organizing and conducting the elections. Demographic information and data on the value of new construction projects were obtained from the National Institute of Statistics and Censuses (INEC).

The dataset includes information for all municipalities during the period 2006-2014. However, this paper focuses only on municipalities with councils of five, seven, and nine seats because 96.3% of the observations fall in these categories. Table 3.2 reports summary statistics for the main variables organized by council size. For instance, the upper panel in Table 3.2 reports average values for geographic and sociodemographic characteristics. Notice that there are no major differences in the demographic composition among municipalities with fewer or more representatives, in terms of age composition of the population or teenage pregnancies.

The middle panel in Table 3.2 reports the shares of municipal expenditures and revenues from different sources. It is worth noting that more populous municipalities spend a larger fraction of their budget on services. This is consistent with anecdotal evidence from Costa Rica suggesting that larger municipalities provide more services such as police and museums. Note also that local tax revenues represent a larger fraction of the revenues received by municipalities. This is consistent with the literature of local governments in Latin America and reflects the fact that municipalities in Costa Rica provide a limited number of services. In countries such as Colombia and Bolivia where decentralization has increased the number of responsibilities bestowed on local governments, the fraction of revenues received from intergovernmental transfers is much larger because most decentralization processes in Latin America have struggled with raising the revenue-generating capabilities of the municipalities.

Table 3.2 also reports summary statistics for the political composition of the council. Overall, larger councils have members from more parties and a smaller share of seats held by local parties. In particular, Costa Rica's political landscape is dominated at the local level by two major parties, the *National Liberation* and the *Social Christian Unity* parties. For instance, about 88% of the mayors elected during my sample belong to one of these parties. For the reader's convenience, table 3.3 reports summary statistics for the same variables but for the entire sample.

3.4 Estimation Strategy

A causal effect of council size in Costa Rica can be estimated by a RD design because council seats are assigned using a discontinuous function of population (see table 3.1. This approach is appealing because is much closer to a randomized design than other evaluation strategies such as IV's (Lee and Lemieux (2010)). In particular, a RD design would be valid provided that: there are no other co-treatments at the population thresholds and localities do not have precise control over the treatment. That is, municipalities can not precisely sort themselves on a given side of the population threshold. The next section provides evidence that both of these conditions hold in the sample.

Following Lee and Lemieux (2010) I implement an estimation strategy that consists of two local regressions, one on each side of the threshold. The pooled regression equation is the following

$$\ln(y_{it}) = \alpha_l + \alpha_d D_{it} + \beta_l f(pop_{it}) + \beta_d f(pop_{it}) D_{it} + \mathbf{X_{it}} \boldsymbol{\beta} + \tau_t + \varepsilon_{it} \tag{3.1}$$

where indexes i and t refer to municipality i and time period t, respectively. Define $y_{i,t}$ as per capita municipal expenditures, $pop_{i,t}$ as the relevant population at the municipality (expressed as share of the national population), D_{it} is an indicator variable equal to one for observations at the right of the threshold and zero otherwise, and $\mathbf{X_{it}}$ is a vector of additional controls related with population (e.g., the share of people more than 65 years old).

3.4.1 Validity of the RD Design

As mentioned in the previous section, a RD design is only appropriate if municipalities have no precise control over the assignment variable and if there are no other co-treatments at the thresholds. This section presents supporting evidence that these assumptions hold in my sample.

The assignment variable in my sample corresponds to the population estimates for the years before the elections, since the number of council seats to be contested are allocated a year in advance of the elections. In the sample, these are the population estimates for the years 2005 and 2009. The histogram for these population estimates is presented in panel (a) of figure 3.2 for all municipalities in Costa Rica. Notice that most of the municipalities have less than 4% of the national population. In particular, 96.2% of the observations are below the 4% threshold and 91.7%

have less than 3% of the national population. Thus, in order to guarantee that there are some observations in the neighborhood of the thresholds, the analysis focuses on municipalities with at most 3% of the national population. A histogram for the reduced sample is presented in panel (b) of figure 3.2.[6]

Examining Confounded Treatments

There is no specific test to assess for the existence of confounded treatments other than a careful and thorough review of the operation of local governments. I reviewed the regulation determining government transfers, the salary of the mayor, the salary of the council, and access to credit by the municipalities; and found that none of these variables are a function of the population thresholds from table 3.1.

Moreover, because the current population thresholds were introduced through a reform to the municipal code in 1998, I reviewed the records of the meeting in which the national legislature approved the new code to get a sense of whether the new thresholds were the result of gerrymandering. From the records of the meeting it is clear that the main changes, as perceived by most legislators, were that: 1) the code revoked the ability of the council to appoint and remove the mayor, now elected by popular vote, 2) district councils previously appointed by the municipal council were to be elected by popular vote, and 3) the elections of the mayor and district councils were set to occur at a different month but during the same electoral year as the presidential elections. There was no evidence that the population thresholds were a central subject in the reform to the municipal code. Moreover, the legislator who drafted the new municipal code belonged to a party which lost seats in most municipalities due to the transition to the new code.

Examining Sorting

To test for the possibility that municipalities have precise control over the assignment variable, I examine histograms of the population distance from each municipality to the threshold. In particular, a change in the density of municipalities in the neighborhood of the threshold would be indicative that some municipalities have precise control over the assignment variable (Lee and Lemieux, 2010).

Figure 3.2 reports histograms for the population distance of the assignment variable around the 1% and 2% population thresholds. Notice that there is no evidence of changes in the density

[6] In Costa Rica, population estimates for each municipality are not collected every year but rather build out of the most recent census. The estimates are prepared by the National Institute of Statistics and Censuses (INEC) and the Central American Center for Population (CCP).

of the assignment variable at either of the thresholds. Moreover, the histogram for observations in the neighborhood of the 2% threshold indicates that inference about the effect of council size would require extrapolation from observations away of the cutoff.

