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Responsiveness of local governments to financial and institutional reforms: evidence from Italy

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Introduction

During the last decade, the political instability and the financial global crisis have deeply characterized Italian public policy reforms. Since 2008 different governments have outlined a number of policies aiming at reforming local taxation, the structure of the public sector and, lastly, the national electoral system. All these reforms cover different areas of Political Economy, providing an excellent framework to political economists to study how they impact on fiscal policy decisions at the local level.

This thesis proposes three distinct contribution to the field of economic analysis on local government. In particular, each of the three studies presented in the following chapters focuses on a specific policy reform allowing us to analyze how it affects local fiscal policy decisions. For this purpose, we use two main approaches. We use tools of economic theory to formulate reasonable hypotheses about the responsiveness of local governments facing institutional or financial changes or even exogenous changes in population size. After that we use data on Italian municipalities to test the hypotheses.

In the first chapter we consider the case of the fiscal reform which replaced the local property tax on principal dwellings with compensating grants from the central government. In 2008, in fact, the central government totally exempted citizens from the payment of the property tax (ICI) levied on principal dwellings leading municipalities to a significant decrease in the availability of own resources that were replaced by a compensating transfer from the central government. The transfer was not exactly replacing the distribution across municipalities of the lost revenue, because part of it was distributed according to criteria linked to past performances of municipalities.

This empirical framework allows the flypaper effect for Italian municipalities to be tested. The fact that the local government perceives the grant as exogenous, permits us to exploit a quasi-natural experiment since we can compare the expenditure of the same municipality according to two different financing system: one based on own revenues (before 2008) and the other one based on vertical transfers (after 2008).

In the first part of the chapter we outline a simple theoretical model, where we assume that taxation is non distortionary (since in the empirical part we focus on taxes on principal dwellings), the introduction of a political bias against taxation gives rise to the flypaper effect. If the public good is "very important" and so a relevant proportion of the private income (through taxation) has already been dedicated to finance it, a further increase in population decreases the extent of the flypaper since the increase in marginal utility due to a unit increase in the public good is lower than an increase in marginal utility due to a unit increase in private consumption. If the public good is, instead, not a big priority a further increase in population increases the extent of the flypaper since the increase in marginal utility due to a unit increase in the public good is higher than an increase in marginal utility due to a unit increase in private consumption.

In the second part of the chapter we test the hypotheses derived from the theory, by using data on Italian municipalities, focusing on two groups of expenditure: the principal expenditure (Administration & Management, Road & Traffic, Planning & Environment, accounting on average in 2006-2011 for 70% of total expenditure), essential to guarantee the minimum standard daily life of a municipality and the rest, defined as residual expenditure.

Our result confirms that the flypaper effect holds for both kind of expenditure, but it is decreasing in population in the case of principal expenditure and increasing in population in the case of residual expenditure.

Chapter 2 explores the relation between the provision of local public infrastructures and the population size of the localities. The problem of reforming the size of the local government has recently become a hot topic in the Italian political debate. Before 2014, Italy counted three layers of local government, the regions (ordinary statute region and special statute region), the provinces and the local municipalities (more than 8,000 bodies). One of the Italian government response to the world financial crisis (thus to implied crisis of public finances), has been the approval, in April 2014, of the Law no 56/2014, which abolished the provinces, and imposed forms of networking between municipalities in managing some expenditure functions; this has generated a new intriguing problem relative to the assignment of the expenditure function of the provinces to the other levels of local government: regions or municipalities or network of municipalities. At the same time the idea that Italian municipalities should reduce in number and melt in localities with a number of citizens which can minimize the cost of provision of local services, it is always more pressing in the media (Carlo Cottarelli – Italy's spending review commissioner – in a speech to the Italian Parliament in October 2014 said: "eight thousand municipalities are too many, boosting costs unnecessarily, we should think about a reduction").

The identification of the optimal size of local government can be strongly related with its population size and spillovers of the provided public good (Oates, 1972). In our work we explore the relationship between population size and spillovers which can be empirically evident if the local public goods are either complements or substitutes in use. In particular, public infrastructures like roads, bridges, or dams, are examples of complement infrastructures, since they share the property that their benefits from use are higher if also the neighboring municipalities provide the same type of infrastructure on their territory. For example, if two neighboring municipalities provide good roads, and if roads are not used only for local trips (confined within the boundaries of a given municipality) but also for inter-municipal trips, then the benefits from road usage are higher for the residents of both municipalities than in the case in which only one of them provides good roads. On the contrary, public facilities like theaters, libraries, or sport grounds, are examples of substitute infrastructures, since the citizens of a given municipality can use either the facilities provided in their own municipalities or those provided in the neighboring municipalities, but never both at the same time.

We show in a simple theoretical model that the size of the reaction of the per capita expenditure on infrastructures (positive if the public infrastructures are complement and negative if they are substitute) to the increase in neighboring expenditure is decreasing (in absolute value) in the size of the local municipality. Namely, a highly populated municipality hardly reacts to changes in infrastructures of neighbors relatively less populated, since any given change in the per capita expenditure of a small municipality has a negligible per capita impact, in terms of public infrastructure spillover on the residents of the large municipality.

We then test our theoretical predictions by using a dataset for the 223 municipalities belonging to the Italian Autonomous Province of Trento. Due to its "autonomy" status, the Province of Trento is a very interesting experimental framework, since fiscal theory can be tested within a simple institutional setting in which there are only two government layers: the province in the role of the central authority and municipalities in the role of local authorities. After building a measure of the stock of infrastructures provided by municipalities, we estimate their determinants by explicitly introducing a spatial lag-error component. We find robust evidence that some of public infrastructures are of the complement type, since in small municipalities their level is positively affected by the level of infrastructures provided by the neighboring municipalities. Furthermore, according to our theoretical model, the spatial interaction tends to vanish for large municipalities, in fact, the size of the slope of the reaction function decreases in magnitude as the population increases.

In Chapter 3 we link the literature on the electoral system to that on the fiscal federalism. In Italy, voters elect mayors directly with an electoral system that depends upon the census population. Municipalities with fewer than 15,000 inhabitants elect their mayors in accordance with a single-ballot plurality rule where only one list can support her; while the rest of municipalities uses a runoff plurality rule where multiple lists can support her.

The discussion of this chapter begins with the thought that the single-ballot regime always induces parties to merge in coalitions and the double-ballot regime induces coalitions only if polarization is very high (Bordignon et al., 2013). Under the double-ballot regime what matters is not to win the first round but to pass it and win the final election: a centrist party that manages to pass the first round has a larger probability to win the final election as it can then collect the voters of the excluded extremist party, if it is not extremely ideological. Hence, the difference in the outcome policies between the single and double-ballot in the low polarization case, might be related to the possibility that in the double-ballot case there is no need of coalitions to win the election. As a result, in the single-ballot scenario, the fiscal policy is determined from an agreement of coalitions' parties; on the other hand, in the double-ballot regime, the fiscal policy can express the idea of only one party if the polarization is low. Since coalition members might possibly have divergent interests and so each member has an incentive to protect a particular part of the budget, it is reasonable (Roubini and Sachs, 1989; Kontopoulos and Perotti, 1999) to expect lower expenditure and taxes in the double-ballot (with low polarization) than in the single ballot regime.

We then perform a regression discontinuity analysis to test the impact of the runoff electoral system on public revenue and expenditure, and evaluate it for a given polarization of the electorate supporting the mayor (proxied by the number of lists supporting the mayor). Our results suggest that municipalities under the double-ballot system have lower total revenue and current expenditure than the municipalities where a single-ballot system holds. However, these differences become increasingly less robust, the greater the number of lists supporting the successful mayoral candidate.

This result assumes particular relevance in these months for Italy. In fact in the Italian Parliament is actually on track the reform of the electoral law. The final version of the new electoral system (so-called Italicum) is similar to that running for municipal elections. As a matter of fact the party that will get, at least, 40% of votes at the national level, it will get 55% of the seats in the lower chamber (Camera dei Deputati) and so elections will end up at the first round. If no party gets 40% of total votes then, the two parties with most votes will compete in a run-off election and the winner will get 55% of the seats in the lower chamber (Camera dei Deputati).[1]

[1] The upper chamber (Senate - Senato della Repubblica) of Parliament will be no longer elected by citizens, in fact senators will be appointed by local government and a small part by the President of the Republic.

Chapter 1

A quasi-natural experiment of the flypaper effect: the 2008 local fiscal reform in Italy

Abstract

We investigate the impact on expenditure of tax on principal dwellings before 2008 and the impact on expenditure of the grant which, after 2008, compensated for the abolition of the tax on principal dwellings. We setup a theoretical model in which the introduction of a political bias against taxation gives rise to the flypaper effect. If the public good is very important with respect to private consumption then an increase in the municipal size implies a decrease in the extent of the flypaper effect; the opposite happens if the public good is not important with respect to private consumption.We then test the hypotheses coming from the model by using data on Italian municipalities, focusing on two groups of expenditure: the principal expenditure, which are those essential to guarantee the minimum standard daily life of a municipality and the rest, defined as residual expenditure. We find that the flypaper effect holds for both kinds of expenditure, but decreases with respect to population in the case of principal expenditure and increases with respect to population in the case of residual expenditure.

1.1 Introduction

In 2006, just before the end of the election campaign, Berlusconi, the right-wing candidate for Prime Minister, said "If you vote for us again, we will abolish property tax for your primary residence". There is evidence in Italy (Bordignon and Piazza, 2010) that this tax is a salient political issue at local level,[1] in fact this claim bought homeowners' votes for the right-wing candidate; however, on the other hand, this striking proposal put local governments in a state of uncertainty, since property tax is a very important source of funding for municipalities.

[1]According to Corriere della Sera – the most popular Italian newspaper – this tax is considered as the most "hated" tax by Italian taxpayers (Corriere della Sera, May 22, 2007).

Two years later, in 2008, the central government in Italy totally exempted citizens from the payment of the property tax (ICI) levied on principal dwellings, thus leading to a significant decrease in the availability of municipalities' own resources, which were replaced by a compensating transfer from the central government. Such a change in fiscal policy allows us to investigate the impact of the municipal revenue linked to principal dwellings (either raised by municipalities before 2008, or funded through the central transfers after 2008) on local expenditure.

Federal grants distributed to members of a federation should only alter income levels and affect state expenditure in the same way lump-sum grants to individual community members would (Bradford and Oates, 1971). However, empirical works in the field do not support this theory and one of the most accredited alternative explanations is the "flypaper effect". Grants stimulate government expenditures more than transfers to individuals for the same amount of money (Gramlich, 1977). Hence, a proportion of federal money remains in the public sector rather than of being distributed among citizens. In seminal empirical works, Henderson (1968) and Gramlich (1969) found that an extra dollar of personal income increased government spending from \$0.02 to \$0.05 but an equivalent extra dollar of grants increased government spending by \$0.30: this larger effect of lump-sum aid on government spending was then called "flypaper effect" following Arthur Okun's observation that "money seems to stick where it hits". Starting from these findings, much literature has developed documenting and seeking to explain the flypaper effect.[2]

According to Inman (2009), the flypaper effect can arise for four reasons. The first one concerns the data: researchers might confuse matching grants with lump-sum grants or may be particularly sensitive to some kind

[2]For a comprehensive analysis see, e.g., Hines and Thaler (1995), Gamkhar and Shaw (2007) and Inman (2009).

of transfers as Wyckoff (1991) finds for capital expenditures. The second explanation relies on a possible econometric mis-specification as empirical studies on the flypaper effect often omit important unobserved input variables (Becker E. 1996; Megdal S. B., 1987; Zampelli E. 1986). A new interesting explanation, related to this second reason, comes from the idea that federal transfers can be endogenous in a regression of the local expenditure (Knight, 2002): a positive correlation between constituent preferences for public goods and intergovernmental grants biases upwards the coefficient relating federal transfer to local expenditure. The third explanation is based on the voter ignorance hypothesis. The representative voter does not know the level of grants received by the local government which it cannot then include in its private budget constraint, or, as stated by Hines and Thaler (1995) the representative voter is aware of the aid received by the local government but distinguishes between "public budget", which is the responsibility of government officials, and a "private budget", which is the citizen's responsibility, meaning that only part of the grant is included in the private budget. Finally, according to the fourth explanation, the flypaper effect is a consequence of an inability of citizens to write complete "political contracts" with their elected officials because they have imperfect information about intergovernmental grants and budget-maximizing bureaucrats who use hidden information to expand their budget (Wyckoff, 1988). Besides these explanations, part of the literature points out that the flypaper effect can arise where subnational governments use distortionary taxes to fund their expenditure (Hamilton, 1986; Becker and Mulligan, 2003; Voleden, 2007) and, at the same time, receive federal grants, which are very difficult, for the citizens, to relate to the federal taxes they pay, hence, they are perceived as lump sum grants. These grants in addition to the distortionary taxes intended to finance the public good lead not only to the classical income effect, but also to a price effect, decreasing the marginal cost of public funds (Dahlby, 2011).

There is a large amount of literature testing the flypaper effect. In particular, Winer (1983), using data on Canadian provinces for the period 1952-1970, shows that the effect of grants on provincial spending for poor provinces is about two times larger than that for the rich provinces. Blanco (2006) finds that the flypaper effect in Brazil is more marked in municipalities with a low level of population density. Buettner and Wildasin (2006) use a panel dataset of 1270 U.S. municipalities over the period 1972-1997 finding that a permanent one dollar per capita increase in grants leads to a 28.7 cent increase in spending and, interestingly, this effect is more pronounced for large US cities compared to small ones. Kalb (2010) uses data on German municipalities and shows that an increase in the amount of grants received by the local government implies not only an increase in expenditure, but also a loss in productive efficiency.

In relation to the Italian case, Levaggi and Zanola (2003), using data at regional level from 1989 to 1993, find evidence of the flypaper effect for health expenditure. Revelli (2013) shows how excess sensitivity of local public spending to grants arises in the presence of tax limitations. By using data for the Italian provinces over the years 2000 to 2007 he finds that the response of local spending to grants is significantly higher for fully constrained provinces than for provinces that can handle at least one tax instrument. Finally, Gennari and Messina (2014) test the presence of flypaper also investigating the role played by some political factors like the electoral cycle or the political strength of the local cabinet, by using data on Italian municipalities from 1999 to 2003 and, find a strong flypaper effect but that is not affected by political factors.

In this work we exploit a sort of *quasi-natural experiment* since an exogenous change in fiscal policy allows the expenditure of municipalities to be compared based on two different financing systems: one based on own revenue (pre-2008) and the other based on vertical transfers (post-2008).

The work is structured as follows. Section 1.2 presents the theoretical model. Section 1.3 discusses the fiscal policy reform and provides some institutional information on Italian financing systems as well as a description of the data. Some preliminary evidence is illustrated in Section 1.4. Our empirical strategy and results are in Section 1.5. Section 1.6 is the conclusion.

1.2 The theoretical model

In this Section we use a neoclassical model similar to the one in Dahlby (2011). However, in Dahlby's model the flypaper effect arises due to the fact that a benevolent local government uses a local tax which is distortionary. In the model that follows, taxation is instead non-distortionary, since we focus on taxes on principal dwellings, but we introduce a political bias against local taxation that gives rise to the flypaper effect.[3]

Consider a municipality. The welfare of the municipality is represented by the quasi-concave utility function $u(c, G)$, where c is per capita private consumption and G is the public good.

The municipal government finances the public good with a tax on principal dwellings and with a transfer from the central government. The per capita local tax base, b, is exogenously given, and the tax is proportional, at rate τ.

The budget constraint of the private sector is

$$c = y - \tau b,$$

[3]This feature of our model has some evidence in Italy, where municipalities, when increasing tax, usually prefer to increase the surtax on national income tax than local property tax on dwellings, since the former, even if it is formally a local tax, is perceived as a national one hence not related to local policy maker behavior (Bordignon and Piazza, 2010).

where y is the per capita income of the municipality, exogenously given.

The budget constraint of the municipality is

$$G = (\tau b + t)N,$$

where t is the per capita grant from the central government, in lump sum form, and N is the size (population) of the municipality.

The local government's objective function is

$$V = u(c, G) - l(\tau b)$$

where $l(\tau b)$ is a loss function that captures citizens aversion to taxation, strictly convex in tax revenues. This function captures in a reduced form the bias that citizens have when evaluating fiscal policies: they overvalue the costs of taxation while they undervalue the benefits of the public good. The policy maker maximizes her political support by maximizing true social welfare $u(.)$ while minimizing the unpopularity stemming from taxation.

To illustrate, consider the following quadratic specification

$$u(c, G) = \left(\alpha - \frac{(1-\beta)c}{2}\right) c + \left(\alpha - \frac{\beta G}{2}\right) G$$
$$l(\tau b) = \frac{\phi}{2}(\tau b)^2$$

where $\alpha > 0$, $0 < \beta < 1$ are parameters characterizing the preferences for the private and the public good, and $\phi \geq 0$ is a parameter capturing the degree of aversion to taxation.

From the first order condition with respect to the tax rate we get:

$$\tau^*(y, t)b = \frac{(1-\beta)y + \alpha(N-1) - \beta N^2 t}{1 + \phi + \beta(N^2 - 1)}; \tag{1.1}$$

hence:

$$G^*(y, t) = \frac{[(1-\beta)y + \alpha(N-1) + (1-\beta+\phi)t]\, N}{1 + \phi + \beta(N^2 - 1)}. \tag{1.2}$$

In the absence of transfers, i.e., if $t = 0$, the provided public good (1.2) is N times the optimal raised per capita revenue, $\tau^*(y,0)b$. In fact, it is easy to see that in this case:

$$\tau^*(y,0)b = \frac{(1-\beta)y + \alpha(N-1)}{1+\phi+\beta(N^2-1)}, \tag{1.3}$$

and, the total revenue, which coincides with the provided public good when $t = 0$, is equal to

$$\Gamma(y,0) = \frac{[(1-\beta)y + \alpha(N-1)]\,N}{1+\phi+\beta(N^2-1)}.$$

If we introduce a transfer $t > 0$, the optimal raised revenue (1.1) is lower than the optimal raised revenue when no grant holds (1.3) because the grant ($t > 0$) increases the available total revenue not affecting the local political cost of taxation and therefore the local policy maker needs less taxes to finance any given public good. Moreover, since the policy maker knows that increasing the provision of the public good through the increase in transfer does not affect private consumption, she will choose a higher level of public good than in the case when there was no grant. In fact, using (1.3), we can re-write (1.2), as follows:

$$G^*(y,t) = \Gamma(y,0) + \frac{(1-\beta+\phi)tN}{1+\phi+\beta(N^2-1)},$$

which states that the provided public good when a transfer holds is higher than the public good provided when a transfer does not hold ($\Gamma(y,0)$).

We are interested in comparing the change in $G^*(y,t)$, when a change in local tax revenue is exogenously induced by, for example, an increase in y and comparing it, with the case when an increase in t is introduced. In the absence of political aversion to taxation (i.e., $\phi = 0$), since taxes are non-distortionary (i.e., tax bases are exogenous), we do not observe the flypaper effect, that is:

$$\left.\frac{\partial G^*}{\partial t}\right|_{\phi=0} = \left.\frac{\partial G^*}{\partial \Gamma}\frac{\partial \Gamma}{\partial y}\right|_{\phi=0} = \frac{(1-\beta)N}{1+\beta(N^2-1)}.$$

Instead, if $\phi > 0$, which means that there are political costs in raising local taxation, we have the flypaper effect, since

$$\frac{\partial G^*}{\partial t} = \frac{(1-\beta+\phi)N}{1+\phi+\beta(N^2-1)} > \frac{(1-\beta)N}{1+\phi+\beta(N^2-1)} = \frac{\partial G^*}{\partial \Gamma}\frac{\partial \Gamma}{\partial y}$$

Transforming one unit of income into public good is more expensive (because citizens must be locally taxed), than transforming one unit of transfers in public good, which does not have any political cost for the local policy maker. Note in fact that the flypaper effect is more marked the larger ϕ is.

Moreover:

$$\frac{\partial G^*}{\partial y \partial N} = \frac{(1-\beta)(1-\beta+\phi-\beta N^2)}{[1+\phi+\beta(N^2-1)]^2}$$

$$\frac{\partial G^*}{\partial t \partial N} = \frac{(1-\beta+\phi)(1-\beta+\phi-\beta N^2)}{[1+\phi+\beta(N^2-1)]^2}$$

and:

$$\frac{\partial G^*}{\partial t \partial N} - \frac{\partial G^*}{\partial y \partial N} = \frac{\phi(1-\beta+\phi-\beta N^2)}{[1+\phi+\beta(N^2-1)]^2}. \tag{1.4}$$

Note that $\frac{\partial g G^*}{\partial t \partial N} - \frac{\partial G^*}{\partial y \partial N} < 0$ if and only if $\beta > \frac{1+\phi}{1+N^2}$; in this case an increase in the municipality size decreases the size of the flypaper effect: if the public good is "very important" (i.e., $\beta > \frac{1+\phi}{1+N^2}$) and so a significant proportion of the private income (through taxation) has already been allocated to finance it, a further increase in population decreases the already positive flypaper effect.

The political cost of raising taxation is the reason why an increase in the lump sum grant increases the public good provided more than an increase in private income. The more highly populated the municipality is, the lower the per capita cost of providing the public good becomes, hence the political cost is also lower. This feature can imply a decrease in the flypaper effect if the initial level of the public good (before the increase in population) is very high, such that the increase in marginal utility (net of marginal disutility due to the political cost of taxation) due to a unit increase in public good is lower than an increase in marginal utility due to unit increase in private consumption. On the other hand, $\frac{\partial G^*}{\partial t \partial N} - \frac{\partial G^*}{\partial y \partial N} > 0$ if and only if $\beta < \frac{1+\phi}{1+N^2}$, therefore the public good is not a high priority.

If public good provision before the increase in population is low, the increase in marginal utility due to a unit increase in public good is higher than the increase in marginal utility (net of marginal disutility due to the political cost of taxation) due to a unit increase in private consumption. Hence, the lower cost of providing the public good due to the increase in population implies an increase of its provision and hence of the flypaper effect.

1.2.1 Testable Hypotheses

We are interested in comparing the change in $G^*(y,t)$, when an increase in local tax revenue is exogenously induced with the case when an increase in t is introduced. Hence, we can use our theory by assuming that the change in tax revenue on principal dwellings that we observe in our data (which will be described below) is due to an exogenous change in municipalities' endowments, which, through the optimization process, (that we described in the previous Section) gives rise to a change in equilibrium taxes affecting the provided public good. So we test the following Hypotheses:

Hypothesis 1: $\frac{\partial G^*}{\partial t}\big|_{t>0} > \frac{\partial G^*}{\partial \Gamma}\big|_{t=0}$ $\forall \beta \; and \; \phi > 0$

Hypothesis 2: $\frac{\partial G^*}{\partial t \partial N}\big|_{t>0} - \frac{\partial G^*}{\partial \Gamma \partial N}\big|_{t=0} < 0$ if and only if $\beta > \frac{1+\phi}{1+N^2}$ and $\phi > 0$, which is the case for expenditure functions financed by the majority of tax revenue.

Hypothesis 3: $\frac{\partial G^*}{\partial t \partial N}\big|_{t>0} - \frac{\partial G^*}{\partial \Gamma \partial N}\big|_{t=0} > 0$ if and only if $\beta < \frac{1+\phi}{1+N^2}$ and $\phi > 0$, which is the case for expenditure functions for which the minority of tax revenue is used.

1.3 Institutional framework

Municipalities in Italy are responsible for a wide range of important public programs regarding welfare services, territorial development, local transport, nursery school education, sports and cultural facilities, local police services, as well as most infrastructural spending. Municipalities can rely on two main revenue sources: transfers from upper levels of government (mainly central and regional governments) and own revenues (from own taxes and fees).

In what follows we describe the financial feature of Italian municipalities over the years 2006 to 2011, which coincides with the time span of our dataset. The main local tax revenue is a property tax ICI (*Imposta comunale sugli immobili*) introduced in 1992 and applied to real estate. This tax is paid every year by property owners directly to the municipality where the property is located. In particular ICI levied differently on principal dwellings and on other properties and the tax base is the cadastral income, which does not vary over time. The difference between the two is the different possible tax rates: the maximum threshold is lower for the principal dwellings and deductions are allowed only for principal dwellings. Other important tax revenue sources for the Italian municipalities are the tax on urban waste disposal (Tarsu) which is calculated based on land registry values, the tax on the occupation of public space and a surtax on personal central income tax. Additional own revenues can be raised by Italian municipalities through fees which are linked to the municipal provision of various services.

1.3.1 The 2008 tax reform

Law no. 93/2008 replaced the property tax levied on principal dwellings with a compensating transfer from the central government. As a consequence in 2008 and subsequent years, each municipality received a transfer whose amount was determined by two criteria: a) efficiency in tax collection, given by a1) the ratio between the average value of the revenue of the property tax levied on principal dwellings for the period 2004-2006, measured in cash terms, and a2) the average value of the revenue of the property tax levied on principal dwellings for the period 2004-2006, measured in accrual terms; b) compliance of the domestic stability pact for the year 2007. Furthermore, some special exceptions were allowed for small municipalities.

Clearly the fulfillment of these two past goals can not be affected by today's policy maker decisions, making the received per capita transfer for the local policy maker exogenous.

Nevertheless, the aggregate amount of compensating transfer received by Italian municipalities in 2008 was about 2.8 billion euro, while the revenue from the property tax on principal dwellings collected in 2007 was around 3.5 billion euro.

In order to appreciate the impact of the reform on the composition of the municipal budget we analyze the source of municipal finance for the period 2006-2011 (that is the time span we use in the empirical analysis, which will follow). For the period before the reform (2006-2007) property tax accounts, on average, for about 24% of municipalities' total revenue: in particular, the property tax levied on principal dwellings is about 8% and that levied on non − principal dwellings (buildings, lands, production activities, secondary dwellings) is about 16%. In the same period, current transfers from central government constitute on average 19% of the total revenue of Italian municipalities.

After the reform (from 2008 to 2011), the total property tax (only applied to non-principal dwellings) constitutes about 17% of the total revenue and current transfers from central government are, on average, 26% of total revenue. This increase (from 19% to 26%) in the central transfer quota of the municipal revenue is almost completely driven by the introduction of the compensating transfer which, for the period 2008-2011 is, on average, 5% of total municipal revenue.

1.3.2 Dataset

The empirical analysis is based on a dataset for Italian municipalities resulting from a combination of different archives publicly available from the Italian Ministry of the Interior, The Italian Ministry of the Economy and the Italian Institute of Statistic. The distinction between revenue from property tax levied on principal dwellings and revenue from property tax levied on non-principal dwellings has only been recorded in Italian municipalities' budget since 2006. Therefore, our panel dataset covers all Italian municipalities belonging to Regions ruled by "ordinary" statutes for the period 2006-2011.[4] It includes a full range of information organized into three sections: 1) municipal financial data; 2) electoral data covering the results of elections in which the mayors in office during the period covered by the dataset were elected; 3) municipal demographic and socio-economic data such as population size, age structure, average income of inhabitants. Since we are interested in testing the flypaper effect and its relation with the size (population) of the municipality, we exclude from our dataset municipalities that are the capital of the province where they are situated, because their average population (180,000) is by far larger than the average population of all other municipalities (5,500) and this difference is statistically significant.[5] Moreover, municipalities that are the capital of the province normally provide a much wider range of services than others. Also, we did not include municipalities in regions with special autonomy and other municipalities with missing values from our dataset. Finally we obtain a sample

[4]We also collected data for the period 2003-2005 since in the analysis which follows we use lags of the dependent variable and of some explanatory variables as instruments.

[5]In our dataset the number of municipalities that are the capital of the province is 77 for each year corresponding to 1,36% of the municipalities available in the sample.

of 5,651 municipalities including 33,906 observations from 2006 to 2011.[6]

1.3.2.1 Dependent variable

Our dependent variable is the level of per capita current expenditure in each municipality (G), which, according to our theoretical model, we split into two groups: principal expenditure (G_p) and residual expenditure (G_r). The principal expenditure group comprises three expenditure functions, *Adminstration & Management*, *Road & Transport* and, *Planning & Environment*. The total of these latter functions, which altogether are essential in the daily life of a municipality, constitute, on average for the period 2006-2011, almost 70% of the total current expenditure (Table 1.1). The remaining 30% of total expenditure is for *Municipal police*, *Education*, *Culture*, *Sport*, *Tourism*, *Social welfare*, and also in a very low percentage for *Economic development*, *In-house productive services* and *Justice*. The latter functions are important, but not as essential as the previous ones; in fact many medium-sized and small municipalities do not spend any money on them or they manage these function by networking with other municipalities.

[6]Over 48,606 (8,101 municipalities for 6 years) potential observations, our sample includes 33,906 observations. As a matter of fact, we exclude 8,388 (1,398 municipalities for 6 years) observations referring to municipalities in Special Statute Regions and Province, 462 (77 municipalities for 6 years) observations relative to municipalities that are the capital of the province, and 5,850 observations (974 municipalities for 6 years) relative to municipalities/years where data are not complete or data are missing.

Table 1.1: Composition of current expenditure in the period 2006-2011, average values.

Expenditure function	Per capita value (1)	Percentage on the total (2)
Administration & Management	331.11	41.67
Justice	0.62	0.08
Municipal Police	35.15	4.42
Education	74.20	9.34
Culture	15.65	1.97
Sport	12.61	1.59
Tourism	8.57	1.08
Roads & Transport	81.55	10.26
Planning & Environment	140.44	17.67
Social welfare	80.23	10.10
Economic development	4.10	0.52
In-house productive services	10.33	1.30
Per capita current expenditure	794.57	100.00
Per capita current principal expenditure	553.10	69.61
Per capita current residual expenditure	241.47	30.39

1.3.2.2 Explanatory variables

We build a variable *icigrants* containing the per capita value of the property tax on principal dwellings from 2006 to 2007 and the per capita value of the grants compensating for the corresponding missing revenue on principal dwellings from 2008 to 2011.

We then build a matrix of neighbors (W) to each municipality for every year based on geographical contiguity. We then make a row standardization such that the elements of each row add up to one. As a result we have, for each municipality in the period 2006-2011, an average value of its neighboring current per capita expenditure (WG), per capita principal expenditure (WG_p) and per capita residual expenditure (WG_r). We need this variable since expenditure in neighboring municipalities can be correlated with exogenous controls hence leading to biased and inconsistent estimates of the parameters (Case et al., 1993; Revelli, 2002). As additional variables we include the per capita value of the current grants (*netgrants*) which are net of compensating grants replacing ICI on principal dwelling from 2008 onwards.

1.3.2.3 Control variables

We also include a set of time-varying variables which characterize a municipality's demographic, economic and political situation. In relation to demographic control we include the population of the municipality (*pop*), the population density (*density*) calculated as the number of citizens per area and the inverse of the population *(ipop*): these variables can capture the presence of scale economies or diseconomies in the provision of public goods. The proportion of citizens aged between 0 and 5 (*child*); the proportion aged over 65 (*aged*) and the proportion of families (*families*) can account for some specific public needs (e.g., nursery school, nursing homes for the elderly).

Regarding economic and financial controls we include the average per capita income proxied by the personal income tax base (*income*) and the per capita value of the property tax levied on non-principal dwellings (*ici2*).

We add some political control that may influence local budget. In particular we set a dummy (*election*) equal to one for each election year during the period 2006-2011 and zero otherwise; we measure the political power of the mayor by using the percentage of votes cast in the first ballot (*voteshare*). Since Italian law establishes a limit of no more than two consecutive terms of office for a mayor, a dummy variable (*termlim*) has been created to indicate whether a mayor in office in a given year is in her second consecutive term of office, and thus ineligible for a further term: the impossibility of further reelection may significantly bias the budget-related decisions of a municipality (Besley and Case, 1995; List and Sturm, 2006). The summary statistics, data description and data sources of all the variables used in the analysis are reported in Appendix A, Tables A.1 and A.2.

1.4 Preliminary evidence

As a preliminary piece of evidence it is interesting to look at the mean difference in expenditure revenue variables before and after the reform (Table 1.2). In particular, average per capita current expenditure (from now on only "expenditure") after the reform is 56.47 euro higher than that before the reform and this difference is statistically significant at 1%. The same difference for both principal and residual expenditure is, respectively, 52.14 (1% significant) and 4.33 (10% significant). Note also that the per capita revenue from property tax on principal dwellings is, on average, 63.84 euro and after the reform, the corresponding revenue from compensating grants is 22.77 euro lower, the difference being statistically significant (1%). So we find preliminary strong evidence of an increase in expenditure after the reform, even if the available revenue compensating the municipalities was lower. The reform seems to have led to a significant increase in principal expenditures.

Table 1.2: Mean difference in expenditure and revenue from principal dwellings before-after the reform.

Expenditure	Before the reform (1)	After the reform (2)	Difference in means (3)=(2)-(1)
Current expenditure	756.93	813.39	56.47***
Principal expenditure	518.34	570.48	52.14***
Residual expenditure	238.59	242.92	4.33*
icigrants	63.84	41.07	-22.77***

Notes: Period 2006-2011. Years before the reform are 2006 and 2007. Years after the reform are 2008, 2009, 2010 and 2011.

We investigate further by focusing on the period 2007-2008[7], namely the years just before and after the fiscal reform, to test whether there is a difference in municipal spending behavior according to size. We apply the differences-in-differences approach (DD). To do this we use data in 2007 (when the tax on principal dwelling was still in force) and data in 2008 (the first year when tax on principal dwelling was replaced by a compensating transfer). We split the sample into large and small municipalities, where large municipalities are those with a population of over 5,500 inhabitants[8] (the mean) and, small municipalities are those below the mean. We also split the expenditure into principal and residual, as previously defined.

In relation to *principal expenditure*, the difference in principal expenditure (Table 1.3 - Panel A) for small municipalities before and after the reform (22.12 per capita euros) is larger than the same difference for large municipalities (16.84) and such differences are statistically significant at 1%. The difference of the differences in principal expenditure between small and large municipalities, before and after the reform, leads to an estimate that is equal to -5.27 per capita euros (statistically significant at 1%). Therefore, the change in fiscal regime has led to a increase in principal expenditure for both small and large municipalities, however large municipalities increase their principal expenditure less than small municipalities.

As it regards *residual expenditure* (Table 1.3 - Panel B) we find evidence that the difference in residual expenditure for large municipalities before and after the reform (17.97 per capita euros, statistically significant at 1%) is higher than the same difference for small municipalities (3.43 per capita euros, statistically significant at 1%). Hence, the difference of the differences in residual expenditure between small and large municipalities, before and after the reform, leads to an estimate that is equal to 14.54 per capita euros

[7]The restriction to the years 2007-2008 reduces the data set to a sample of 11.302 observations (5,651 municipalities observed twice).

[8]Municipalities with a population of over 5,500 account for almost 30% of the sample.

(statistically significant ay 1%), implying that the change in fiscal regime has led to an increase in residual expenditure for both small and large municipalities, however large municipalities increase their residual expenditure more than small municipalities.

Table 1.3: Regression DD estimates of fiscal reform on principal and residual expenditure.

	A. Principal current expenditure			B. Residual current expenditure		
	Small	Large	Difference (Large-Small)	Small	Large	Difference (Large-Small)
	(1)	(2)	(3)	(4)	(5)	(6)
2007	611.65	387.16	-224.49***	227.88	259.72	31.84***
	(5.74)	3.62	6.79	(4.29)	(3.19)	(5.35)
2008	633.77	404.00	-229.77***	231.31	277.69	46.38***
	(6.00)	3.69	7.04	(4.27)	(3.31)	(5.40)
Difference (2008 - 2007)	22.12***	16.84***	**-5.27*****	3.43***	17.97***	**14.54*****
	(1.49)	(1.32)	**(2.00)**	(0.96)	(1.16)	**(1.52)**

Notes: Number of observations 11,302. Column (1) reports average per capita principal current expenditure for small municipalities before and after the reform; column (2) displays average per capita principal current expenditure for large municipalities before and after the reform; column (3) shows the average difference of per capita principal current expenditure for small and large municipalities before and after the reform. Column (4) reports average per capita residual current expenditure for small municipalities before and after the reform; column (5) displays average per capita residual current expenditure for large municipalities before and after the reform; column (6) shows the average difference of per capita residual current expenditure for small and large municipalities before and after the reform. Robust standard errors, clustered at the municipal level, are shown in parentheses. Significance at 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Our analysis suggests that after the change in fiscal regime, large municipalities increased their principal expenditure less than small municipalities (-5.27); on the other hand, large municipalities increased their residual expenditure more than small municipalities (14.54) .