Examining distribution of additional covariates

Continuity of other baseline covariates at the threshold is usually considered a good test for the assumption that variation in the treatment is approximately randomized. The idea is simple, if local governments do not have precise control over the assignment variable then the distribution of baseline covariates at the threshold should be continuous. With this mind, I test for difference of means on measures of demographic composition and wealth of the municipalities around the 1% threshold (since this is my preferred specification).

Table 3.4 reports the p-values for tests of difference of means for the baseline covariates, each column in the table refers to a different window size around the 1% threshold. For instance, column two includes all observations around the 1% threshold but below the 2% threshold, this is the broadest window. On the other hand, column six includes all municipalities with more than 0.9% but less than 1.1% of the national population, this is the smallest window. The last two rows in the table indicate the number of observations to the right and to the left of the threshold for each window size.

The first four covariates in Table 3.4 are directly related with the assignment variable. As the analysis moves from the largest to the smallest window, the differences in average values between observations below and above the threshold become statistically significant for share of population over sixty-five, share of population younger than fifteen, and share of new births from teenagers. The fact that the population composition variables are statistically different in the neighborhood of the threshold could be the result of the small sample size. Regarding the variables related with the wealth of a municipality, such as number and value of new construction projects and total energy consumption, I find that for large window sizes average values on each side of the threshold are statistically different from one another but the differences fade away as the window size narrows.

I interpret these results as reflecting the bias-variance trade-off. Extending the window too far from the threshold reduces the likelihood that the municipalities being compared are similar in terms of baseline covariates. However, estimates from a narrow window around the threshold will be less precise and will also be subject to bias when the sample size is too small, since every observation will have a large weight in the estimate of the local mean. With this in mind, I keep the size of the window at 33% in my preferred specification.

3.5 Results

Ideally, I would like to identify the effect of council size on all the decisions taken by the councils. In particular, recall that municipal councils in Costa Rica are responsible for: approving and amending the budget proposed by the mayor, approving the tariffs charged for municipal services, approving (electing sometimes) the winners of procurement auctions for municipal projects, and developing proposals for changes in the property tax[7].

Out of the outcomes mentioned above, there is only information on the expenditures and revenues by municipal governments. Because of this, I begin by looking at changes in total expenditures only. Intuitively, I would expect to find no council size effect on total expenditures since municipalities can not freely adjust their sources of revenue. This is specially true for small municipalities whose primary sources of income are tax revenue and transfers from the central government.

Thus, if anything, I expect to find a council size effect for specific categories of expenditures. For example, council members might prefer to increase spending in projects that are of benefit to their constituencies over increasing spending in municipal services.[8] If this is the case, an increase in the number of representatives would lead to an increase in the share of investment expenditures and a decrease on the share of expenditures in services (Weingast et al., 1981).

3.5.1 Graphical Evidence

Before looking at the parameter estimates from the RDD specification, I present RD plots for the main variables of interest. Specifically, I construct these plots using the STATA command introduced by Calonico et al. (2014b) which implements a quantile-spaced partitioning scheme that constructs bins with roughly the same number of observations. This is desirable in my sample given the sparsity of the data (see figure 3.3).

Figure 3.4 reports RD plots for municipal expenditures (in natural log), the share of municipal revenues from local taxes, and the share of expenditures on personnel and the administration of the municipality. In particular, I look at administrative and personnel expenditures because these

[7]Although municipalities have the authority to collect the property tax, they cannot adjust the rate of tax. Only the national legislature can approve for changes in the property tax of a municipality

[8]Notice that even if council members are elected in an *at-large* system, they might still have specific constituencies that they would like to favor.

are the areas where the mayor would have more discretion. Thus, a discontinuity in these categories of expenditures would be consistent with a scenario where an increase in council size leads to greater oversight of the executive (see Pettersson-Lidbom, 2012; Garmann, 2015).

The plots in figure 3.4 reveal that there is a large variability in the sample. This is partially due to the discrete characteristic of the running variable and to the small sample size. In particular, there is no evidence of a discontinuity at the first population threshold for the expenditure variables. There is however some evidence of a discontinuity for the share of revenues coming from local taxes at the 1% threshold. In particular, while there is a lot of variation on the estimates on either side of the threshold, the estimates to the left seem to be consistently above those immediately to the right of the threshold.

Regarding the threshold at 2%, two observations stand out. First, there is no discontinuity at the threshold for any of the variables. While there seems to be a discontinuity for the share of revenues from taxes, it is a product of the point estimate to the left of the threshold being abnormally high, even relative to the rest of estimates to the left of the cutoff. More importantly, is clear from figure 3.4 that there are no observations in the neighborhood of the threshold and that any inference would require extrapolation from observations away from the discontinuity. Taken together, I interpret this preliminary evidence as failing to reject the null hypothesis that an increase in the number of representatives has no effect on municipal revenues and expenditures.

3.5.2 Parameter estimates from an RD specification

I report now parameter estimates for the effect of council size from equation 3.1. Recall that α_d is the parameter of interest, capturing the difference in the intercepts between local regressions to the left and right of the threshold. As mentioned before, the estimated equation allows for the effect of the assignment variable to be different on each side of the threshold, includes controls for baseline covariates and year fixed effects, and clusters the standard errors by municipality. These results are reported in table 3.5.

All parameter estimates in table 3.5 correspond to α_d from equation 3.1. The columns indicate the degree of polynomial used for the running variable and whether baseline covariates were included as controls. The first five rows report estimates for regressions with different categories of expenditures as the dependent variable and the last four rows report estimates for regressions with different sources of revenues as the dependent variable. Notice that few parameter estimates are statistically significant. More important, most estimates are not robust to the inclusion of a higher order polynomial for the assignment variable. The estimates also change substantially when baseline covariates are included in the regression. Thus, the results from the RD specification support the evidence from the RD plots and fail to reject the null hypothesis that a change in council size from five to seven members in Costa Rican municipalities has an effect on municipal expenditures and revenues.