1.5 Econometric strategy and results

Our econometric strategy is based on a dynamic panel data model that also contains a space component. Thus, the dynamic version we estimate (Anselin et al. 2007) is as follows:

$$
\begin{aligned}
G_{it} = \alpha + \delta G_{it-1} + \lambda WG_{it} + \rho netgrants_{it} + \gamma_1 icigrants_{it} + \gamma_2 \left(icigrants_{it} \times post\right) \\
+ \gamma_3 \left(icigrants_{it} \times pop_{it}\right) + \gamma_4 \left(icigrants_{it} \times pop_{it} \times post\right) + \gamma_5 pop_{it} \\
+ \gamma_6 \left(pop_{it} \times post\right) + \beta^{'} x_{it} + \mu_i + \psi_t + \varepsilon_{it}
\end{aligned} \tag{1.5}
$$

where G_{it} is total expenditure, which we then split into principal expenditure (G_{pit}) and residual expenditure (G_{rit}), for municipality i in year t; WG_{it} is the average expenditure of the neighboring municipalities of municipality i in year t, where W is a matrix of identical exogenous weights (based on geographical contiguity); $netgrants_{it}$ is the per capita value of the current grants which are net of the compensating grants (for the principal dwellings property tax abolished in 2008) ; $icigrants_{it}$ is the per capita revenue from the property tax on principal dwellings from 2006 to 2007 and the per capita revenue from grants compensating for the corresponding missing revenue on principal dwellings from 2008 to 2011; *post* is a dummy variable equal to 1 in the years when the property tax had been replaced by the compensating grant (from 2008 onwards); pop_{it} is the population of municipality i in year t; x_{it} is the vector of explanatory variables described in section 1.3.2.3; ψ_t is a year specific intercept; μ_i is an unobserved municipal specific effect and ε_{it} is a mean zero, normally distributed random error.

Thus, the coefficient $\gamma_1 + \gamma_3 \times pop_{it}$ which corresponds to $\frac{\partial G^*}{\partial \Gamma}\big|_{t=0}$ in Section 1.2.1, captures the impact of an increase in tax on principal dwellings for a given level of population and the coefficient $\gamma_1 + \gamma_2 + \gamma_4 \times pop_{it}$, which is $\frac{\partial G^*}{\partial t}\big|_{t>0}$ in Section 1.2.1, captures the impact of an increase in the compensating transfer for a given population level. Our first hypothesis (the flypaper effect) $\frac{\partial G^*}{\partial t}\big|_{t>0} - \frac{\partial G^*}{\partial \Gamma}\big|_{t=0} > 0$ stated in Section 1.2.1, is then verified if $\gamma_2 + \gamma_4 \times pop_{it} - \gamma_3 \times pop_{it} > 0$, regardless of whether we use the principal or the residual expenditure as dependent variables.

Since γ_4 proxies $\frac{\partial G^*}{\partial t \partial N}\big|_{t>0}$ and γ_3 proxies $\frac{\partial G^*}{\partial \Gamma \partial N}\big|_{t=0}$ in Section 1.2.1, our second hypothesis $\frac{\partial G^*}{\partial t \partial N}\Big|_{t>0} - \frac{\partial G^*}{\partial \Gamma \partial N}\Big|_{t=0} < 0$ is verified, when we use the principal expenditure as the dependent variable, if $\gamma_4 - \gamma_3 < 0$, it means that an increase in population decreases the flypaper effect. Finally our third hypothesis $\frac{\partial G^*}{\partial t \partial N}\Big|_{t>0} - \frac{\partial G^*}{\partial \Gamma \partial N}\Big|_{t=0} > 0$ is verified, when we use the residual expenditure as the dependent variable, if $\gamma_4 - \gamma_3 > 0$, it means that an increase in population increases the flypaper effect.

1.5.1 The choice of instruments

In order to estimate (1.5) we use the system GMM dynamic panel estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). This estimator is an augmented version of the difference GMM (Arellano and Bond, 1991) hence more efficient than the latter (Blundell and Bond, 1998). The system GMM, unlike the difference GMM, which just employs the difference equation, builds a stacked dataset, one in levels and one in differences. Then the differences equations are instrumented with levels, while the levels equations are instrumented with differences (for details see Appendix A).

The dynamic model we estimate includes the lagged endogenous variable of G_{it} and, in our case, it also includes further endogenous variables: the neighboring spending (WG_{it}) and the grants net of compensative grants from 2008 (*netgrants*). These variables are then instrumented by using the other exogenous variables and their lags. In relation to the other variables, one might argue about the endogeneity of *icigrants* and *ici2*. However, we consider the variable *icigrants* as exogenous because, on one hand, the tax base of the property tax is given by the cadastral income that is exogenous (for the same reason the variable *ici2* is also exogenous); on the other hand, compensating grants were determined for each municipality using previous socio-economic indicators as explained in Section 1.3.1 therefore must necessarily be perceived by the policy maker as exogenous.

The validity of the instruments used in the regression is evaluated according to the Hansen and the AR tests. In particular, in the equation for total expenditure, we start by instrumenting our lagged dependent variable and the other endogenous variables using the standard treatment i.e. using the first order lag to instrument the lagged endogenous variable and the second order lag to instrument the other two endogenous variable WG_{it} and $netgrants_{it}$. However, it turns out that these instruments are not valid since we reject the null hypothesis of the Hansen test (p-value=0.024). As a consequence we use longer lags, namely the second order lag for the lagged endogenous variable and the third order lag for both WG_{it} and $netgrants_{it}$. Again in this case we reject the null hypothesis of the Hansen test (p-value=0.029), and we also find second-order serial correlation (p-value=0.078). Finally, using longer lags, we find the combination of lags that allows us to deal with both the serial correlation condition and the validity of instruments. In particular, we instrument the endogenous lagged variable by using its sixth and seventh order lag i.e. using G_{it-7} and G_{it-8} for the equations in differences and ΔG_{it-6} for the equations in levels;[9] for WG_{it} we use the third, forth and fifth order lag i.e. using WG_{it-3}, WG_{it-4} and WG_{it-5} for the equations in differences and ΔWG_{it-2} for the equations in levels.[10] Finally, for $netgrants_{it}$ we only use lag 5, namely $netgrants_{it-5}$ for the equations in differences and $\Delta netgrants_{it-4}$ for the equations in levels.[11] In this way we do not reject the null hypothesis of no second-order serial correlation (p-value = 0.523) and we do not reject the null hypothesis of the Hansen test (p-value = 0.354). We also test the validity of any subset of instruments, namely instruments for the level equations, instruments for the lagged endogenous variables G_{it-1}, instruments for WG_{it} and instruments for $netgrants_{it}$, using the C-test and also in this case, for each subset, we do not reject the

[9] An addition instrument ΔG_{it-7} is available but it would be mathematically redundant in system GMM, which is why it is dropped (Roodman, 2009).

[10] see footnote 9.

[11] see footnote 9.

null hypothesis that the specified variables are proper instruments.[12]

In relation to the equation for principal expenditure (G_{pit}), we start again by instrumenting our lagged dependent variable and the other endogenous variables using the first order lag to instrument the lagged endogenous variable and the second order lag to instrument both the other two endogenous variables WG_{pit} and $netgrants_{it}$. However, it turns out that our instruments are not valid since we reject the null hypothesis of the Hansen test (p-value=0.002). As a consequence we use longer lags, namely the second order lag for G_{pit-1} and the third order lag for both WG_{pit} and $netgrants_{it}$. In this case, we do not reject the null hypothesis of the Hansen Test (p-value=0.178) and also we do not reject the null hypothesis of no second-order serial autocorrelation (p-value=0.329). However, by looking at the C-test, we reject the hypothesis of exogeneity for the instruments of G_{pit-1}, namely the instruments are not exogenous (p-value=0.087). Again, we use longer lags and we come up with the combination of lags that allows the tests to be passed. In particular, we instrument G_{pit-1} by using its fifth and its sixth lag, i.e. using G_{pit-6} and G_{pit-7} for the equations in differences and ΔG_{pit-5} for the equations in levels;[13] for WG_{pit} we use lags 3 and 4, namely WG_{pit-3} and WG_{pit-4} for the equations in differences and ΔWG_{pit-2} for the equations in levels.[14] For $netgrants_{it}$ we only use lag 4, that is to use $netgrants_{it-4}$ for the equations in differences and $\Delta netgrants_{it-3}$ for the equations in levels[15]. In this way we do not reject the null hypothesis of no second-order serial correlation (p-value = 0.777) and do not reject the null hypothesis of the Hansen test (p-value = 0.430). We then test the validity of any subset of instrument by using the C-test and, for each subset,

[12]P-value instruments for level equation is 0.376; P-value instruments for G_{it-1} is 0.289; P-value instruments for WG_{it} is 0.440 and P-value instruments for $netgrants_{it}$ is 0.824. The null hypothesis is that specified variables are exogenous.

[13]see footnote 9.

[14]see footnote 9.

[15]see footnote 9.

we do not reject the null hypothesis that the specified variables are proper instruments.[16]

Finally, for residual expenditure (G_{rit}) we use the standard instrumenting treatment i.e. the first order lag to instrument the lagged endogenous variable (namely we use G_{rit-2} as an instrument for the equations in differences and ΔG_{rit-1} for the equations in levels[17]), the second order lag to instrument the endogenous variable WG_{rit} (we use WG_{rit-2} as an instrument for the equations in differences and ΔG_{rit-1} for the equations in levels[18]) and the second order lag to instrument the other endogenous variable $netgrants_{it}$ (we use $netgrants_{it-2}$ as an instrument for the equations in differences and $\Delta netgrants_{it-1}$ for the equations in levels[19]). It turns out that the instruments are valid since we do not reject either the null hypothesis of the Hansen Test (p-value=0.307), or the null hypothesis of no second-order serial autocorrelation (p-value=0.868). We also test the validity of any subset of instrument by using the C-test and again in this case, for each subset, we do not reject the null hypothesis that the specified variables are proper instruments.[20]

1.5.2 Results

We do our estimations using the SYS-GMM (Table 1.4 col. 3 and Table 1.5, col. 3 and col. 6), which in our framework (see Appendix A) is necessary to correct the bias and inconsistency of the estimates we would get by using the

[16]P-value instruments for level equation is 0.190; P-value instruments for G_{pit-1} is 0.371; P-value instruments for WG_{pit} is 0.634 and P-value instruments for $netgrants_{it}$ is 0.540. The null hypothesis is that specified variables are exogenous.

[17]see footnote 9.

[18]see footnote 9.

[19]see footnote 9.

[20]P-value instruments for level equation is 0.307; P-value instruments for G_{rit-1} is 0.166; P-value instruments for WG_{rit} is 0.623 and P-value instruments for $netgrants_{it}$ is 0.177. The null hypothesis is that specified variables are exogenous.

OLS (Table 1.4, col.1 and Table 1.5 col. 1 and col. 4) or, the FE estimator (Table 1.4, col.2 and Table 1.5 col. 2 and col. 5).

We start considering total expenditure as the dependent variable (Table 1.4, col. 3). The coefficient of the lagged dependent variable (0.5525) is positive and statistically significant at 10% implying that the total expenditure has a certain degree of inertia. In relation to neighboring expenditure, the estimated coefficient is 0.3825 and significant at 10%, meaning that municipalities tend to increase their own current spending as a response to an increase in expenditure of their neighboring municipalities.

The coefficient accounting for the flypaper effect, $\gamma_2 + \gamma_4 \times pop_{it} - \gamma_3 \times pop_{it}$, is positive and statistically significant for any level of population from 13,000 inhabitants, thus confirming the presence of the flypaper effect (Hypothesis 1). In order to appreciate this effect consider, as an example, a municipality with population of 13,000 inhabitants, then the impact on expenditure of a unit increase in revenue from compensating grant is given by $[-0.1145 + (0.0313 \times 13) - (-0.0016 \times 13) = 0.3139]$ which is statistically significant at 10%.[21]

[21] In what follows, all the linear combinations have been computed dividing the population by 1000 since in the regressions the variable *pop* has been rescaled dividing it by 1000.

Table 1.4: Estimation results on total current expenditure.

	Per capita current expenditure		
	OLS	FE	SYS-GMM
Variables	(1)	(2)	(3)
lagged dependent variable	0.9753***	0.2882***	0.5525*
	(0.0217)	(0.0435)	(0.3218)
neighboring expenditure	0.0285**	0.2520***	0.3825*
	(0.0120)	(0.0519)	(0.2194)
icigrants	0.1112***	-0.0229	0.1371
	(0.0360)	(0.0445)	(0.1210)
icigrants×post	0.0466	0.0403	-0.1145
	(0.0651)	(0.0985)	(0.2738)
icigrants×pop	-0.0027	-0.0003	-0.0016
	(0.0026)	(0.0028)	(0.0047)
icigrants×pop×post	-0.0028	0.0167***	0.0313*
	(0.0042)	(0.0048)	(0.0163)
pop	-0.5041**	-6.9518	1.0450
	(0.2484)	(4.8706)	(1.2108)
pop×post	0.9575***	-1.0796***	-1.6695
	(0.2909)	(0.3310)	(1.2214)
post	-52.8555***	9.6041	-39.2583*
	(5.5080)	(9.3868)	(23.3774)
ici2	0.0348	0.0068	0.0911
	(0.0223)	(0.0094)	(0.1378)
netgrants	0.1354***	0.2571***	-0.7411
	(0.0410)	(0.0932)	(0.4640)
Constant	-11.6067	221.5237***	138.6382
	(14.0894)	(81.2008)	(91.3486)
Observations	33,906	33,906	33,906
R-squared	0.946	0.323	
N° instruments			31
AR(1) (p-value)			0.003
AR(2) (p-value)			0.523
Hansen test (p-value)			0.354

Notes: Column (1) reports OLS robust estimator. Column (2) shows FE robust estimator. Column (3) displays two-step system-GMM estimator. In all regressions we control for *ipop, child, aged, families, density, income, election, termlim, votshare* and *year effects*. The variable *pop* has been rescaled dividing it by 1000. In column (3) the *lagged dependent variable* is instrumented by using lags six and seven, the *neighboring expenditure* variable is instrumented by using lags three, four and five; the *netgrants* variable is instrumented by using lag five. A part from the Hansen test, we have employed the C-test for checking the validity of our procedure of instrumentation (see Section 1.5.1). Robust standard errors are shown in parenthesis. *** significant at 1%; ** significant at 5%; * significant at 10%.

When we consider principal expenditure as the dependent variable (Table 1.5 - col. 3) we find a degree of inertia of expenditure (the coefficient of the lagged dependent variable is 0.5482 and statistically significant at 1%), while we do not find any evidence of horizontal spill-over since the coefficient of the neighboring expenditure (0.0985) is not statistically different from zero.

The coefficient accounting for the flypaper effect, $\gamma_2 + \gamma_4 \times pop_{it} - \gamma_3 \times$

pop_{it}, is always positive and statistically significant as long as the population is less than 15,000 inhabitants, hence confirming the presence of the flypaper effect for this group (Hypothesis 1). As an example, take a municipality with an average population level (5,500 inhabitants), then the impact on principal expenditure of a unit increase in the compensating grant is given by $[0.3801 + (-0.0214 \times 5.5) - (-0.0066 \times 5.5) = 0.2988]$ an estimation that is statistically significant at 1%. Notice that, the population threshold of 15.000 inhabitants after which the flypaper effect does not hold, anticipates to a certain extent the test of Hypothesis 2, which states that the flypaper effect is negatively linked with the population. However, in order to test Hypothesis 2, we need to compare both coefficients γ_4 and γ_3 (see the last paragraph of Section 1.5). The former coefficient is negative and equals -0.0214 (statistically significant at 1%), the latter one is -0.0066 and statistically significant at 5%. The difference between the two coefficients is negative $[-0.0148 = -0.0214 - (-0.0066)]$ and statistically significant at 10%, implying that an increase in population leads to a decrease in the extent of the flypaper effect for this group of expenditures hence confirming Hypothesis 2.

Finally, when we use the residual expenditure as the dependent variable (Table 1.5 - col. 6) we again find a degree of inertia in the expenditure (the coefficient of the lagged dependent variable is 0.6344 and statistically significant at 1%) and no evidence of horizontal spill-over (the coefficient of the neighboring expenditure is 0.0340 but not statistically significant from zero).

The coefficient accounting for the flypaper effect, $\gamma_2 + \gamma_4 \times pop_{it} - \gamma_3 \times pop_{it}$, is always positive and statistically significant for any given population level confirming Hypothesis 1. Let us consider again, as an example, a municipality with an average population level (5,500 inhabitants), then the impact on residual expenditure of a unit increase in the compensating grant is given by $[0.0897 + (0.0071 \times 5.5) - (-0.0012 \times 5.5) = 0.1354]$ an estimation that is statistically significant at 1%. Furthermore, in order to test Hypothesis 3, we compare coefficients γ_4 and γ_3. The former coefficient is positive and equal to 0.0071 (statistically significant at 1%), the latter is -0.0012 and not statistically significant. The difference between the two coefficients is positive $[0.0083 = 0.0071 - (-0.0012)]$ and statistically significant at 1%, implying that an increase in population leads to a increase in the extent of the flypaper effect (Hypothesis 3). Note that in this case, as we would expect, the flypaper effect holds for any population level since the relationship between flypaper and population is positive.