3.6 Conclusion

This paper studies the effect of a change in the number of representatives on public finances using data from municipal governments in Costa Rica. It focuses on these governments because they share many characteristics common to local governments in developing countries. For instance, their main sources of revenues are property taxes and intergovernmental transfers; their roles involve the provision of basic services such as potable water and maintenance of roads, and they are governed by a mayor and a council of representatives. My findings suggest that an increase from five to seven representatives in municipalities with about one percent of the national population has a negligible impact on local tax revenues and expenditures on services, personnel, and investment projects, in spite of the fact that changes in council size lead to an increase in the number of parties on local councils.

The lack of evidence in support of the hypothesis that changes in the composition of the council affect the performance of these governments is probably the result of the small sample size used in this study or of the lack of good measures for outcomes such as corruption and pork barrel spending in these governments. Given current efforts in Costa Rica and other Latin American governments to strengthen the role of municipalities, future research analyzing the effects of such variables as partisanship, number of representatives, council diversity, information about public officials, and electoral rules focusing on the performance of local governments is needed in order to make a better case for decentralization reforms.

Table 3.1: Costa Rica's Population Thresholds.

Population Thresholds	Council Seats	No. Obs	Share of Obs.	Share of National Population
$< 1\%$	5	400	61.73	29.97
1% - $< 2\%$	7	148	22.84	25.62
2% - $<4\%$	9	76	11.73	26.39
4% - $<8\%$	11	20	3.09	14.39
$\geq 8\%$	13	4	0.62	7.28

Note: Population thresholds are expressed as a percentage of the national population since 2002. Share of national population is computed as the average share of the national population in each category over the period 2006 - 2014.

Table 3.2: Average values for main variables by council size

Variable	No. of Representatives 5	7	9
Geographic & Demographic Variables			
Population	27020.17	62066.74	112718.30
share population<15	26.38	26.12	25.63
share population>65	6.42	6.31	5.94
No. Districts	4.78	6.08	7.92
Area (km^2)	513.40	700.35	1019.40
Share births from women 10-17	8.68	8.48	8.98
Value new construction (millions CRC)	3797.83	7809.91	13005.26
No. of new projects	251.13	441.22	821.04
Energy consumption (GWh)	50.19	96.64	230.88
Public Finances			
Share administrative expenditures	32.32	33.52	35.88
Share investment expenditures	34.04	26.98	22.37
Share expenditures on services	28.28	34.48	39.08
Share earmarked expenditures	5.35	4.34	2.68
Share revenues from taxes	41.90	43.24	52.96
Share rev. from Central Gov. transfers	28.86	22.01	15.40
Share revenues from loans	2.22	2.22	1.16
Political Variables			
No. parties in the council	3.27	4.19	4.75
HHI of parties in the council	0.37	0.30	0.27
Share of seats held by local parties	5.00	6.56	0.93
Share of seats held by the party of the mayor	41.79	36.31	36.01

Note: The sample includes all municipalities with less than three percent of the national population for the period 2006-2014. However, some variables are not available for all years in the sample.

Table 3.3: AVERAGE VALUES FOR MAIN VARIABLES

Variable	Obs.	Mean	Std. Dev.	Max	Min
Geographic & Demographic Variables					
Population	596	42624.87	28693.95	140699.00	5590.00
share population<15	596	26.25	3.66	36.96	17.86
share population>65	596	6.35	1.38	10.11	3.07
No. Districts	596	5.36	2.52	16.00	1.00
Area (km^2)	596	600.57	680.44	2809.93	6.96
Share births from women 10-17	596	8.65	3.08	18.27	0.00
Value new construction (millions CRC)	596	5535.66	7781.39	50077.58	293.54
No. of new projects	596	344.23	269.65	2277.00	50.00
Energy consumption (GWh)	596	76.27	85.31	542.65	3.78
Public Finances					
Share administrative expenditures	593	32.91	8.60	71.71	0.00
Share investment expenditures	593	31.35	14.65	85.10	0.00
Share expenditures on services	593	30.69	12.08	56.98	0.00
Share earmarked expenditures	593	4.88	6.39	44.47	0.00
Share revenues from taxes	593	43.13	14.82	82.10	8.51
Share rev. from Central Gov. transfers	593	26.07	19.01	87.12	0.00
Share revenues from loans	593	2.13	4.99	33.32	0.00
Political Variables					
No. parties in the council	596	3.62	0.92	6.00	2.00
HHI of parties in the council	596	0.34	0.09	0.52	0.18
Share of seats held by local parties	596	5.06	8.28	28.57	0.00
Share of seats held by the party of the mayor	596	39.96	13.10	60.00	11.11

Note: The sample includes all municipalities with less than three percent of the national population for the period 2006-2014. However, some variables are not available for all years in the sample.