Table 1.5: Estimation results on principal and residual current expenditure.

	per capita principal current expenditure			per capita residual current expenditure		
	OLS	FE	SYS-GMM	OLS	FE	SYS-GMM
Varibales	(1)	(2)	(3)	(4)	(5)	(6)
lagged dependent variable	0.9009***	0.2569***	0.5482***	0.9993***	0.2768***	0.6344***
	(0.0259)	(0.0640)	(0.1420)	(0.0310)	(0.0278)	(0.0708)
neighboring expenditure	0.0630***	0.3212***	0.0985	0.0054	0.1173***	0.0340
	(0.0129)	(0.0637)	(0.0974)	(0.0156)	(0.0332)	(0.0524)
icigrants	0.1306***	-0.0177	0.2686***	0.0079	-0.0068	0.0699***
	(0.0439)	(0.0550)	(0.0633)	(0.0213)	(0.0177)	(0.0261)
icigrants×post	0.0623	0.0286	0.3801***	0.0138	0.0188	0.0897
	(0.0693)	(0.0869)	(0.1216)	(0.0342)	(0.0461)	(0.0546)
icigrants×pop	-0.0025	-0.0003	-0.0066**	-0.0007	0.0001	-0.0012
	(0.0024)	(0.0028)	(0.0031)	(0.0013)	(0.0014)	(0.0014)
icigrants×pop×post	-0.0055	0.0097**	-0.0214***	0.0022	0.0066***	0.0071***
	(0.0038)	(0.0040)	(0.0083)	(0.0021)	(0.0024)	(0.0025)
pop	-0.2333	-8.8298***	0.3734	-0.2431	1.7584	1.0587***
	(0.2060)	(2.7650)	(0.2805)	(0.1615)	(3.6068)	(0.2538)
pop×pos	0.7283***	-0.7718***	0.7506	0.1297	-0.2815	-0.3399**
	(0.2496)	(0.2742)	(0.5252)	(0.1516)	(0.1795)	(0.1529)
post	-43.3130***	10.7279	-44.9094***	-6.4807***	-2.7137	-6.4843***
	(5.5198)	(11.0747)	(8.8441)	(2.1035)	(2.3244)	(2.3934)
ici2	0.0482*	0.0063	0.1326**	0.0050	0.0005	0.0441*
	(0.0273)	(0.0081)	(0.0570)	(0.0051)	(0.0016)	(0.0229)
netgrants	0.1342***	0.2144**	0.7082***	0.0228***	0.0416**	0.0424
	(0.0395)	(0.0833)	(0.1717)	(0.0078)	(0.0190)	(0.0365)
Constant	-7.4981	113.8762*	-153.8324***	-6.2728	122.1438***	-42.8764***
	(12.1028)	(65.2132)	(46.2517)	(6.8085)	(39.5522)	(14.1906)
Observations	33,906	33,906	33,906	33,906	33,906	33,906
R-squared	0.921	0.348		0.939	0.091	
N° instruments			30			28
AR(1) (p-value)			0.000			0.000
AR(2) (p-value)			0.777			0.868
Hansen test (p-value)			0.430			0.307

Notes: Columns (1) and (4) report OLS robust estimator by using, respectively, per capita principal current expenditure and per capita residual current expenditure as dependent variables. Columns (2) and (5) show FE robust estimator by using, respectively, per capita principal current expenditure and per capita residual current expenditure as dependent variables. Columns (3) and (6) display two-step system-GMM estimator by using, respectively, per capita principal current expenditure and per capita residual current expenditure as dependent variables. In all regressions we control for *ipop*, *child*, *aged*, *families*, *density*, *income*, *election*, *termlim*, *votshare* and *year effects*. The variable *pop* has been rescaled dividing it by 1000. In column (3) the *lagged dependent variable* is instrumented by using lags five and six, the *neighboring expenditure* variable is instrumented by using lags three and four; the *netgrants* variable is instrumented by using lag four. In column (6) the *lagged endogenous variable* is instrumented by using lag one, the *neighboring expenditure* variable is instrumented by using lag two; the *netgrants* variable is instrumented by using lag two. A part from the Hansen test, we have employed the C-test for checking the validity of our procedure of instrumentation (see Section 1.5.1). Robust standard errors are shown in parenthesis. *** significant at 1%; ** significant at 5%; * significant at 10%.

1.6 Conclusion

In this study we investigated the impact on expenditure of tax on principal dwellings before 2008 and the impact on expenditure of the grant which, after 2008, compensated for the abolition of the tax on principal dwellings. This is an interesting reform which allows the existence of the flypaper effect in the spending behavior of Italian municipalities to be tested.

First, we setup a theoretical model in which the introduction of a political bias against taxation gives rise to the flypaper effect. If the public good is very important with respect to private consumption then an increase in the municipal size implies a decrease in the extent of the flypaper effect; the opposite happens if the public good is not important with respect to private consumption. The increase in size of the municipality makes the public good cost less and this feature, when the public good is very important, increases the sensitivity of the public good to the grant less than the sensitivity of the public good to the tax. On the other hand, when the public good is less important, the increase in the size of the municipality increases the sensitivity of the public good to the grant more than the sensitivity of the public good to the tax.

We then tested the hypotheses coming from the model by using data on Italian municipalities, focusing on two groups of expenditures: the principal expenditure, which should be that essential to guarantee the minimum standard daily life of a municipality and the rest, defined as residual expenditure. We find that the flypaper effect holds for both kinds of expenditure, but decreases with respect to population in the case of principal expenditure and increases with respect to population in the case of residual expenditure.

Chapter 2

Local infrastructures and externalities: does the size matter?

Abstract

We setup a model in which the residents of two neighboring municipalities can use the services provided by public infrastructures located in both jurisdictions. If services are either complements or substitutes in use, the municipalities strategically interact when investing in infrastructures; moreover, when they differ in population size, the small municipality reacts more to the expenditure of its neighbor than the big one. The theoretical predictions are then tested by estimating the determinants of the stock of public infrastructures of the municipalities belonging to the Autonomous Province of Trento, in Italy. By introducing a spatial lag-error component, we find that municipalities positively react to an increase in infrastructures by their neighbors, but the effect tends to vanish above a given population threshold.

2.1 Introduction

Is the provision of public infrastructures by a local jurisdiction affected by that of its neighbors? And how is the effect (if any) related to the size of local jurisdictions in terms of population? A proper answer to these questions can give an important contribution to the discussion about the optimal boundaries of areas over which public infrastructures are provided. In fact, this is a hot topic in Europe, where some countries are rethinking the structure of their public sector (in terms of both the number and the types of government layers) by relying on two main theoretical arguments, namely the presence of scale economies and of positive spillovers in infrastructures provision, both pointing at inefficient levels of infrastructure provision by local jurisdictions that are too small in size.[1]

The theoretical literature on fiscal externalities recognizes that there are

[1] In the celebrated Decentralization Theorem by Oates (1972), the exploitation of scale economies and the internalization of spillovers account for the benefits of centralization, while uniform public goods provision in the presence of heterogeneous preferences at the local level account for its costs.

various ways in which decisions taken in one jurisdiction may spill-over into other jurisdictions.[2] Fiscal policies of regional governments can directly affect the welfare of residents in neighboring jurisdictions, as for expenditures on public goods and services (e.g., environmental policies) whose benefits transcend borders. Public policies in one region can also indirectly affect residents elsewhere through their impact on local governments' budgets, giving rise to the so-called fiscal externalities (e.g., tax policies that induce tax base mobility across jurisdictions). Case et al. (1993) is the first systematic empirical work addressing these issues; using data on expenditures of continental US States over the period 1970-1985, they find that state government's per capita expenditure is positively and significantly affected by that of its neighbors'. Other important studies are Murdoch et al., (1993) and Solé-Ollé (2006), showing that public expenditure spillovers are stronger at low levels of government's layers than at high levels.

There is also a growing literature on fiscal externalities specifically related to the provision of local infrastructures. Cremer et al., (1997) modelling the provision of local infrastructures in a federation in which two communities strategically interact by comparing the per capita cost of providing infrastructures with the transport cost that their own citizens must bear to go and enjoy the infrastructures provided by the neighboring community. For given production and transport costs, the decision to provide infrastructures depends on the size of the community. Haughwout (2002) proposes a spatial equilibrium model by considering the role of infrastructures in determining the distribution of economic activity across regions. The empirical evidence suggests that central cities' land prices are positively related with public infrastructures provision; however, as the same author points out, the omission from the model of the costs and benefits of spillovers might be one of the main causes of the limited local infrastructure benefits found in

[2] For a comprehensive analysis of the issue, see, e.g., Dahlby (1996).

the empirical analysis. Buettner et al., (2004), by using German data on public expenditure of Lander governments, find that the agglomeration level has no effect on the per capita expenditure on infrastructures; in particular, there is no cost disadvantage, both for highly urbanized and for sparsely populated regions. Also in this case, however, one might argue that the results are driven by the assumption of no spatial interaction between local infrastructures. In fact, if spatial autocorrelation turns out to be an important expenditure determinant, not accounting for it can yield biased and inconsistent estimates for many of the determinants of the expenditure equation (Case et al., 1993; Revelli, 2002).

In our work, to set the stage for the empirical analysis, we build up a simple theoretical model in which two neighboring local jurisdictions independently provide public infrastructures. If local infrastructures can be consumed by the citizens of both jurisdictions, the model shows that each local government increases (respectively, reduces) its expenditure on infrastructures in response to an increase in its neighbor's expenditure if local infrastructures are complements (respectively, substitutes) in use by citizens. Public infrastructures like roads, bridges, or dams, are examples of *complement infrastructures*, since they share the property that their benefits from use are higher if also the neighboring jurisdictions provide the same type of infrastructures on their territory. If two neighboring jurisdictions provide good roads, and if roads are not used only for local trips (i.e., confined within the boundaries of a given jurisdiction) but also for inter-jurisdictional trips, then the benefits from road usage are higher for the residents of both jurisdictions than in the case in which only one of them provides good roads. In this sense, local roads, like other types of infrastructures, can be complement in use. On the contrary, public facilities like theaters, libraries, or sport grounds, are examples of *substitute infrastructures*, since the citizens of a given jurisdiction can use either the facilities provided in their own jurisdiction or those provided in the neighboring jurisdictions, but never both at the same time.

We also shows that, in per capita terms, the size of the reaction of expenditure on infrastructures to changes in the expenditure by the neighboring jurisdiction is decreasing, in absolute value, in the size of the local jurisdiction. That is, in per capita terms a highly populated jurisdiction hardly reacts to changes in infrastructures of a scarcely populated neighbor, since any given change in the per capita expenditure of a small jurisdiction has a negligible per capita impact, in terms of public goods spillovers, on the residents of a large jurisdiction.

In the empirical analysis, we use a dataset containing financial and socioeconomic variables for the 223 municipalities belonging to the Italian Autonomous Province of Trento. After constructing a measure of the stock of infrastructures provided by municipalities, we estimate their determinants by explicitly introducing a spatial lag-error component. We find robust evidence that some types of public infrastructures are of the complement type, since in small municipalities their level is positively affected by the level of infrastructures provided by the neighboring communities. However, and in accordance with our theoretical predictions, the spatial interaction tends to vanish for large municipalities.

The work is structured as follows. Section 2.2 presents the theoretical model and Section 2.3 illustrates the empirical hypotheses. Section 2.4 describes the data, Section 2.5 outlines the estimation strategy and discusses the results. Section 2.6 concludes.

2.2 The theoretical model

Consider a regional economy composed of two municipalities, labelled $i = 1, 2$.[3] Let N_i be the population resident in jurisdiction i, and y_i its per-capita endowment of income, exogenously given. Income is used to consume private and local public goods, the latter financed with a local income tax. We assume that individuals cannot change their place of residence, although they can move to consume the public good provided in the neighboring municipality.

Consider, without loss of generality, community 1. The utility function of the representative individual resident in municipality 1 is:

$$u_1(G_1, G_2) = \left(\alpha_1 - \frac{G_1}{2}\right) G_1 + \theta \left[\left(\alpha_1 - \frac{G_2}{2}\right) G_2 + \phi G_1 G_2\right] + \left(\beta_1 - \frac{c_1}{2}\right) c_1, \tag{2.1}$$

where G_i denotes the public good (infrastructures) provided by municipality i on its territory, and c_1 the private consumption. The parameters $\alpha_i > 0$ and $\beta_i > 0$ are a measure of the intensity of preferences for the consumption of public and private goods, respectively.[4]

The utility function (2.1) also contains two parameters, $\theta \in [0, 1]$ and $\phi \in [-1, 1]$, which are key for the analysis, and that are assumed to be identical in the two jurisdictions. The parameter θ represents a classical positive spillover of local public goods provision; at one end, $\theta = 1$ implies full

[3]The fact of limiting the analysis to the case of only two jurisdictions obviously implies that each one of them is the neighbor' of the other one. We adopt such a simplified setup for analytical convenience. A richer, but also more complex, specification is that of the "circular region", a formalization akin to that used in spatial models of product differentiation, in which the local jurisdictions are located along a circle, so that each one of them has two neighbors, one at its left and one at its right of the regional territory (see Solé-Ollé, 2006, for an application of such a type of framework).

[4]Heterogeneity between jurisdictions in terms of the preference parameters α_i and β_i can be due to geographical factors, demographic factors (e.g., the share of elderly in total population), characteristics of the local economy, and so on.

spillover; at the other end, $\theta = 0$ implies no spillovers.[5] A first interpretation is that a share θ of the residents in jurisdiction 1 fully enjoy the public infrastructures located in jurisdiction 2. A second interpretation is that all residents in jurisdiction 1 enjoy at a $\theta\%$ rate the public infrastructures located in jurisdiction 2.

The parameter ϕ measures instead the degree of complementarity (if positive) or substitutability (if negative) in the use of public infrastructures provided by the two jurisdictions.[6] For instance, road services provided by the two municipalities are complement in usage if drivers (e.g., commuters, or shoppers) must cross the border in a typical journey: in this case, it is $\theta > 0$, $\phi > 0$. Two swimming pools, one located in each municipality, are instead likely to be substitutes in usage: in this case, it is $\theta > 0$, $\phi < 0$.

Let t_i be the per capita local tax. By substituting the local government budget constraint, $N_i t_i = G_i$, into the representative individual's budget constraint, $c_i = y_i - t_i$, we obtain the local economy resource constraint:

$$c_i = y_i - \frac{G_i}{N_i}. \tag{2.2}$$

2.2.1 Investment in public infrastructures

Local policy makers simultaneously and independently set their own expenditures on infrastructures with the aim of maximizing the welfare of the rep-

[5] In line with the prevalent literature, we assume that the spillover is automatically determined by the provision of local infrastructures. It is possible to extend our framework to the more realistic case in which the effective level of enjoyment depends on usage levels, endogenously chosen by individuals of the two jurisdictions.

[6] Most models analyzing local public goods spillovers assume that the total amount of public goods enjoyed by the residents of any given jurisdiction is equal to a weighted sum of the 'home' and the 'neighbors' public goods supplies, which means that the public goods provided by different jurisdictions are perfect substitutes (in our model, this case is obtained by setting $\phi = -1$). The more general functional form of the utility function given in Eq. (2.1) is widely used in oligopolistic models with product differentiation (see, e.g., Singh and Vives, 1984).

resentative resident. Formally, and considering, without loss of generality, municipality 1, the policy maker chooses the public good G_1 to maximize Eq. (2.1), subject (2.2) for $i = 1$, taking as given the public good G_2 of municipality 2.

The first order condition of the given problem is:

$$\frac{\partial u_1}{\partial G_1} = (\alpha_1 - G_1 + \theta\phi G_2) + (\beta_1 - c_1)\frac{\partial c_1}{\partial G_1} = 0,$$

that can be written as:

$$(\alpha_1 - G_1 + \theta\phi G_2) - \left(\beta_1 - y_1 + \frac{G_1}{N_1}\right)\frac{1}{N_1} = 0. \tag{2.3}$$

From Eq. (2.3) we can show that the second order sufficient condition for a maximum holds true, since:

$$\frac{\partial^2 u_1}{\partial G_1^2} = -1 - \frac{1}{N_1^2} = -\left(1 + \frac{1}{N_1^2}\right) < 0.$$

2.3 Empirical Hypotheses

Let $g_i = G_i/N_i$ denote the per capita level of public good (infrastructure) in jurisdiction i, after some calculations (see Appendix B) we can re-write Eq (2.3) as:

$$\frac{\alpha_1}{N_1 N_2} - \frac{g_1}{N_2} + \frac{\theta\phi g_2}{N_1} - (\beta_1 - y_1 + g_1)\frac{1}{N_1^2 N_2}. \tag{2.4}$$

By solving Eq. (2.4) with respect to g_1, we obtain the best response (or reaction) function expressed in per capita terms:

$$\tilde{g}_1(g_2, N_1, N_2) = \left(\alpha_1 - \frac{\beta_1 - y_1}{N_1} + \theta\phi g_2 N_2\right) \bigg/ \left(N_1 + \frac{1}{N_1}\right). \tag{2.5}$$

A similar best response function, denoted by $\tilde{g}_2(g_2, N_2, N_1)$, can be obtained for municipality 2. By combining the two functions, one can solve for the Nash equilibrium in the provision of public good of the two municipalities.[7] We characterize the factors that determine the sign and the size of the slope of the reaction function (2.5). In fact, the latter represents the key interaction effect for the expenditure decisions of local governments that we try to assess in our empirical analysis.

From the best response function (2.5), it is immediate to obtain its slope as:

$$\frac{\partial \tilde{g}_1}{\partial g_2} = N_2 \theta \phi \bigg/ \left(N_1 + \frac{1}{N_1} \right) . \tag{2.6}$$

Provided that the benefits of public infrastructures spill-over across jurisdictions (i.e., $\theta > 0$), Eq. (2.6) shows that the sign of the slope of the reaction function is determined by the sign of the parameter ϕ, expressing complementarity (when positive) or substitutability (when negative) of public infrastructures services in the neighboring jurisdictions.

2.3.1 Testable Hypothesis

If municipalities adopt best response functions computed in per capita terms, and assuming spillovers (i.e., $\theta > 0$), Eq. (2.6) shows that, for given ϕ and N_2, the slope of the best response function is, in absolute value, decreasing if $N_1 > 1$, in fact:

$$\frac{\partial^2 \tilde{g}_1}{\partial g_2 \partial N_1} = -\phi \theta \gamma N_2, \quad \text{where } \gamma = \frac{N_1^2 - 1}{(1 + N_1^2)^2} > 0 \text{ for } N_1 > 1. \tag{2.7}$$

The size of the slope of the best response function of jurisdiction i is, in absolute value, decreasing in its population N_i, for given population N_j of the neighboring jurisdiction j. The intuition behind this result is simple. In per capita terms, a large jurisdiction has little incentives to react to

[7] If a stable Nash equilibrium exists, then it is unique, since the reactions functions are linear in the expenditure levels. On the normative side, it is possible to show that in general the expenditure decisions emerging in the Nash equilibrium are not efficient, since local policy makers do not internalize the positive spillovers of public expenditure accruing to the residents in the other municipality.

changes in the infrastructures level by a small neighboring community, as any given change in the per capita expenditure of the latter brings about benefit spillovers to the residents in the large community that are, in per capita terms, very small.[8]

2.4 The empirical analysis

The model presented in the previous section is tested by using a dataset on the 223 municipalities belonging to the Italian Autonomous Province of Trento. Italy counts four administrative government layers: the central authority and, at the local level, Regions, Provinces and Municipalities. While most Regions and Provinces are ruled by “ordinary” statutes, some of them - the “autonomous” Regions and Provinces - are ruled by “special” statutes.[9] Autonomy means wider competencies on public functions than those attributed to Ordinary Regions and Provinces, as well as the right to cash almost all tax revenues that originate at the local level. In particular, the Province of Trento cashes 90% of all revenues from central taxes that originate on its territory, while the remaining 10% is withheld by the central government. Thanks to its autonomy, the Province of Trento is a very interesting experimental framework, as fiscal federal theory can be tested within a simple institutional setting in which there are only two government layers: the Province in the role of the central authority and the Municipalities in the role of local authorities, with the latter financing their expenditure functions with own revenues and transfers from the Province.

[8] It is possible to show that if the provided good is rival in consumption, the result holds provided that the population of the municipality is larger than the population of the neighbors.

[9] Italy counts five Autonomous Regions (Sicily and Sardinia, which are insular territories, and Valle d’Aosta, Trentino Alto-Adige, and Friuli Venezia-Giulia, which are northern boundary territories) and two Autonomus Provinces (Trento and Bolzano, making up the Trentino Alto-Adige Region).

At the municipal level, own revenues include a property tax and a range of user-fees,[10] while provincial transfers are in part of the "specific" type (i.e., targeted to specific expenditure functions) and in part of the "general" type, with the latter allocated by means of formulas based on fiscal needs and fiscal capacities of the municipalities. On the expenditure side, budgetary data distinguish between "recurrent" and "capital" outlays. Our focus is on the latter type of expenditures, since they build up over time the stock of public infrastructures.

2.4.1 Data and variables

The main variable in the dataset is the yearly capital expenditure, in real terms,[11] for the 223 municipalities over the period 1990-2007, divided into 12 functions that reflect investments on different types of infrastructures. We also collected data on the capital transfers granted by the Province of Trento to its municipalities, since this source of revenues is an important determinant of investment outlays.[12] The provincial capital transfers are in part of the specific type (i.e., earmarked to specific infrastructural projects in one of the 12 expenditure functions) and in part of the general type

[10]For the period covered by our study, the main local tax at the municipal level is ICI (Imposta Comunale sugli Immobili), which is based on the cadastral value of real estates and on the market value of building lots. Minor taxes include a surcharge on the personal income tax and a surcharge on the tax on electricity consumption. User charges include waste collection and fees for public services such as public transport, nursery schools, and so on.

[11]We used the 2007 base year deflator for gross fixed capital formation computed by the "Autorità per l'Energia" (www.autorita.energia.it).

[12]There is also a well known literature on the effects of grants on public expenditure, usually finding that grants can stimulate government expenditures more than monetary transfers to individuals of the same amount (Gramlich, 1977). Hence, a quota of the federal money sticks to the public sector instead of being distributed to citizens (the so-called *flypaper effect*). Interestingly, Wyckoff (1991) finds that capital expenditures are particularly sensitive to grants.

(usually formula-based, with reference to measures of fiscal needs and fiscal capacities).[13]

We build a measure of the municipal capital stock (i.e., the endowment of infrastructures) by applying the perpetual inventory method (see, e.g. Goldsmith, 1951; Meinen et al., 1998), according to which the capital stock at time t is assumed to be equal to the capital stock at time $t-1$, net of depreciation (if any), plus gross investment (capital expenditure) at time t. In our benchmark definition of the capital stock, we consider year 2001 as the initial capital stock, given that all the control variables are available from 2001 to 2007: the initial 2001 capital stock is computed by summing the yearly expenditure flows over the twelve-year period from 1990 to 2001. Assuming no depreciation, the 2002 capital stock is then obtained by adding to the 2001 stock the 2002 expenditure, and similarly for the following years from 2003 to 2007. Hence we end up with a seven-year series of municipal capital stock for the period 2001-2007. However, the capital stock does not show great variance between years, since infrastructural investments that typically take several years to be completed usually appear in the municipal budgets as uniform annual quota of expenditures. Furthermore, not all the controls (see below) are either available for each one of the years 2001-2007 or, when available, they do not show great variance between years. Therefore, in the empirical analysis of Section 2.5 we use a cross-sectional dataset instead of a panel, by using as dependent variable the average value of the capital stocks for the period 2001-2007.[14]

[13]Data on general transfers cover the period 1991-2007 and account for about 60% of capital expenditures of all municipalities. Specific transfers cover only the period 2001-2007 since for the period 1991-2000 there was no distinction between the two categories of transfers in budgetary data. For the period 2001-2007, total transfers account for about 68% of capital expenditure, with specific transfers accounting for about 60% of the total.

[14]To compute the per capita value of the 2001-2007 stock, we divide it by the average population over the same period. To test the robustness of the results, we built several different measures of the capital stock, and found no significant changes. In particular,

The per capita value of the average capital stocks for the period 2001-2007 is about 16,671 euros. Table 2.1 shows that almost 75% of the total stock is concentrated on three expenditure functions, namely *Administration & Management*, *Roads & Transport* and *Planning & Environment*. Moreover, these three functions are also those for which, in every year considered, all municipalities have a positive expenditure. For these reasons, our empirical analysis focuses on the determinants of four measures of infrastructural endowments: the total stock and the three above mentioned functions.

Table 2.1: Summary statistics on the Infrastructure stocks.

Expenditure Function	Per Capita Value (euro)	Percentage on the total	Number of zeros	% of observations with zero
	(1)	(2)	(3)	(4)
Administration & Management	3,625.57	21.75	0	0.00
Municipal police	7.39	0.04	210	94.17
Justice	236.09	1.42	25	11.21
Education	966.39	5.80	20	8.97
Culture	463.25	2.78	8	3.59
Sport	947.73	5.68	18	8.07
Tourism	226.63	1.36	85	38.12
Roads & Transport services	4,688.47	28.12	0	0.00
Planning & Environment	4,172.41	25.03	0	0.00
Social welfare	816.42	4.90	6	2.69
Economic development	468.83	2.81	63	28.25
In-house productive services	51.83	0.31	152	68.16
TOTAL	**16,671.01**	**100.00**		

Turning to the control variables, we build up a measure of the provincial capital grants (*grants*) using the same method outlined above for the capital stock. As for the other variables, the dataset includes demographic, territorial and socioeconomic data that can be relevant determinants of in-

we computed the initial capital stock in year 1994 (obtaining a 14-year series) and in year 2006 (obtaining a 2-year series), assuming no depreciation. Then we also considered linear depreciation rates of 2%, 3%, 4% and 5%, which are in line with those used in similar studies estimating the stock of public infrastructures, such as those carried by the World Bank (Agénor et al., 2005; Arestoff and Hurlin, 2006) and the IMF (Kamps, 2006. For the Italian case, Marrocu and Paci (2010) use a 4% depreciation rate to build a measure of the capital stock series for the period 1996-2003 at the regional level.

frastructural stocks. The average altitude level, from 2001 Census, of the municipal territory (*altitude*) can account for the fact that providing public services in the mountains requires “greater”, hence more costly, infrastructures than in plains. The number of residents (*population*, the 2001-2007 average value) and the population density (*population density*, computed as the number of residents per area) can capture the presence of scale economies in infrastructures provision. The shares (also in this case we refer to the 2001-2007 average value) of inhabitants older than 65 (*aged*) and of those aged 0-5 (*children*) can account for some specific infrastructural needs (e.g., infant schools, nursing homes for elderly). The per capita number of houses (*houses*), from 2001 Census, can capture the demand for public infrastructures from resident households, as well as those linked to tourism activities, since the variable includes also holiday properties. The per capita number of employees (from 2001 Census) in both the public and the private sector, (*total employees*), as well as the per capita number of firms (from 2001 Census) in the private sector (*local unit*), can proxy the demand for public infrastructures from the productive sector. Finally, in order to capture a possible link between expenditure variation and population change we include the population growth rate (*population growth*), defined as the percentage difference between the population average in 2001-2007 and that in 1991-1997.[15]

A peculiarity of the Province is the presence of 16 “communities”, each one formed by several contiguous municipalities belonging to an homogenous geographic and economic area. By means of their community, the municipalities jointly provide some public services that benefit the whole area covered by the community, thus realizing some economies of scale and spillover internalization. Since the community of affiliation can bear some weight in the investment decisions of a municipality, we include as a control

[15] The years 1991 and 2001 are the census years and 2007 is the last year of the dataset.

a dummy variable for each community (*communities dummy*).

In order to control for the outliers, we compute the interquartile range (IQR) for all the dependent variables, picking up those observations (outliers) passing over the left or right boundary and defining accordingly a dummy variable (*outliers dummy*).[16] Finally, we define a dummy variable (*metropolitan dummy*), equal to one for the two most populated cities in the Province, which are Trento (about 110,000 inhabitants) and Rovereto (about 35,000 inhabitants). These are by far the biggest cities, since the other 221 municipalities have an average population of about 1,600 inhabitants.

Summary statistics, data description and data sources of all the variables used in the analysis are reported in Appendix B, Tables B.1 and B.2 while Table B.3 provides the list of municipalities outliers.

2.5 Econometric specification

Estimation of the standard empirical model of public expenditure through a linear specification might not take into account expenditures and or economic shocks in neighboring municipalities which can be correlated with exogenous controls and so lead to biased and inconsistent estimates of the parameters (Case et al., 1993; Revelli, 2002). Therefore, before deciding upon the econometric strategy, we need to know whether the data present spatial dependence among municipalities.

To do so we first need to define spatial variables. We build a matrix of neighbors to each municipality based upon their geographical location, which can be expressed through a (223×223) matrix, such that the element corresponding to row a and column b is 1 if the spatial units a and b are geographically neighbors, and zero otherwise. We then make a row standardization such that the elements of each row sum to one; note also

[16]We used the IQR stata command, which allows for the detection of both mild and severe outliers.

that, since all neighbors have the same weight, all elements of a row are identical. Hence, the product of the (223×223) matrix by the (223×1) vector of expenditure levels yields for each municipality a simple average of its neighboring municipalities expenditure.

We compute the traditional measure of spatial dependence that is the Moran's spatial statistics (Cliff and Ord, 1981; Anselin, 1988) for the per capita *Total Infrastructures* and for the three selected sub-functions, *Administration & Management*, *Roads & Transport* and *Planning & Environment*. As Table 2.2 shows, all our variables of interest exhibit a spatial pattern of positive autocorrelation that is stronger for both expenditures in *Total Infrastructures* and *Roads and Transport*.

Table 2.2: Moran Spatial Statistic.

	Total	Administration & Management	Roads & Transport	Planning & Environment
	(1)	(2)	(3)	(4)
Moran I statistic	0.14***	0.08**	0.18***	0.06*

Notes: The spatial matrix used to compute the Moran test is a binary, contiguity-based one, according to which two municipalities are neighbors if they share a border, and is row-standardized. *** significant at 1%; ** significant at 5%; *significant at 10%.

However, the result of the Moran test is unable to discriminate properly between spatial-lag and spatial-error dependence.[17] Hence, in order to obtain a more precise indication of which is the most likely source of spa-

[17] There are two primary types of spatial dependence. The *spatial error dependence* occurs when the error terms across different spatial units are correlated. In this case the OLS assumption of uncorrelated error terms is violated and hence the estimates are biased. Spatial error is due to omitted (spatially correlated) covariates that, if not attended, would bias the estimate. Spatial error models sort out of the problem by estimating the coefficient of the spatial error. The *spatial lag dependence* implies that the dependent variable y in jurisdiction i is affected by independent variables of jurisdiction i and j and hence the dependent variable of j also affects it, and vice-versa. The assumption of uncorrelated error terms and independent observations is violated and therefore the regression estimates are biased. The solution to this puzzle can be that of instrumenting the endogenous spatial lag (i.e., the dependent variable of j entering in the estimate of the dependent variable of i). See Appendix B for details.

tial dependence, we perform the two robust Lagrange multiplier (LM) tests proposed by Anselin et al., (1996)[18] which are based on the OLS residuals of a non-spatial regression model, using all the control variables described in Section 2.4.1. The robust LM tests (Table B.4 in the Appendix B) indicate the presence of spatial lag dependence for *Total Infrastructures* (the robust LM test value is 3.53 and statistically significant at 10%) while for the *Roads & Transport* expenditure function the spatial pattern appears to be driven by both spatial lag and spatial error, even though the test statistic for the former (the robust LM test statistic is 9.50 and statistically significant at 1%) is larger than that for the latter (the robust LM test statistic is 6.05 and statistically significant at 5%). On the other hand, the robust LM test for the *Planning & Environment* expenditure function suggests the presence of spatial dependence in the error term (the test is equal to 5.44 and statistically significant at 5%), while for *Administration & Management* the robust LM test does not indicate the presence of neither spatial lag nor spatial error dependence.

For each one of the four infrastructural measures, we now proceed to estimate the slope of the reaction function characterized in Section 2.3, and then test for the Hypothesis 1 stated in Section 2.3.1 , by estimating whether the size of the slope of the reaction function depends on population size.

2.5.1 Strategic interaction evidence

Using the per-capita neighbors' average expenditure, we first estimate the OLS coefficients (Table 2.3, columns 1, 3, 5 and 7). Moreover, since the spatial tests shown above suggest the presence of different patterns of spatial dependence for the four infrastructural measures we focus on, we perform a three-step procedure developed by Kelejian and Prucha (1998) to estimate a spatial autoregressive model with autoregressive disturbance (Table 2.3,

[18] Both LM-statistics are Chi-Square distibuted with one degree of freedom.

columns 2, 4, 6 and 8) taking into account both the source of spatial dependence (spatial-lag and spatial-error) by using as instruments the average of all neighbor's exogenous variables and correcting for heteroskedasticity of unknown form (GS2SLS Robust; see Drukker et al., 2010 and 2011a, for details).

The estimated spatial lag coefficient, λ, for *Total Infrastructures* is 0.17 and 1% significant while the spatial error coefficient, ρ, is not significant (Table 2.3, col. 2). The positive coefficient suggests that municipalities tend to increase their own infrastructure spending as a response to the rising expenditure of their neighboring municipalities, thus confirming the hypothesis of horizontal expenditure spillovers with complementarity in use; that is, in terms of the model in Section 2.3, the estimated coefficient λ is consistent with the existence of positive spillovers ($\theta > 0$) and complementarity in use ($\phi > 0$), which implies best response functions that are positively sloped. As for the specific expenditure functions, for *Road & Transport* we find a 1% significant and positive coefficient of 0.25 for the spatial lag coefficient, λ, and a negative spatial error coefficient of 0.44 (5% significant), indicating that both types of spatial dependence coexist in the model (Table 2.3, col. 6). For *Planning & Environment* the estimated spatial lag coefficient is not significant but in this case we find a negative and 5% significant spatial error coefficient of magnitude -0.47 (Table 2.3, col. 8). Finally, for the *Administration & Management* expenditure function we do not find any evidence of horizontal strategic interaction, since neither the spatial-lag nor the spatial-error coefficient are statistically different from zero (Table 2.3, col. 4). These results confirm those of the spatial auto-correlation tests illustrated in Table 2.2 and in Table B.4 of the Appendix B. The reason is that the *Road & Transport* function contains investments on infrastructures that are complement in use, like roads and bridges, since the benefits from use of the infrastructure in one jurisdiction are higher if also the neighboring jurisdictions provide the same type of infrastructures on their territory. In the *Planning & Environment* function, where the expenditure is related to infrastructures like dams, the spatial link in expenditure does not hold. However, there is a spatial link in the residuals of the estimate, which can be explained by some missing spatial variable reflected by the significance in the spatial error coefficient. Finally, in the *Adminstration & Management* function, which contains expenditures for buildings and facilities necessary to provide purely local administrative services, we do not find any spatial link, since there are no spillovers in use ($\theta = 0$, in terms of the model in Section 2.3).

Table 2.3: Spatial model estimation results.

	Total		Administration & Management		Roads & Transport		Planning & Environment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
λ	0.10*	0.17***	-0.17*	-0.03	0.14*	0.25***	-0.03	0.19
	(0.06)	(0.05)	(0.10)	(0.09)	(0.08)	(0.07)	(0.12)	(0.12)
ρ		-0.19		-0.17		-0.44**		-0.47**
		(0.16)		(0.15)		(0.17)		(0.19)
Grants	0.87***	0.85***	0.37**	0.37**	0.82***	0.79***	0.72***	0.74***
	(0.09)	(0.09)	(0.18)	(0.16)	(0.13)	(0.12)	(0.14)	(0.13)
Altitude	4.31***	3.83***	1.33	1.18	1.61**	1.44**	0.75	0.48
	(1.47)	(1.29)	(0.90)	(0.79)	(0.79)	(0.65)	(1.01)	(0.87)
Population	-0.07*	-0.07**	-0.06**	-0.06**	-0.03**	-0.04**	-0.03*	-0.03**
	(0.04)	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)
Houses	2,509.36***	2,520.73***	446.31	391.00	633.78*	553.40*	1,290.00**	1,129.69***
	(883.25)	(812.42)	(527.35)	(491.88)	(380.58)	(334.17)	(501.19)	(416.22)
Aged	1,969.37	1,113.78	3,885.67	2,863.65	-1,603.27	-3,598.87	7,444.27	7,796.44
	(9,428.57)	(8,908.13)	(6,030.13)	(6,095.43)	(4,648.27)	(4,038.59)	(5,463.26)	(4,872.74)
Children	607.58	-3,717.58	-2,784.41	-5,084.36	-14,927.14	-16,478.47	11,248.30	5,203.81
	(30,717.96)	(28,556.94)	(18,234.70)	(17,034.96)	(20,203.51)	(18,083.26)	(16,124.65)	(14,392.43)
Population density	-0.83	-0.72	-0.46	-0.34	0.30	0.34	-0.31	-0.20
	(0.86)	(0.78)	(0.51)	(0.44)	(0.37)	(0.31)	(0.48)	(0.40)
Population growth	4,595.67	4,509.20	-2,203.88	-2,162.01	-1,762.93	-2,020.82	-416.09	-150.50
	(4,267.68)	(3,894.62)	(3,181.63)	(2,927.71)	(2,367.13)	(2,218.06)	(3,124.13)	(2,585.39)
Total employees	4,176.50	4,136.67	1,997.99	1,998.71	1,014.33	903.37	91.68	666.79
	(3,153.76)	(2,872.37)	(2,095.22)	(1,916.08)	(1,246.07)	(1,171.68)	(1,670.28)	(1,435.63)
Local unit	16,940.34	17,513.38	7,418.23	6,664.84	201.99	1,013.53	341.13	293.50
	(12,216.94)	(11,371.28)	(7,250.13)	(6,699.34)	(5,564.78)	(5,066.46)	(7,977.42)	(7,186.91)
Outliers dummy	10,167.77**	10,676.13***	8,286.30***	8,370.97***	7,490.02***	7,646.37***	8,541.15***	8,514.42***
	(4,115.77)	(3,944.14)	(1,171.37)	(1,141.15)	(1,011.15)	(906.81)	(1,671.18)	(1,443.07)
Metropolitan dummy	3,667.06	3,693.94	1,457.60	1,603.52	993.67	1,483.74	448.00	251.21
	(2,529.95)	(2,589.14)	(1,410.58)	(1,495.82)	(1,171.10)	(1,464.50)	(1,070.78)	(1,059.25)
Constant	-3,169.04	-3,278.43	-757.66	-598.66	1,138.46	1,408.10	-1,229.46	-1,821.05
	(2,911.58)	(2,688.47)	(1,975.98)	(1,909.38)	(1,689.41)	(1,466.95)	(1,711.60)	(1,469.92)
Communities dummy	YES	YES	YES	YES	YES	YES	YES	YES
Observations	223	223	223	223	223	223	223	223
R-squared	0.91		0.72		0.86		0.82	

Notes: Columns (1), (3) ,(5) and (7) display OLS robust estimator results by using, respectively, total per-capita expenditure, administration and management per-capita expenditure, road and traffic per-capita expenditure and planning and environment per-capita expenditure as dependent variables. Columns (2), (4) ,(6) and (8) show the spatial lag-error model estimation results by using GS2SLS (Generalized method of moment and instrumental variables) robust estimator correcting for heteroskedasticity issues of unknown form. The spatial weight matrix (W) used is of the type: contiguity-based and it is row-standardized. Robust standard errors are shown in parentheses. *** significant at 1%; ** significant at 5%; *significant at 10%.