Table 3.4: P-values for tests of difference of means for additional covariates

	Window Around the 1% threshold				
Variable	0 - 2%	0.5 - 1.5%	0.7 - 1.3%	0.8 - 1.2%	0.9 - 1.1%
Population	0.0000	0.0000	0.0000	0.0179	0.1311
Share population age<15	0.3908	0.4356	0.0449	0.0000	0.0000
Share population age>65	0.3815	0.3386	0.1955	0.0163	0.0110
Share new births from women age 10-17	0.3425	0.8882	0.0712	0.0000	0.0000
Value new construction (millions CRC)	0.0000	0.0046	0.6680	0.9307	0.4963
No. of new construction projects	0.0000	0.0004	0.0265	0.1136	0.4212
Energy consumption (GWh)	0.0000	0.0015	0.3946	0.1867	0.0029

Table 3.5: Parameter estimates for the ATE at the 1% threshold

Variable	w/o baseline covariates		w/ baseline covariates		Observations
	f(pop)=1	f(pop)=2	f(pop)=1	f(pop)=2	
ln(expenditures)	-0.376	-0.047	-0.077	0.222	206
	(0.250)	(0.262)	(0.189)	(0.145)	
ln(administrative expenses)	-0.475*	-0.377	-0.014	0.068	205
	(0.243)	(0.275)	(0.142)	(0.187)	
ln(expenses on services)	-0.854***	-0.354	-0.191	0.226	205
	(0.303)	(0.375)	(0.177)	(0.151)	
ln(investment expenses)	-0.176	0.310	-0.172	0.343	205
	(0.348)	(0.476)	(0.311)	(0.241)	
ln(earmarked expenses)	-0.866	1.202	-1.661	0.642	206
	(1.390)	(1.974)	(1.977)	(1.821)	
ln(revenues)	-0.436	-0.478	0.154	0.155	208
	(0.465)	(0.582)	(0.494)	(0.562)	
ln(tax revenues)	-0.709	-0.696	0.148	0.179	208
	(0.435)	(0.587)	(0.453)	(0.563)	
ln(property tax revenues)	-0.518	-0.470	0.210	0.201	208
	(0.444)	(0.528)	(0.415)	(0.498)	
ln(central govt. transfers)	-0.960	-1.735	-1.021	-1.316	208
	(1.066)	(1.892)	(0.893)	(1.514)	

*** p<0.01, ** p<0.05, * p<0.1
All parameter estimates correspond to parameter α_d in equation 3.1. All regressions include year-province fixed effects. Baseline covariates include $ln(area)$, share of population age 15-65, share of population older than sixty-five, and $ln(GWh)$. Std. errors clustered by municipality.

Figure 3.1: Provinces and Municipalities of Costa Rica

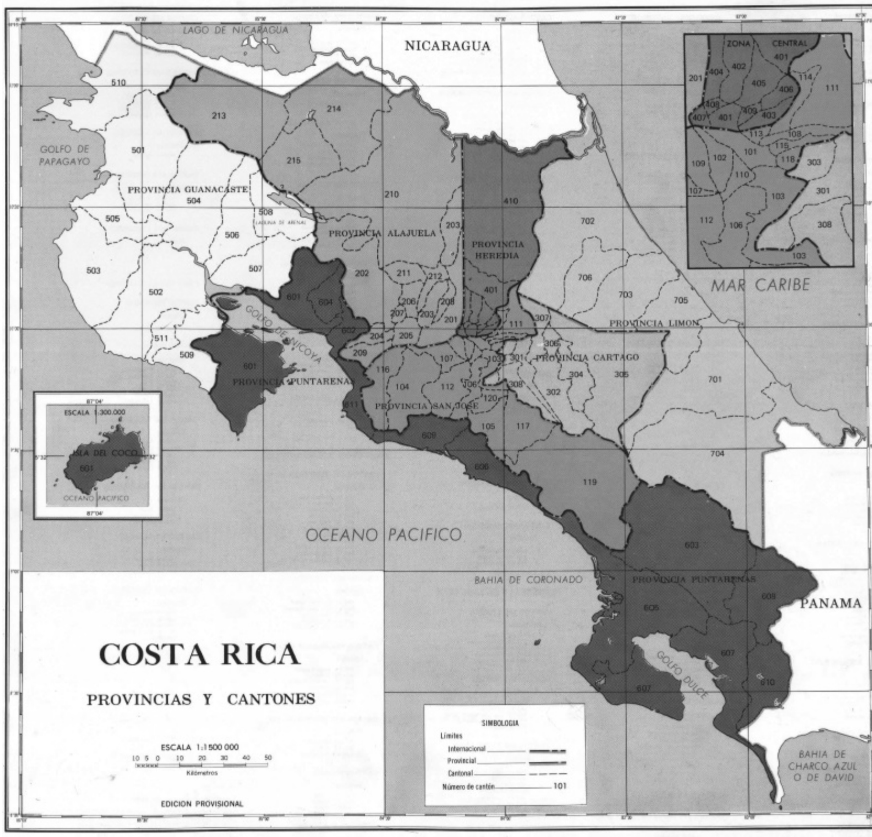
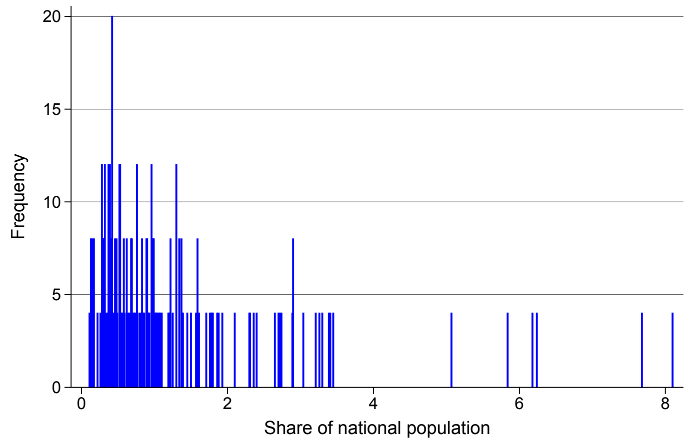
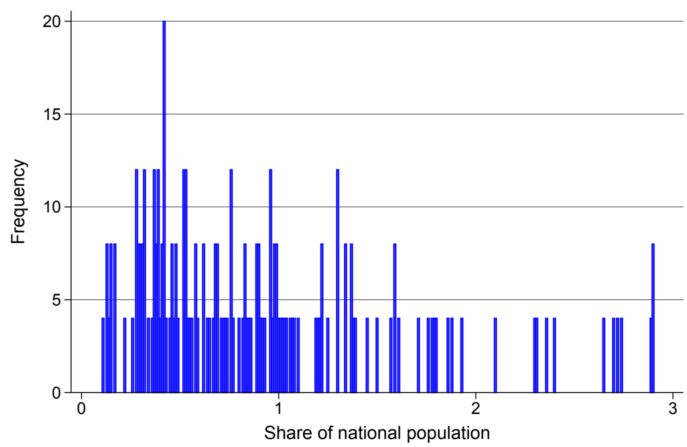