2.5.2 The impact of the population size

In this section we extend our empirical analysis by interacting the average of neighbor's per capita expenditure with the population.[19] We first estimate

[19]To test the robustness of our results, we have also taken into account the relative size of a municipality with respect to its neighbors by interacting the average of neighbor's per capita expenditure with the ratio between population and the average of neighbor's

a spatial model in which we account for the interaction term by OLS (Table 2.4, columns 1, 4, 7 and 10).[20] We then use the GS2SLS estimator (Table 2.4, columns 2, 5, 8 and 11) where we account only for the endogeneity issue of the spatial parameter, but we do not instrument its interaction with the population. In order to check whether the results obtained from GS2SLS regression are robust to possible endogenity bias due to the interaction term we also include, as additional instruments, the product of the neighbor's exogenous variables with population (columns 3, 6, 9 and 12, Table 2.4).

The spatial interaction parameter, λ, is significantly different from zero for *Total Infrastructures* in all three specifications: OLS (col. 1), GS2SLS (col. 2) where only neighbor's infrastructure are instrumented with all neighbors exogenous variables, and GS2SLS (col. 3) where neighbor's infrastructure are instrumented with all neighbors exogenous variables and the product of neighbors'infrastructure with population is instrumented with the product of neighbor's exogenous variables with population, confirming that municipalities' infrastructures are positively affected by those of the neighbors. Also for the *Roads & Transports* expenditure function λ remains significantly different from zero in all three specifications. We also find evidence of horizontal spending spillovers for *Planning & Environment*, since λ turns out to be significantly different from zero at 10% in the specification when we instrument only for neighbor's infrastructure (col. 11) and in the specification when both neighbor's infrastructure and the product of neighbors'infrastructure with population are instrumented (col. 12).

In columns 1, 2 and 3 of Table 2.4 we find evidence that the externality effect on *Total Infrastructures* is negatively driven by population (in fact the interaction term *(neighbors spending)*population* is equal to -0.39, 5% significant in the specification in column 1; -0.45, 1% significant in the

population, finding no changes in the results.

[20] The results of the non-spatial regression model are reported in Table B.5 of the Appendix B.

specification in column 2; −0.39, 5% significant in the specification in column 3), confirming the Hypothesis stated in Section 2.3.1.

Inspecting more in detail we observe that this result is entirely due to the *Roads & Transport* expenditure function (columns 7, 8 and 9), for which the interaction term is negative (−1.17, 1% significant in the specification in column 7; −1.23, 1% significant in the specification in column 8 and −1.00, 1% significant in the specification in column 9). For *Planning & Environment* the interaction term is negative but, however, is statistically not different from zero (col. 10, col. 11 and 12). Finally, for *Administration & Management* the spatial coefficients and the interaction turns out to be statistically not different from zero in all the specifications, apart in the OLS specification (col. 4) where the spatial parameter λ is negative (−0.20) and statistically different from zero at 10%.

As for the spatial error coefficient, ρ, it is not significantly different from zero for *Total Infrastructures* (in both specifications at column 2 and 3) while it is significant for both *Road & Transport* (−0.44, 1% significant in the specification in col. 8 and −0.46, 1% significant in the specification in col. 9) and *Planning & Environment* (−0.41, 5% significant in the specification in col. 11 and −0.45, 5% significant in the specification in col. 12).

Our results show that *Total Infrastructures* are positively determined by the neighbor's infrastructure and so we can say that infrastructures affecting the provision of neighbor's infrastructures are complements: this result is strongly determined by *Roads & Transport* infrastructures. Moreover, the population of the municipality plays an important role, for both *Total Infrastructures* and *Roads & Transport,* in determining the size of the slope of the reaction function (confirming the Hypothesis stated in Section 2.3.1).

Table 2.4: Spatial model and interaction with population.

	Total			Administration & Management			Roads & Transport			Planning & Environment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
λ	0.14**	0.21***	0.21***	-0.21*	0.00	-0.08	0.25***	0.35***	0.34***	0.01	0.21*	0.23*
	(0.06)	(0.05)	(0.05)	(0.11)	(0.09)	(0.09)	(0.08)	(0.07)	(0.07)	(0.14)	(0.13)	(0.13)
ρ		-0.18	-0.19		-0.24	-0.18		-0.44***	-0.46***		-0.41**	-0.45**
		(0.16)	(0.17)		(0.15)	(0.14)		(0.16)	(0.17)		(0.18)	(0.19)
Neighbors spending * Population	-0.39**	-0.45***	-0.39**	0.25	0.19	0.27	-1.17***	-1.23***	-1.00***	-0.27	-0.21	-0.15
	(0.18)	(0.17)	(0.16)	(0.25)	(0.20)	(0.23)	(0.33)	(0.29)	(0.27)	(0.23)	(0.23)	(0.23)
Grants	0.86***	0.84***	0.84***	0.37**	0.37**	0.37**	0.78***	0.76***	0.76***	0.71***	0.73***	0.73***
	(0.09)	(0.09)	(0.08)	(0.18)	(0.16)	(0.16)	(0.13)	(0.12)	(0.12)	(0.15)	(0.13)	(0.13)
Altitude	4.65***	4.22***	4.10***	1.15	0.99	1.01	1.99**	1.79***	1.68***	0.65	0.37	0.34
	(1.42)	(1.25)	(1.25)	(0.91)	(0.80)	(0.79)	(0.77)	(0.64)	(0.63)	(1.01)	(0.87)	(0.87)
Population	0.48*	0.57**	0.47**	-0.18	-0.15	-0.18*	0.36***	0.37***	0.30***	0.05	0.03	0.01
	(0.26)	(0.24)	(0.23)	(0.12)	(0.09)	(0.11)	(0.11)	(0.10)	(0.09)	(0.07)	(0.06)	(0.07)
Houses	2,382.34***	2,369.45***	2,384.41***	484.14	389.59	441.10	512.95	428.70	453.67	1,281.75**	1,152.44***	1,142.47***
	(869.47)	(796.88)	(795.87)	(521.15)	(484.35)	(483.57)	(380.20)	(332.94)	(332.02)	(504.77)	(427.44)	(423.56)
Aged	1,906.98	1,288.11	1,195.29	4,063.03	2,407.21	3,055.88	-2,017.58	-3,781.36	-3,755.80	7,549.66	7,668.45	7,592.31
	(9,407.78)	(8,879.32)	(8,900.37)	(6,016.28)	(6,212.11)	(6,035.80)	(4,582.24)	(3,997.87)	(3,967.90)	(5,415.54)	(4,881.79)	(4,864.78)
Children	-1,315.34	-5,454.08	-5,799.35	-2,758.28	-6,246.95	-4,949.05	-18,838.30	-20,766.69	-20,361.58	11,001.59	5,930.14	5,517.65
	(30,629.61)	(28,469.76)	(28,452.73)	(18,311.44)	(16,960.47)	(17,131.07)	(19,908.48)	(17,752.45)	(17,807.80)	(16,199.31)	(14,502.75)	(14,432.38)
Population Density	-1.05	-0.96	-0.92	-0.44	-0.27	-0.32	0.10	0.17	0.20	-0.35	-0.23	-0.21
	(0.86)	(0.78)	(0.78)	(0.49)	(0.42)	(0.42)	(0.40)	(0.34)	(0.33)	(0.48)	(0.41)	(0.41)
Population growth	4,685.98	4,616.63	4,653.86	-2,210.55	-2,176.45	-2,174.15	-1,636.99	-1,770.11	-1,778.99	-445.50	-237.30	-209.57
	(4,269.57)	(3,895.49)	(3,886.30)	(3,191.27)	(2,900.26)	(2,915.19)	(2,325.04)	(2,181.09)	(2,179.00)	(3,119.88)	(2,631.02)	(2,603.18)
Total employees	3,869.87	3,879.20	3,899.29	2,174.53	2,082.59	2,161.76	1,012.47	1,043.16	1,022.35	115.09	580.74	621.57
	(3,137.68)	(2,837.23)	(2,838.74)	(2,163.75)	(1,921.45)	(1,963.50)	(1,234.55)	(1,166.29)	(1,164.82)	(1,669.06)	(1,461.46)	(1,453.64)
Local unit	19,179.96	19,763.99*	19,498.96*	7,042.96	6,155.76	6,377.81	1,315.12	1,603.29	1,532.70	615.30	368.31	272.37
	(12,207.45)	(11,319.90)	(11,310.91)	(7,296.97)	(6,677.07)	(6,717.98)	(5,582.83)	(5,093.50)	(5,057.19)	(7,992.98)	(7,221.57)	(7,198.25)
Outliers dummy	10,254.36**	10,755.43***	10,779.10***	8,291.36***	8,384.63***	8,374.56***	7,415.54***	7,492.34***	7,510.43***	8,533.51***	8,543.25***	8,553.18***
	(4,118.36)	(3,931.83)	(3,937.91)	(1,171.67)	(1,145.34)	(1,135.08)	(973.47)	(874.58)	(873.39)	(1,682.66)	(1,468.69)	(1,457.61)
Metropolitan dummy	91.18	-236.31	340.84	2,517.13	2,374.30	2,671.16	-1,630.26	-1,027.21	-517.47	-199.97	-176.38	-35.82
	(3,733.13)	(3,759.75)	(3,599.99)	(1,908.58)	(1,579.04)	(1,739.14)	(1,456.69)	(1,751.09)	(1,680.15)	(932.33)	(1,007.91)	(1,068.37)
Constant	-3,563.93	-3,706.10	-3,658.38	-476.14	-255.08	-296.57	1,167.71	1,517.63	1,508.55	-1,179.54	-1,696.90	-1,783.81
	(2,936.28)	(2,714.56)	(2,711.99)	(2,046.49)	(1,960.47)	(1,984.59)	(1,669.05)	(1,447.14)	(1,443.67)	(1,719.73)	(1,507.46)	(1,503.76)
Communities dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	223	223	223	223	223	223	223	223	223	223	223	223
R-squared	0.91			0.73			0.87			0.82		

Notes: Columns (1), (4), (7) and (10) display OLS robust estimator results by using, respectively, total per-capita expenditure, administration and management per-capita expenditure, road and traffic per-capita expenditure and planning and environment per-capita expenditure as dependent variables. Columns (2), (5), (8) and (11) show the spatial lag-error model estimation results by using GS2SLS (Generalized method of moment and instrumental variables) robust estimator correcting for heteroskedasticity issues of unknown form. Columns (3), (6), (9) and (12) replicate the previous estimation by using the lag of the explanatory variables multiplied by the population as additional instruments. The spatial weight matrix (W) used is of the type: contiguity-based and it is row-standardized. Robust standard errors are shown in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

2.6 Conclusions

In this study we investigated the types of interactions that can emerge among municipalities in providing infrastructures. First, we setup a theoretical model in which two jurisdictions provide their own infrastructures, assuming that the inhabitants of both jurisdictions can use them. If local infrastructures are complements in use, there is a positive interaction when jurisdictions set their own expenditures; the interaction is instead negative if infrastructures are substitute in use by citizens. The model also predicts that an increase in population decreases the size of the reaction function slope. We then tested these results by using data on municipalities of the Italian Province of Trento, finding that total infrastructures of a jurisdiction are positively linked to neighbor's total infrastructures. This result holds also for some specific types of infrastructures, namely *Roads & Transport* and *Planning & Environment*, for which the municipalities show a complementarity relationship with their neighbors as it regards decisions on infrastructure provisions. Also the theoretical prediction about the impact of population on the strategic response has been confirmed for the same type of infrastructural measures, since the size of the slope of the reaction function decreases in magnitude as population increases.

Chapter 3

Policy outcome of single and double-ballot elections

Abstract

We use data for all Italian municipalities from 2001 to 2007 to empirically test the extent to which two different electoral rules, which hold for small and large municipalities, affect fiscal policy decisions at local level. Municipalities with fewer than 15,000 inhabitants elect their mayors in accordance with a single-ballot plurality rule where only one list can support her/him, while the rest of the municipalities uses a runoff plurality rule where multiple lists can support her/him. Per capita total taxes, charges and current expenditure in large municipalities are lower than in small ones if the mayor of the large municipality does not need a broad coalition to be elected, otherwise the use of a single- or double-ballot rule does not make any difference in the policy outcome.

3.1 Introduction

Electoral systems play a crucial role in shaping incentives within which public policies are established. Political economy literature includes a substantial body of work devoted to the task of exploring the impact on public expenditure of plurality versus proportional electoral rules, and of the size of electoral districts. However, few works have been done (Osborne and Slivinski, 1996; Bordignon et al., 2013; Bracco and Brugnoli, 2012) on the possibility that elections do not take place in a one-shot game, but in a two-stage process.

We will focus our attention on the Italian case, which is very interesting from the point of view of the impact of different electoral systems on fiscal policies, since it includes municipalities which adopt the single-ballot system, and others that adopt the double-ballot system, depending on the size of their respective populations. If a municipality's population is less than 15,000, the mayor is elected by means of a single-ballot system and only a single list can support her/him, otherwise the election is conducted according to a double-ballot system and multiple lists are admitted to support her/him.

By using a data set on the financial and electoral characteristics of Italian municipalities in 2001-2007[1], we find evidence that, as a result of different electoral rules, per capita own revenue and current expenditure (in this case the evidence is weaker) are lower in large municipalities than in small ones. However, if the mayor of a large municipality is supported by a broad coalition, then the result tends to disappear.

The paper is organized as follows: Section 3.2 outlines the financial and electoral characteristics of Italy's municipalities. Section 3.3 reviews the relevant literature. In Section 3.4 we describe the theoretical background. The dataset is illustrated in Section 3.5. In Section 3.6 we develop the empirical approach to test the impact of electoral systems on fiscal policies. Sections 3.7 and 3.8 respectively present the results and some robustness checks. Finally, Section 3.9 concludes.

3.2 Institutional framework

The Italian Constitution provides for five layers of government: central government, the regions (ordinary statute regions and special statute regions), the provinces, the local municipalities (more than 8,000 bodies), and the metropolitan authorities (which are yet to be constituted).

[1]We did not use data available from 2008 to 2011, because in this period the local fiscal system has been deeply reformed more than one time. In 2008 the property tax (ICI) levied on principal dwellings was replaced by intergovernmental grants. In 2012, instead, a substantial part of intergovernmental grants to municipalities was replaced by the introduction of a new property tax on principal dwellings (IMU) and a set of local devolved small taxes in 2011. On the contrary in the years 2001-2007 we do not assist to any structural reform of the Italian local fiscal tax system and so the electoral system effect we want to capture is more clear-cut identified.

In our data set as regards their share of the overall government budget, municipalities account on average for about 8.6% of total public expenditure in Italy during 2001-2007 (that is the time span we used in the empirical analysis). They are responsible for a large array of important public programs in the field of welfare services, territorial development, local transport, infant school education, sports and cultural facilities, local police services, as well as most infrastructural spending. On the revenue side, as a result of a lengthy process of fiscal devolution, municipalities can rely on own-source taxes for about 40% (average during 2001-2007) of their total revenue. The main municipal taxes are a property tax, a tax on urban waste disposal, a tax on the occupation of public space, and a surtax on the personal income tax levied by central government. With regard to these taxes, municipalities have some powers to set rates and to establish other basic elements of the tax bases. Other revenue derives from various charges for public utilities and for services such as refuse collection, or the provision of public infrastructures. Transfers from central government account on average for about 30% of the municipal budget during 2001-2007.

As for the municipal-level electoral system, since 1993 Italy has opted for a mayor-council system: the municipal council members and the mayor are separately elected directly by citizens in elections normally held every 5 years. The mechanism of direct election implies that the mayor is endowed with strong powers over municipal politics (a basic feature of presidential government), even though the council retains the power to dismiss the mayor by means of a vote of no confidence in him/her (a basic feature of parliamentary government).[2]

[2]The council performs this task through the discussion and approval of the executive's courses of action as set out in the program that the mayor has to submit to the council together with his/her budget proposals. If a vote of approval is not passed, then two different scenarios may ensue: either the government continues with its action without the council exercising its extreme power; or else the council does in fact exercise said

There are two different systems for the election of the mayor, and of the municipal council, depending on the number of inhabitants in the municipality. The first applies to municipalities with up to 15,000 inhabitants (referred to herein as “small” municipalities), while the second applies to those with more than 15,000 inhabitants (“large” municipalities). The decennial census is the statistics used to distinguish between small and large municipalities. According to the 1991 census, in our dataset small municipalities (that is, the vast majority of Italian municipalities) count 6,044, whereas there are 508 large ones, while in the 2001 census, the small municipalities number 6,019, whereas there are 533 large ones.

In small municipalities, the electoral system is quite simple: each mayoral candidate is associated with a list of candidates for member of the city council. Voters are entitled to vote for a mayoral candidate and may cast, if they wish, a preference vote for a specific candidate for member of the city council. The mayoral candidate who gains the largest number of votes is elected mayor.

A double-ballot majoritarian electoral mechanism is applied in the case of large municipalities. Each mayoral candidate is associated with one list, or coalition of lists, of candidates for the post of councilor; in the first ballot, voters are entitled to vote for a mayoral candidate and, if they wish, for one list associated, or otherwise, with said candidate (that is, a split vote is permitted). Each mayoral candidate must officially declare his/her affiliation to one or more lists running for election to the council. This declaration shall only be deemed valid if it coincides with similar declarations made by the candidates featured on the lists in question. In other words, a coalition of parties is offered to electors. The mayoral candidate who receives the absolute majority of votes is elected mayor in the first ballot. If the mayoral

power by voting a motion of no confidence, which if approved leads to new elections for both the council and the mayor (Scarciglia, 1993; Fabbrini, 2001).

candidate does not receive the absolute majority of votes in the first ballot, then a second ballot is held between the two candidates collecting the largest number of votes in the first round.[3] During the second ballot, voters are entitled to vote for a mayoral candidate, whereas council members are those elected in the first round. The candidate who ultimately obtains the absolute majority of votes is elected mayor.

3.3 Related literature

Political science literature investigated on the difference between single versus double ballot regarding the number of equilibrium candidates in the electoral competition both theoretically (Cox, 1997; Myerson, 1999) and empirically (Fujiwara, 2011). There is also a narrow stream of literature in political economy, theoretical (Osborne and Slivinski, 1996) and both theoretical and empirical (Bordignon et al., 2013) and only empirical (Bracco and Brugnoli, 2012) looking at the impact of the two different electoral systems on public policy decisions.

The theoretical literature starts from the Duverger's Law (1954) saying that ‘‘simple-majority single-ballot favors the two party system'' whereas ‘‘simple majority with a second ballot or proportional representation favors multipartyism." This intuition has been formalized in two theoretical papers (Cox, 1997; Myerson, 1999) as the "M+1 rule": if M is the number of seats available, M+1 turns to be the number of candidates on whom the voters have an incentive, given the strategic behavior favored by the voting mechanism, to concentrate their votes. As a matter of fact, in a single-ballot plurality rule election, if a citizen believes that candidates 1 and 2 have the greatest chances of winning the election, even if said citizen's

[3]In the period between the first and second ballots, the lists excluded during the first round can now join those that are backing one of the two candidates in the second round, thus creating a sort of band-wagoning effect.

preferred candidate is candidate 3, he/she strategically chooses to vote for 1 or 2 in order to maximize his/her chances of being a pivotal voter. As all voters vote according to a similar logic, candidate 3 is deserted by his/her supporters, who all vote for candidates 1 or 2. Similarly, in the first round of a double-ballot plurality rule election, given that two seats are at stake in this case, three candidates remain in the running for the second round of voting (Cox, 1997; Martinelli, 2002). Note, however, that this holds when there is no risk of the unexpected victory of the minority candidate during the first round, that is, when the share of electors backing said candidate is very small (Bouton, 2013).

There are very few empirical works on the single-vs double-ballot electoral system. Fujiwara (2011) uses figures for mayoral elections held in Brazil in 1996-2004, to provide evidence that a transition from the single to the double-ballot system leads to an increase in the number of votes cast for third-placed candidates, and a reduction not only in the gap between the votes cast for the second and third-placed candidates, but also in that between the winning candidate and the third-placed candidate. Bordignon et al., (2013), build up a theory linking the electoral mechanism with the fiscal decisions of the elected governments, and use data on mayoral elections in Italy during the period 1985-2007 finding, in line with previous literature, that the double-ballot leads to a larger number of candidates than the single-ballot. However, in the presence of a not very polarized electorate, the double-ballot system reduces the influence of extremist groups on political policies, allowing moderate parties to run on their own platforms, without being forced to reach a compromise with extremist parties; while for any given level of polarization, the single-ballot system favors coalitions of moderates and extremists. Consequently, they find, in line with Osborne and Silvinski (1996), that equilibrium policies are more dispersed under plurality than under runoff, which elicits more "centrist" policy platforms, limiting the influence of extremist voters. Bracco and Brugonoli (2012) find that in a double-ballot system taxes are lower than in a single-ballot, without however investigating the impact on this result of the number of lists in the coalition supporting the mayor; moreover, interestingly, they also find that runoff municipalities politically aligned with the central government receive, ceteris paribus, more transfers than those not aligned.

3.4 Theoretical background

The single-and double-ballot regimes, for a given not too strong party polarization, imply centrist parties to implement their own policies (Bordignon et al., 2013). The reason of this behavior stands on the fact that under the double-ballot what matters is not to win the first round, but to pass it and to win the final election. A centrist party that manages to pass the first round has a larger probability to win the final election, as it can then collect the voters of the excluded extremist party, if it is not extremely ideological. It will consequently determine two different fiscal policies, which in the single-ballot case comes from an agreement between coalitions' parties and in the double-ballot case express the idea of only one party, which has to take account of both moderates and extremists and so the former is more moderate than the latter. This result holds for not very high polarization levels in the large municipalities (Bordignon et al., 2013). After some polarization level the political outcome of the two regimes is identical (coalitions form also in large municipalities) and the two policy outcomes become very close. We test this result by comparing fiscal output of small municipalities and large ones, for a given voter's polarization. Coherently with the political science literature (Powell, 1982; Pennings, 1998) we proxy polarization in the double-ballot municipality with the number of lists backing the mayor.[4]

[4]Polarization is very often indirectly estimated through the number of parties in an electoral system (Powell, 1982; Pennings, 1998), building on Sartori's idea that in some

The polarization level and so the incentive to build up coalitions is crucial in determining the results of Bordignon et al., (2013). So if there is any difference in the outcome policies between the single-and double-ballot in the low polarization case, this is related to the possibility that in the double-ballot case there is no need of coalition to win the election.

Notice that Roubini and Sachs (1989) and Kontopoulos and Perotti (1999) who argue that coalition members can possibly have divergent interests and so they face a prisoner's dilemma with respect to budget cuts: all the partners have an incentive to protect a particular part of the budget (Alesina and Drazen, 1991). If we link this result to the strategic features of the electoral system we can reasonably expect lower expenditure and taxes[5] in the double-ballot (with low polarization), than in the single-ballot. In fact the theory to which we refer (Bordignon et al., 2013) says that the single-ballot regime always induces parties to merge in coalitions and the double-ballot system induces coalitions only if polarization is very high.

3.5 Data

The empirical analysis is based on a data-set for Italy's municipalities resulting from a combination of different archives publicly available from the Italian Ministry of the Interior, the Italian Ministry of the Economy and the Italian Statistical Office. This panel data set covers all Italian municipalities for the period 2001-2007. It includes a full array of information organized into four different sections: 1) fiscal data on spending and revenue items; 2) institutional data on the main political and personal features of municipal

systems — most often multiparty systems—centrifugal forces produce a fleeing from the center and a pattern of polarized pluralism (Sartori, 1976, pp. 131-145).

[5]During 2001-2007, municipalities in Italy have a strong financial constraint (known as Internal Stability Pact) and so total revenue and expenditure must trend in very similar way, other ways municipalities can be very penalized with federal transfers in subsequent years.

bodies (mayor, municipal executive, municipal council), as recorded at the end of each year; 3) electoral data covering the results of elections in which the mayor and the council members in office during the period covered by the data-set, were elected; 4) municipal demographic and socio-economic data such as population size, population age structure, and the average income of inhabitants.

3.5.1 Dependent variables

Since we are interested in checking if, and how, the electoral system affects budgetary decisions taken at municipal level, as our dependent variables we have adopted information on own revenue, subdivided into taxes and charges, and information on municipal expenditure. As it regards taxes and charges we used per capita revenue as in Besley and Case (1995), or in Esteller-Moré and Solé-Ollé (2001) and not tax rates as in Besley and Rosen (1998) or Devereux et al., (2007, 2008). The reason is threefold. First, a tax financial variable is coherent and comparable with spending. Second, it would be very difficult to have homogeneous comparable rates for all kind of revenues we consider (tax and charges). Third, revenue gives account for both tax rate effort and effort in tax evasion control, which are both complementary important components of the municipality's fiscal policy.

3.5.2 The municipal electoral rule and other political variables

As said before, the municipal electoral rule prescribes two different electoral systems for small and large municipalities. This variation in the electoral mechanism is possibly exogenous with respect to policy-makers' decisional area: we set a dummy (*large*) equal to one when the mayor of a municipality, who held office in a certain year during the period 2001-2007, was elected according to the large-municipality rule, or to zero when, on the contrary, she/he was elected according to the small-municipality rule. The result is that our sample includes both those municipalities where the mayor in office in each single year over the period 2001–2007 was elected by means of one single electoral system, and those where the mayor in office in different years was elected under both electoral rules.

The 15,000-inhabitant threshold for the choice of the electoral system to be applied in a given municipality/election year is not measured with reference to the actual resident population in that year, but rather to the "certified" population as recorded by the census carried out during the first year of each decade by the Italian Statistical Office. This mitigates information about population size being misreported by local authorities in order to endogenously select the electoral mechanism to be applied in a given election year. Moreover, given these operational arrangements, the electoral rule may only lead to a change in the electoral system adopted in a given municipality if an increase/decrease in the "certified" population, determining a jump from below to above (or vice-versa) the discontinuity threshold of 15,000 inhabitants (which, as already mentioned, may occur once a decade), actually applies in the election years that fall, as a rule every 5 years, during that decade. The treatment variable of the regression discontinuity design is, in fact, from 2003 onwards (the year starting from which the 2001 census was used to redefine municipalities' election rules), a dummy equal 1 (from the year when election held) if the population of the 2001 census is greater than 15,000 and before 2003 a dummy equal 1 (until election held, after 2003) if the population of the 1991 census is greater than 15,000.

We measure the political power of the mayor by using the number of votes (*voteshare*) cast in the first ballot. Moreover, a categorical variable (*list*) accounts for the number of lists associated, in the first round, with the mayoral candidate running under the double-ballot rule. Since Italian law establishes a limit of no more than two consecutive mandates for the office of mayor, a dummy variable (*termlim*) has been created to indicate whether a mayor in office in a given year is in his/her second consecutive term of office, and thus ineligible for a further term: the impossibility of further re-election may significantly bias the budgetary decisions of a municipality (Besley and Case, 1995; List and Sturm, 2006).

3.5.3 Socio-economic and demographic controls

We include a set of time-varying variables that characterize a municipality's economic and demographic situation, namely: the population of the municipality (*population*); the average per-capita income proxied by the personal income tax base (*income*); the proportion of citizens aged between 0 and 14 (*child*); the proportion of aged over 65 (*aged*); the proportion of foreign residents (*foreign residents*) and the population density computed as the number of citizens per area (*dens*). Finally, there are certain time-constant characteristics of a municipality that are likely to affect fiscal policies, such as climate and geography. We take these characteristics into account by including a dichotomous variable for each municipality. Changes in the macroeconomic situation may also affect fiscal policies of all municipalities in certain specific years. To account for this, we include a set of time dummies controlling for common yearly shocks.

3.6 Empirical framework

We first run OLS regressions of our financial variables by using the whole available data set[6] and evaluate the impact of the large municipality electoral

[6]Over 56,707 (8,101 municipalities for 7 years) potential observations, our dataset includes 44,466 observations. As a matter of fact we exclude 9,786 (1,398 municipalities for 7 years) observations referred to municipalities in Special Statute Regions and Provinces, 2,455 observations relative to municipalities/years where data are not complete or incorrect, or to municipalities put under commissioner.

system by examining the coefficient of the dummy *large* and its interaction with the number of lists backing the elected mayor.

The financial variables we are interested in are related with actual population because of scale economies for expenditure or agglomeration economies for revenues; indeed, actual population is, by year, very correlated with legal population (on average the correlation index is 0.9419 and it is statistically significant at 1% all the years), implying that the effect of the treatment dummy could be determined solely by the level of population which must be controlled for assessing the effect of the electoral system on the dependent variable. Therefore, in our case the population mean of small municipalities (3,352) is statistically lower with respect to the population mean of large municipalities (53,531), hence, the population variable which can mimic the large municipality dummy cannot be controlled for. To bypass this problem (Egger and Koethenbuerger, 2010) we use a regression discontinuity design (RDD). Namely, we compare the outcome for municipalities "just below" and "just above" the treatment threshold because they will likely have similar characteristics on average, except for the treatment. If it is the case we expect to find a smooth relationship between the outcome and the forcing variable (population) at the cutoff point so that any discontinuity in the outcomes can be attributed to the treatment variable.

There are various ways to perform RDD. The simplest approach is to compare average outcomes in a small neighborhood on either side of the treatment threshold (Imbens and Lemieux, 2008). Nevertheless, this approach could produce very imprecise measures of the treatment effect because the RDD method is subject to a large degree of sampling variability and this procedure would require very large sample size (Pettersson-Lidbom, 2008). Given our small sample size, we follow the polynomial approach (Petterson-Lidbom 2008, 2012), that is to regress our dependent variable on a pth-order polynomial of the population, in addition to the binary treatment indicator. Therefore, the model we estimate takes the following form:

$$Y_{i,t} = \gamma_1 large_{i,t} + \gamma_2 large_{i,t} * list_{i,t} + f\left(pop_{i,t}\right) + \beta^{'} X_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t} \quad (3.1)$$

where $Y_{i,t}$ is a public policy outcome (e.g., total own revenues per capita, taxes per capita, charges per capita and current expenditure per capita) for municipality i at time t; $large_{i,t}$ is a treatment indicator which equals 1 if the municipality is in the large electoral regime and 0 otherwise; $list_{i,t}$ is a variable accounting for the number of lists in the Council election supporting the mayor: it equals 1 for the single-ballot municipalities and for those double-ballot municipalities where only one single list is supporting the mayor, otherwise it equals the number of lists supporting the mayor; $f\left(pop_{i,t}\right)$ is the control function[7] where the variable *pop* has been normalized at 0 when it equals 15,000 because we control not only for a polynomial functional form of the population, but also the same function is interacted with the dummy *large;*[8] $X_{i,t}$ is the vector of control variables discussed in both Section 3.5.2 and 3.5.3; μ_i accounts for municipality fixed effects; τ_t accounts for year fixed effects.

3.6.1 The identification strategy

In Italy there are different policies based on population brackets that might affect the identification of the impact of the two electoral rules, which hold for small and large municipalities, on fiscal policy decisions. In particular, population size determines beyond the electoral rule (single round versus

[7]The control function takes the following form:

$$f\left(pop_{i,t}\right) = \alpha_1 pop_{i,t} + \alpha_2 pop_{i,t}^2 + \ldots + \alpha_n pop_{i,t}^n + \beta_1 large_{i,t} * pop_{i,t} + \beta_2 large_{i,t} * pop_{i,t}^2 + \ldots + \beta_n large_{i,t} * pop_{i,t}^n$$

where n is the chosen polynomial order.

[8]The normalization ensures that the treatment effect at the cut-off point is the coefficient on the treatment variable in a regression model with interaction terms.

runoff), the salary of the mayor, the compensation of the members of the executive committee and of the councilors, the size of the council, the size of the executive committee, whether or not a municipality can have additional elective bodies in every neighborhood and whether or not a municipality can host hospital facilities or organize a health-care district (Gagliarducci and Nannicini, 2013). In addition, the vertical transfers financing system changes proportionally with the population (Law 504/1992). Finally, municipalities below 5,000 inhabitants are exempted from a set of rules imposed by the national government to the municipalities in order to improve fiscal discipline (Internal Stability Pact). The only range of the population for which it is possible to test the impact of the single vs double-ballot electoral rule on fiscal policy decisions without additional overlapping institutional breaks (which would make impossible to separately identify the effect of a change in the electoral system) is the population threshold between 10,000 and 20,000 inhabitants. In fact, if we considered, for instance, the 5,000 to 20,000 population threshold, not only the electoral rule would change but also the wage of the mayor, the compensation of the members of the executive committee and of the councilors, the size of the council, the size of the executive committee and especially the transfers from the central government (Law 504/1992) would change. Also if we considered the 10,000 to 30,000 population threshold, besides the electoral rule, also the possibility to host hospital facilities or organize a health-care district and the transfers (Law 504/1992) amount received by municipalities would change.

Hence, we restrict the sample to municipalities between 10,000 and 20,000 inhabitants.[9] The restriction on the population range 10,000-20,000, reduces the data set to a sample of 3,531 observations. Overall we have information on 546 municipalities, observed at least two times, since our

[9] Summary and descriptive statistics are shown, respectively, in Table 3.1 and Table 3.2.

panel is unbalanced.[10] On average, over 2001-2007, the sample includes 504 municipalities whose 378 are small municipalities (2,644 observations) and 127 are large municipalities (887 observations).[11]

Table 3.1: Summary Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
total own revenue	3531	513.72	231.29	92.04	1815.87
taxes	3531	348.66	158.41	44.14	1542.03
charges	3531	165.06	124.45	5.26	1051.38
current expenditure	3531	676.68	207.94	138.38	1814.08
child	3531	0.14	0.02	0.08	0.25
aged	3531	0.18	0.04	0.06	0.32
foreign residents	3531	0.04	0.03	0.00	0.21
dens	3531	676.45	831.59	39.19	8033.67
income	3531	9780.21	3405.60	2221.06	20376.77
voteshare	3531	51.71	12.06	15.70	100.00
large	3531	0.25	0.43	0	1
termlim	3531	0.32	0.47	0	1
population	3531	-1276.20	2630.07	-4999.00	4991.00
list	3531	1.67	1.47	1	7

Note: The variable population has been normalized at 0 when it equals 15,000 inhabitants

Table 3.2: Descriptive statistics by small and large municipalities.