Figure 3.2: Distribution of the Assignment variable

(a) All municipalities

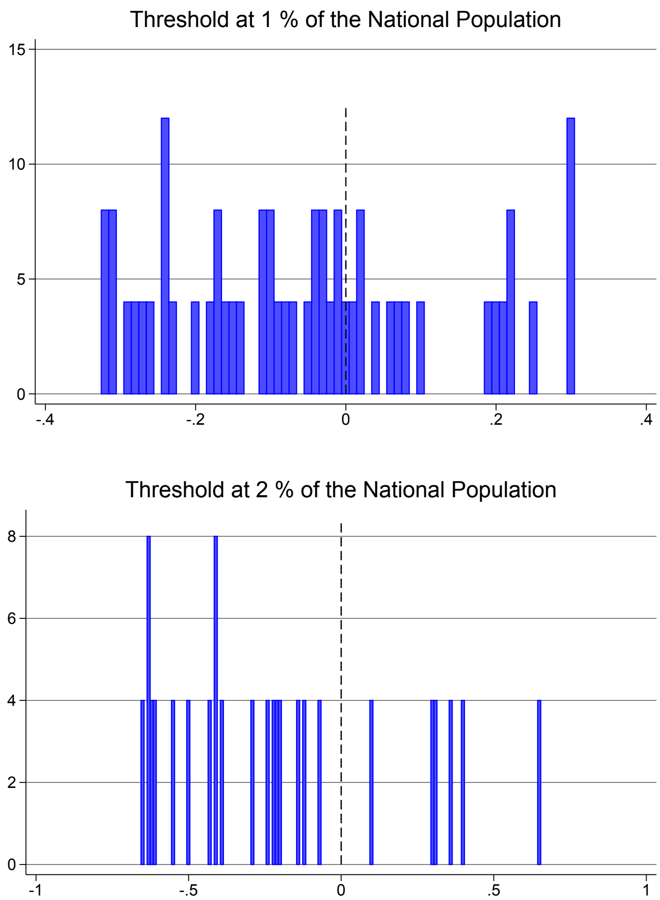


(b) Municipalities with less than 3% of the national population



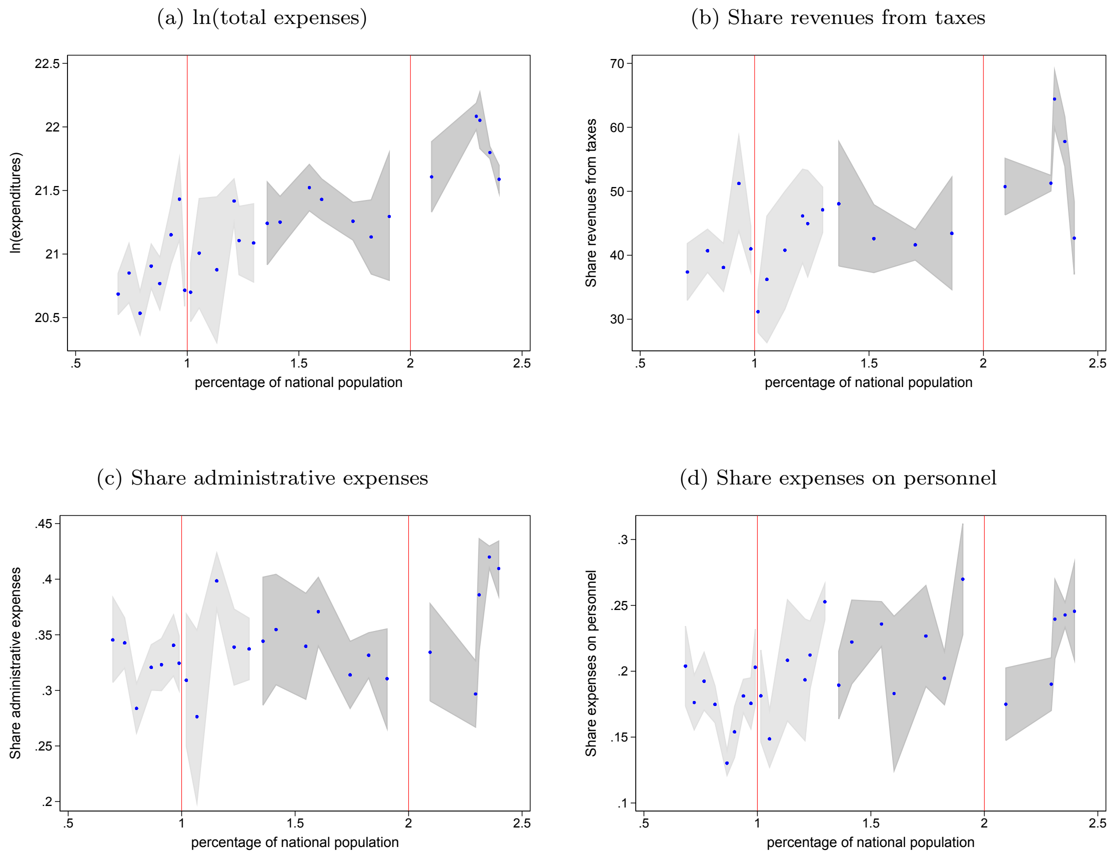
Note: Width of the bins is set at 0.1 percent of the national population.

Figure 3.3: Population Thresholds



Note: Frequency histograms of the running variable for the thresholds at one and two percent of the national population using observations in a thirty-three percent window around the cutoff value. The running variable is expressed as the distance from each municipality to its nearest threshold and the width of the bins is set at 0.1 percent of the national population.

Figure 3.4: RD PLOTS FOR POPULATIONS AROUND THE 1% AND 2% THRESHOLDS



Note: Plots report average values for each covariate within non-overlapping bins to the left and the right of a population threshold. The running variable is a the population in a municipality expressed as a percent of the national population. Bins are computed using the quantile spaced (QS) partitioning scheme introduced by (Calonico et al., 2015).

Appendices

Appendix A Examining the Possibility of Confounded Treatments in Colombian Local Governments

A.1 Transfers from the Central Government

As mentioned in the main text, the decentralization process in Colombia culminated with the transfer of responsibilities, from the central government to municipalities and *departamentos*, in the provision of services such as water and sewerage, education, health, and road maintenance. However, municipalities and *departamentos* did not have, and still lack, enough resources to cope with these responsibilities. Because of this, the central government established a system of intergovernmental grants.

An understanding of the system of transfers is important due to the large fraction that transfers represent out of total revenues for municipalities and *departamentos*. In particular, while there exist multiple channels through which the central government delivers resources to subnational entities, the largest transfer is directed to pay for services in the provision of water, health and education. Between 1993 and 2001, the transfers for these services were delivered though a program called *participaciones municipales* and after 2001 through a program called *Sistema General de Participaciones* (SGP). In the next paragraphs I discuss in detail both, the criteria to decide the total amount of transfers under these programs and the criteria determining the allocation of funds from these programs. Specifically, I find no link between the amount and rules in the allocation of funds from these programs and the population thresholds used to allocate council size.

Table 6 reports the criteria used to determine the total amount of funds that municipalities received through the *participaciones municipales* and SGP programs. In particular, under the old program (*participaciones municipales*), the total amount of funds to be transfered was determined as a fixed percentage of the current income of the central government. This lead to an accelerated growth in the amount of transfers to municipalities and to an increase in the fiscal deficit of the government (Sánchez and Pachón, 2013; Alesina et al., 2005). Because of this, the growth in transfers through the SGP was set instead at an annual fixed rate.

Column (3) in Table 6 reports the breakdown of the funds. Notice that currently, 83% of the total funds from the SGP are earmarked for the provision of education and health, up from 55% under the old program.

Moreover, column (4) list the criteria used to allocate funds to municipalities. Notice that under the new program, different indicators are taken into account for each of the categories of expenditures. In particular, while under both programs population has always been a criteria for the allocation of funds, it is total population and not a discontinuous function of population that is used to designate transfers.[9]

The only population threshold that I found affected the allocation of transfers from the SGP was at 25,000 people. In particular, of the 5.4% of the SGP funds reserved for investments under the category of general-purpose, 17% of these funds are allocated only among municipalities with less than 25,000 people. The remaining 83% is then allocated across all municipalities. Notice that none of the population thresholds used to allocate council size coincides with the 25,000 people threshold (see Table 1.1 in the main text).

Moreover, municipalities differ in how much freedom they have in spending the resources from the SGP. In particular, restrictions in the use of funds are done using the classification of municipalities presented in Table 7. This classification ranks municipalities in terms of economic importance according with two criteria, current revenues and population. Specifically, notice that the population thresholds for municipalities in categories five and six are the same as two of the population thresholds assigning council size. While this would suggest a confounded treatment, a careful inspection of the law reveals that this is not the case. In particular, the law states that municipalities meeting the revenue criterion but not the population criterion are able to move up in the classification. However, municipalities meeting the population criterion but not the revenue criterion are not able to move up. That is, the binding criterion for the classification of municipalities is annual revenue and not population.

To guarantee that the revenue criterion is in fact being use to classify municipalities I obtained the most recent classification from the *Departamento Nacional de Planeacion*. This entity uses the classification to monitor the use of the transfers from the SGP by the municipalities and is therefore a reliable source. Specifically, I find that as of 2016, 88% of the municipalities are still classified in the sixth category of economic relevance. However, according with population estimates, only 24% of the municipalities have populations below ten thousand people. That is, if

[9] I have not included the specific weight of each indicator under the SGP program because there have been continuous changes in the number of indicators and the weight assigned to each indicator. However, from multiple phone-calls with the *Grupo de Financiamineto Territorial* at the *Departamento Nacional de Planeacion*, the entity that administers the SGP, I know that population thresholds have never been used as a criteria in deciding the amount of transfers to municipalities.

the population criterion were to be used to classify municipalities we should observe almost 54% of the municipalities in higher categories.

Royalties

Another source of transfers are royalties from natural resources. Historically, about 80% of the royalties would be assigned to the municipalities and *departamentos* where the natural resources were located, as well as the ports used to ship the commodities. The remaining 20% was allocated through the *Fondo Nacional de Regalias* (FNR). These funds were earmarked for investment projects related with the provision of energy and were awarded to municipalities that submitted valid project proposals. Thus, these funds were not assigned using the population thresholds from Table 1.1.

In 2012 the FNR was replaced by the *Sistema Nacional de Regalias* (SNR). The new program was established to redistribute more of the royalties away from to the municipalities and *departamentos* were the natural resources are produced to the rest of municipalities in the country.

A.2 Salary of public officials

Eggers et al. (2015) observe that in France, Italy and Germany, population thresholds determining council size also determine the wage of the mayor and other public officials. If true in Colombia, this would posit a major problem for the identification of the effect of council size, not only because of a confounded treatment but because it would introduce a strong incentive for public officials to manipulate population estimates.

However, in Colombia the salary of the public officials is not determined by population thresholds. Specifically, the salary of the mayors is approved every year by the council using limits set by the central government on the maximum salary mayors can earn. The limit of the salary varies with the classification of the municipality presented in Table 7. [10]

Similarly, the honoraria earned per session by council members as well as the number of sessions the council can held per year are both determined by laws 136 and 1368 of 1994 and 2009. Specifically, the law states that honoraria paid to council members depend on the economic classification of the municipality as reported in Table 7. Thus, both the salary of the mayor and the council vary according with the economic classification of the municipality. However, as explained

[10] Interestingly, I found an articles in Colombia's newspaper (*El Heraldo*) describing a case were a council refused to increase the salary of the mayor because of perceived poor performance. The mayor in turn argued that an increase in salary was due because the municipality had moved up the latter from the 3rd to the 2nd category as a result of an increase in municipal revenues. This story, while anecdotal, is consistent with the information I have collected.

above, the classification of municipalities into the categories of economic relevance is done using the current revenues of the municipality and not population.

To further test that this is the case, I have obtained information on the honoraria paid to council members for the period 2006-2010. Using this information, I report in Figures 5 and 6, RD plots for honoraria paid to the council and each council member, for each of the thresholds used in my analysis. Notice that while we observe a positive discontinuity for total honoraria paid when crossing the thresholds (due to an increase in council size), there is no evidence of a discontinuity in honoraria paid per council member. These plots confirm that the law is being enforced and that the classification of municipalities in terms of economic relevance, which determines honoraria per council member, is determined only by current revenues of the municipalities.

Table 6: Transfers to municipal governments for the provision of health, education, water, and basic services.

Period	Growth in Transfers	Earmarked for:	Criteria to determine amount of transfers to Municipalities
1993-2001 (*Participaciones Municipales*)	A percentage of the current income of the Central Government	Education: 30% Health: 25% Potable Water and basic sanitation: 20% Promotion of sports, culture and recreation: 5% Free Investment: 20%	40% according with population living in poverty. 20% according with poverty level relative to national average. 22% according with share of national population in the municipality. 6% according with fiscal performance (tax collection). 6% according with administrative performance (costs in the provision of services). 6% according with improvements in the number of people living in poverty.
2002 - Today (SGP)	Fixed growth rate + inflation	Education: 58.5% Health: 24.5% Potable Water and basic sanitation: 11.6% General Purpose: 5.4%	**Education**: Depends on number of students enrolled and potential students not enrolled yet. **Health**: Depends on population without access to health cre, equity, and administrative efficiency. **Water**: Depends on population without access, population being attended, municipal efforts to increase coverage, poverty level, fiscal and administrative efficiency. **General Purpose**: Depends on rural and urban population, relative poverty, and fiscal and administrative efficiency.

Source: Bonet et al. (2014)

Table 7: Classification of Municipalities according with their economic relevance

Category	Current Revenue	Population
Especial	> 400,000	> 500,000
1st	100,001 - 400,000	100,001 - 500,000
2nd	50,001 - 100,000	50,001 - 100,000
3rd	30,001 - 50,000	30,001 - 50,000
4th	25,001 - 30,000	20,001 - 30,000
5th	15,001 - 25,000	10,001 - 20,000
6th	< 15,000	$\leq$ 10,000

Source: Law 193 of 1994.

Note: Current revenue is expressed in monthly minimum wages.

Figure 5: Honoraries paid to Council members (2006-2010)

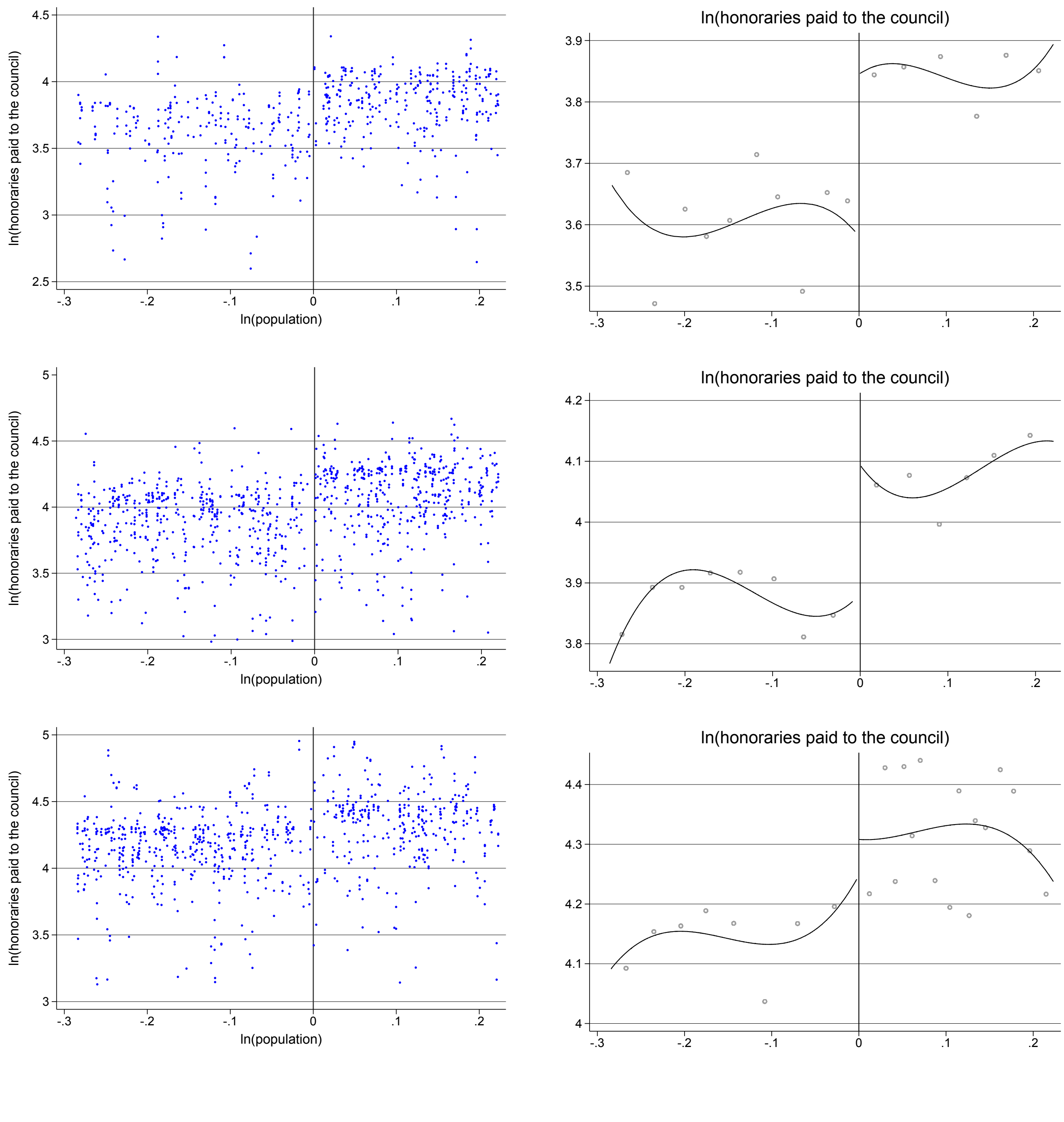
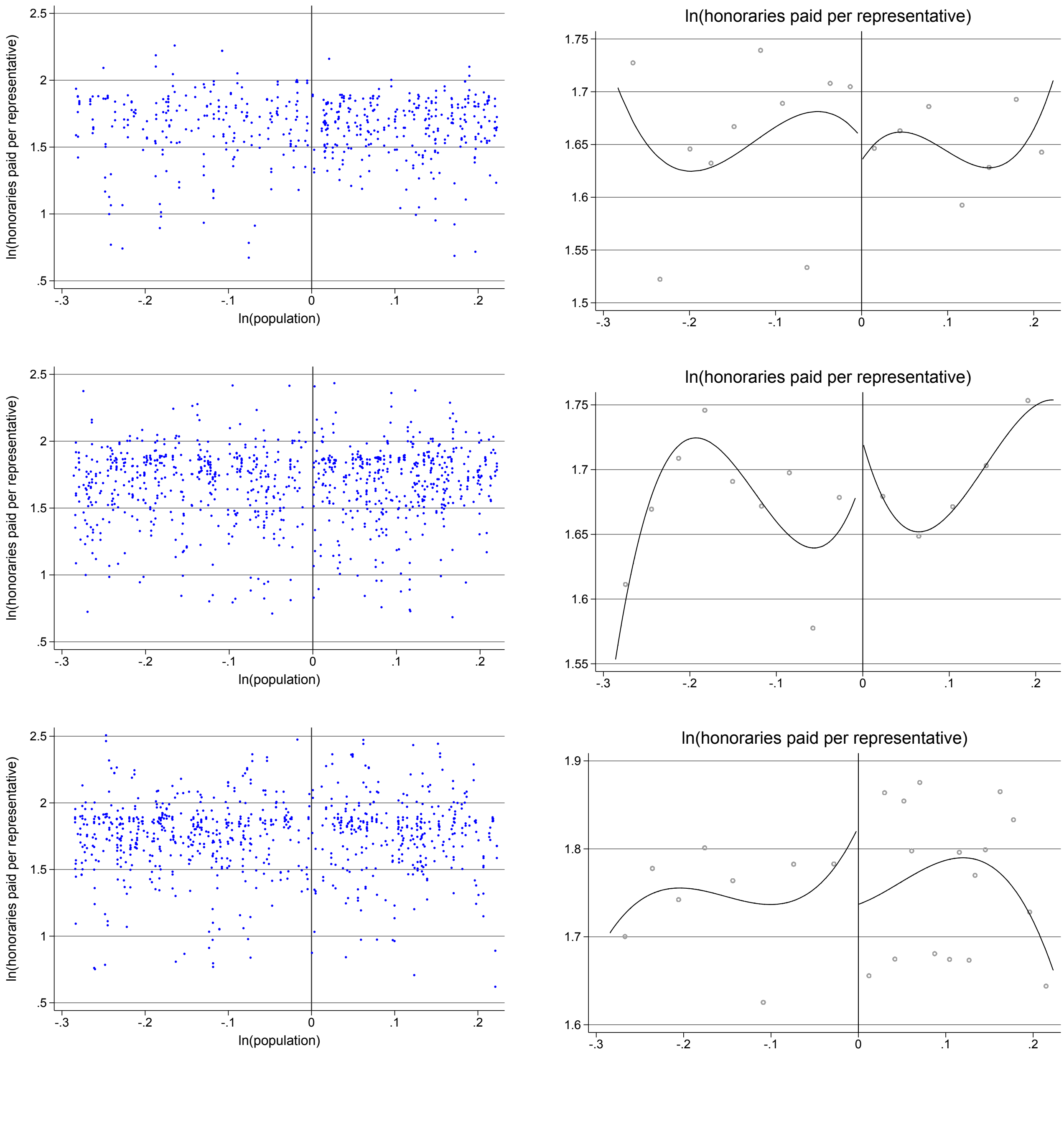


Figure 6: Honoraries paid per council member (2006-2010)



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