	Small					Large				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
total own revenue	2644	510.98	236.17	92.04	1815.87	887	521.89	216.02	101.06	1406.95
taxes	2644	347.19	164.72	44.14	1542.03	887	353.04	137.88	50.54	894.16
charges	2644	163.79	125.91	5.26	1051.38	887	168.85	119.98	16.60	862.47
current expenditure	2644	668.61	208.91	138.38	1814.08	887	700.72	203.24	393.42	1636.78
child	2644	0.15	0.02	0.08	0.25	887	0.14	0.02	0.08	0.22
aged	2644	0.18	0.04	0.06	0.32	887	0.19	0.04	0.07	0.30
foreign residents	2644	0.04	0.03	0.00	0.21	887	0.04	0.03	0.00	0.15
dens	2644	631.57	735.90	39.19	8033.67	887	810.22	1056.33	55.55	8033.67
income	2644	9688.65	3341.34	2221.06	19229.04	887	10053.14	3578.37	2692.98	20376.77
voteshare	2644	52.60	11.47	16.01	100.00	887	49.03	13.31	15.70	82.45
termlim	2644	0.33	0.47	0	1	887	0.30	0.46	0	1
population	2644	-2461.88	1729.48	-4999.00	4828.00	887	2258.10	1391.57	-1509.00	4991.00
list	2644	1.00	0.00	1	1	887	3.67	1.81	1	7

Note: The variable population has been normalized at 0 when it equals 15,000 inhabitants

As far as regards the timing and frequency of elections, the dataset allows to include for all municipalities at least two legislatures, not implying that physically the two elections happen in the period 2001-2007, but at least one should fall in that period. In fact, in 2001 we observe municipalities that

[10]275 observations are not included for the same reasons illustrated in note 6.

[11]Full details on the municipality distribution across the small and large dimension, along all the years included in our dataset, are provided in Table C.1 of the Appendix C.

held elections, respectively, in 1997, 1998, 1999, 2000 and 2001. If elections run every 5 years, municipalities having elections in 1997 (and observed from 2001) have again elections in 2002 and 2007. Following this rule we observe municipalities having elections in 1998 and 2003, in 1999 and 2004, in 2000 and 2005, in 2001 and 2006. Table 3.3 shows that 82.05% of municipalities (448) held 2 elections, while 96 municipalities (17,58%) held 3 elections. Just two municipalities held more than three elections.[12]

Table 3.3: Number of elections by municipalities.

Number of elections	Obs.	%
2	448	82.05
3	96	17.58
4	2	0.37
Total	546	100

Our empirical strategy relies on the treatment coefficient *large* which is identified through municipalities that switch from being small to large electoral regime in the period 2001-2007,[13] given that we use a fixed effect estimate (3.1). In our dataset there are 38 municipalities out of 546 that switched in the considered period. Table 3.4 shows that 32 municipalities switched from small to large electoral regime and 6 municipalities switched from large to small electoral regimes. In particular, most of the municipalities (14) switched in the 2004 election followed by others 9 municipalities that switched in 2007 elections.[14]

[12]For both cases the major resigned before the term and the elections were held at the same year. Additionally it might be the case that among those municipalities which held two or three elections the mayors resigned before the term and so municipalities held again elections before the regular time (5 years). However, there are no cases where the mayor was brought down through a vote of no-confidence during her legislature.

[13]Details of the switchers are in Table C.2 of the Appendix C.

[14]There are only one municipality (Brusciano) that actually switches from one regime to the other that is not considered in our datastet because it was put under commissioner in the considered period.

Table 3.4: Switching municipalities by year.

	Electoral regime		
Year	from small to large	from large to small	Total
2001	0	0	0
2002	0	0	0
2003	6	1	7
2004	12	2	14
2005	1	1	2
2006	5	1	6
2007	8	1	9
Total	32	6	38

Mean differences in policy outcome variables of the switching municipalities subset between small and large electoral regimes, even not statistically different from zero, are negative (Table 3.5). In particular, average per capita total own revenue of large municipalities is 22.66 euro lower than that of small municipalities; the same difference for per capita current expenditure is 31.84.

Table 3.5: Descriptive statistics for small and large electoral regimes relative to switching municipalities.

	small electoral regime				large electoral regime				Difference in Means
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	
total own revenue	543.23	214.32	194.21	990.28	520.57	193.58	188.93	897.54	**-22.66**
									(-0.47)
taxes	364.40	163.23	83.81	801.99	354.82	145.66	133.58	706.23	**-9.58**
									(-35.49)
charges	178.83	102.77	31.24	543.55	165.75	88.41	29.12	341.57	**-13.08**
									(-22.00)
current expenditure	696.49	190.03	399.47	1099.75	664.65	170.14	407.81	1031.93	**-31.84**
									(-41.38)

3.6.2 The large dummy coefficient

Notice that γ_1 accounts for the impact of the large electoral system on the public policy and γ_2 let us understand how the last impact varies according to the number of lists supporting the elected mayor. As long as $\gamma_1 + \gamma_2 * list_{i,t}$ is statistically significant, we can confirm that being in a large electoral regime with the mayor supported by a given number of lists, affects the policy decision of the municipality. If γ_2 is opposite in sign with respect to γ_1 it means that the presence of multiple lists offsets (at least partially) the difference between the double-ballot where the mayor is supported only by one list and the single-ballot where only a unique list can support the mayor. In our sample used in the RDD there are municipalities belonging to the double-ballot regime (887 observations) with only 1 list backing the mayor (164 observations), with 2 lists (65), 3 lists (192), 4 lists (166), 5 lists (136), 6 lists (108) and with 7 or more lists (56).[15]

3.7 Results

We first run fixed effects regressions using the whole sample with robust standard error, clustering by municipality (Table 3.6). The double-ballot system negatively affects *total own revenue* compared to the single-ballot system (-52.92 and 1% significant), but this effect becomes smoother the greater the number of lists supporting the successful mayoral candidate. The same result stems from regressions of *taxes* (-32.58 and 1% significant), *charges* (-20.34 and 5% significant) and *current expenditure* (-43.33 and 1% significant). The interaction with *list* is not significant.

[15] Further statistical details are in Table C.3 of the Appendix C.

Table 3.6: Impact of the large electoral system on the fiscal policy outcome: fixed effect estimates.

Dependent variable	total own revenue (1)	taxes (2)	charges (3)	current expenditure (4)
large	-52.92***	-32.58***	-20.34**	-43.33***
	(14.32)	(11.98)	(10.37)	(15.68)
large*list	2.24	1.50	0.74	0.16
	(1.62)	(1.07)	(1.25)	(1.63)
population	-2,571.42	-1,680.96**	-890.46	-4,134.04**
	(1,990.52)	(691.49)	(1,391.23)	(1,905.48)
termlim	-0.28	0.89	-1.17	1.02
	(2.33)	(1.24)	(1.95)	(2.30)
child	421.96	248.65	173.31	148.94
	(714.33)	(532.56)	(217.99)	(823.06)
old	-1,153.69	-581.39	-572.29*	-1,287.90
	(1,117.71)	(835.47)	(314.68)	(1,294.47)
foreign residents	-1,388.83***	-489.44	-899.39***	-1,572.29***
	(503.44)	(375.22)	(149.93)	(583.89)
dens	-0.18**	-0.08**	-0.10**	-0.20**
	(0.07)	(0.03)	(0.04)	(0.08)
income	-74.56	23.67	-98.24	-80.77
	(87.19)	(37.98)	(90.35)	(78.55)
votshare	158.71	-2.40	161.12	499.21*
	(427.37)	(331.02)	(182.66)	(272.54)
Overall Observations	44,466	44,466	44,466	44,466
Observations small municipalities	41,023	41,023	41,023	41,023
Observations large municipalities	3,443	3,443	3,443	3,443
R-squared	0.57	0.42	0.86	0.46

Notes: Period 2001-2007. All estimates include municipality and year fixed effects. The variables *population*, *dens* and *income* have been rescaled by dividing by 1,000. Robust standard errors, clustered at municipal level, are reported in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

We then run fixed effect regressions by using a RDD with robust standard error, clustering by municipality. Also in this case we run regressions for *total own revenue*, *taxes*, *charges* and for *current expenditure* where we interact the dummy *large* with the categorical variable *list*. For each regression we choose the polynomial order of the control function f(*pop*), by using the Akaike Information Criterion (AIC). According to the AIC, the best polynomial order for the four dependent variables, above mentioned, is the sixth (Table 3.7).

Table 3.7: Akaike's infromation criterion on Table 3.8's regressions.

Polynomial order	Controls	total own revenue	taxes	charges	current expenditure
1	yes	40977.21	38210.16	39067.37	40396.44
2	yes	40979.50	38210.07	39068.14	40399.40
3	yes	40975.64	38211.58	39057.27	40393.52
4	yes	40972.89	38210.17	39047.12	40389.09
5	yes	40972.74	38208.94	39047.34	40389.21
6	yes	**40972.13**	**38206.41**	**39046.51**	**40388.61**
1	no	41071.40	38235.36	39141.30	40489.62
2	no	41073.33	38236.58	39141.18	40490.89
3	no	41068.89	38237.99	39129.95	40484.30
4	no	41067.34	38236.43	39122.09	40481.73
5	no	41066.56	38234.81	39122.56	40482.90
6	no	**41065.87**	**38232.61**	**39121.20**	**40481.54**

Panel A of Table 3.8 shows that the double-ballot electoral system with only one list supporting the mayor negatively affects *total own revenue* compared to the single-ballot system where only a unique list can support the mayor, but this effect becomes smoother the greater the number of lists supporting the successful mayoral candidate. In a double-ballot, in the sixth degree polynomial specification, the coefficient of *large* interacted with the variable *list* is +6.18 and 10% significant. When we compute the linear combination of the coefficient (*large*) not interacted with the same coefficient interacted with *list*, it is always significant until the number of lists is equal to five and decreases as the number of lists increases.

This result is almost entirely due to the revenue from *charges* (in the 6th degree polynomial specification, the coefficient of large is -36.80 and 10% significant; the run-off coefficient interacted with *list* is 4.91 and 10% significant). The revenue from *taxes* is always lower than in the single-ballot system (in the 6th degree polynomial specification, the coefficient of *large* is -31.87, 10% significant and the interacted coefficient 1.26, but not significant). *Current expenditure* is also lower than in the single-ballot system in fact in the sixth degree polynomial specification, the coefficient of *large* is -44.41, 10% significant and the interacted coefficient is 4.05, but not significant, however when we compute the linear combination of the coefficient (*large*) not interacted with the same coefficient interacted with *list*, it is always significant until the third list and decreases as the number of lists increases (Table 3.8).

We can then conclude that with low polarization of the electorate supporting the mayor in the large municipality, the double-ballot electoral rule leads to a lower *current expenditure* and *total own revenue* with respect to the single ballot. The reason is that in single-ballot municipalities, common pool problems can emerge in forming the unique list supporting the mayor,[16] or in double-ballot municipalities with explicit numerous coalitions (the case when the electorate is highly polarized and so the candidate has incentive to merge), the incentive to free-ride is stronger than in double-ballot municipalities with no coalition (the interaction of the dummy *large* with the variable *list* in both estimates of per capita total revenue and expenditure is in fact positive), which is the case when the electorate polarization is low and so there is no incentive for the candidates to merge (Bordignon et al., 2013).

[16]Even if there is formally a unique list supporting the mayor, common pool problems show up because different parties often ally to form the very frequent single Council list (Lista Civica).

Table 3.8: Impact of the large electoral system on the fiscal policy outcome: RDD estimates with fixed effects.

Polynomial order	A. Estimations without covariates				B. Estimation with covariates			
	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1st								
large	-39.18*	-23.83	-15.36	-23.08	-54.32***	-29.58*	-24.74	-33.57*
	(20.55)	(15.54)	(15.08)	(19.65)	(19.96)	(15.13)	(15.39)	(19.68)
large*list	6.26*	1.38	4.88*	4.04	7.96**	1.64	6.32**	5.85
	(3.66)	(2.30)	(2.88)	(3.97)	(3.43)	(2.18)	(2.89)	(3.94)
2nd								
large	-45.30**	-23.26	-22.04	-27.36	-61.55***	-29.01*	-32.54**	-38.90*
	(22.67)	(16.85)	(14.48)	(21.68)	(22.27)	(16.44)	(14.95)	(21.60)
large*list	6.30*	1.38	4.92*	4.11	7.90**	1.63	6.27**	5.82
	(3.64)	(2.30)	(2.85)	(3.95)	(3.40)	(2.17)	(2.86)	(3.92)
3rd								
large	-43.09*	-24.47	-18.62	-26.38	-58.73**	-30.09*	-28.64*	-37.08*
	(23.08)	(16.52)	(15.90)	(21.79)	(22.73)	(16.11)	(16.21)	(21.74)
large*list	6.43*	1.37	5.06*	4.23	8.03**	1.61	6.43**	5.95
	(3.65)	(2.31)	(2.84)	(3.96)	(3.41)	(2.18)	(2.86)	(3.93)
4th								
large	-61.97**	-27.56	-34.41*	-38.79	-77.40***	-33.93**	-43.47**	-48.92*
	(25.36)	(17.02)	(19.80)	(25.10)	(25.01)	(16.65)	(19.80)	(25.05)
large*list	6.21*	1.32	4.89*	4.10	7.79**	1.53	6.26**	5.82
	(3.54)	(2.32)	(2.73)	(3.88)	(3.30)	(2.19)	(2.74)	(3.85)
5th								
large	-66.74***	-31.13*	-35.62**	-43.68*	-84.08***	-37.91**	-46.17**	-55.51**
	(24.64)	(17.18)	(17.85)	(24.00)	(24.90)	(16.82)	(18.57)	(24.07)
large*list	6.13*	1.23	4.90*	4.02	7.72**	1.45	6.27**	5.76
	(3.56)	(2.31)	(2.75)	(3.91)	(3.32)	(2.19)	(2.76)	(3.87)
6th								
large	-68.67***	-31.87*	-36.80*	-44.41*	-85.13***	-38.32**	-46.81**	-55.30**
	(25.47)	(17.37)	(19.13)	(24.63)	(25.65)	(16.98)	(19.71)	(24.68)
large*list	6.18*	1.26	4.91*	4.05	7.74**	1.46	6.28**	5.76
	(3.56)	(2.32)	(2.76)	(3.93)	(3.32)	(2.19)	(2.77)	(3.89)
Overall Observations	3,531	3,531	3,531	3,531	3,531	3,531	3,531	3,531
Observations small municipalities	2,644	2,644	2,644	2,644	2,644	2,644	2,644	2,644
Observations large municipalities	887	887	887	887	887	887	887	887
R-squared	0.88	0.88	0.76	0.87	0.88	0.88	0.76	0.88

Notes: Period 2001-2007; municipalities with a resident population of between 10,000 and 20,000 inhabitants. Estimation methods: polynomial approximation to the 1st, 2nd, 3rd, 4th, 5th and 6th degrees. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. The R-squared is obtained by taking the average R-squared of each polynomial order across regressions. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

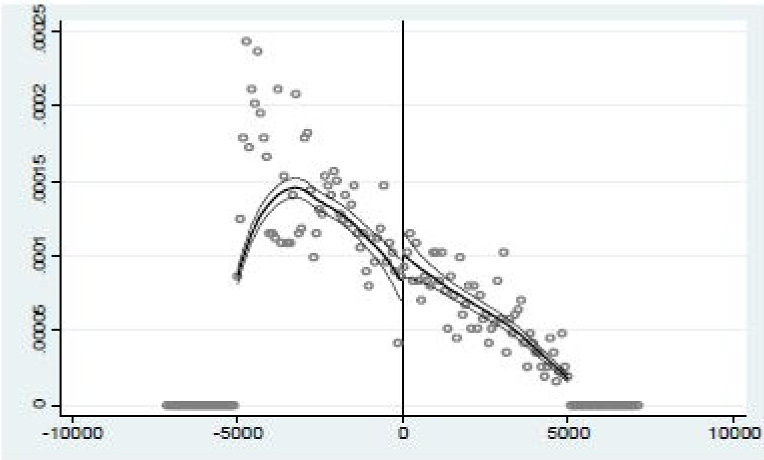
3.8 Robustness checks

In order to confirm that our results are robust and the identification strategy holds, we need to be sure that the discontinuity we found in the dependent variables is not driven by the discontinuity of our exogenous variables.

First, we replicate all the regressions of the previous Section, by controlling for all covariates: all the results obtained in the polynomial specifications still hold (Table 3.8, panel B).

Second, we check whether there is a discontinuity in the forcing variable by performing a McCrary test (McCrary, 2008) which is shown in Figure 3.1. The Figure displays no evidence of strong discontinuity at the cut-off.

Figure 3.1: McCrary Test.



Third, we test whether the covariates do not show any discontinuity with respect to the population.[17] We do not reject the null hypothesis of zero discontinuity in all polynomial order, for *dens*, *votshare* and *termlim*, while for *child* we find a significance only in the fifth polynomial order and for both *old* and *foreign residents* we do not reject the null hypothesis of zero discontinuity starting from the fourth polynomial order. *Income* is significant for the second, third, fourth and fifth polynomial order, however the sign (positive) of the discontinuity goes in the opposite direction of the sign (negative) we find for the *large* dummy. Notice that in our preferred specification, namely the sixth polynomial order degree, we do not reject the null hypothesis for any of our covariates.

[17]Results are in Table C.4 of the Appendix C.

Forth, we test whether the treatment dummy (*large*) is determined by any of the covariates and we do that by regressing it against all the covariates and the control function.[18] We replicate the regressions by using different control functions from the first up to the sixth polynomial order. We test whether the coefficients are significantly different from zero and also not jointly significantly different from zero. All the coefficients, excluding the control function, are not significant except *old* in the first, second, third and fourth order polynomial control function, *foreign residents* in the regression with a first order polynomial control function and *dens* in the sixth order polynomial control function; in all the regressions the covariates are never jointly significantly different from zero.

Fifth[19], we run a placebo test for the polynomial from the first up to the sixth order. We used the sample of municipalities with populations of between 10,000 and 20,000, and in the sub-sample of the small municipalities we set a threshold corresponding to the median population (12,057), and did likewise for the sample of large municipalities, which gave a median population of 16,957. We ran the same regressions that we had run with the 15,000 threshold, but the coefficient that accounts for the threshold effect was never significant a part that of *charges* (10% significant) in the regression with the "fake" threshold of 16,957 inhabitants for the first order polynomial control function and covariates.

Sixth, we implement the local linear regression approach by restricting the sample to municipalities in the interval *[-h,+h]*, where h is an optimal bandwidth selected following the methodology suggested by Imbens and Kalyanaraman (2010) that, in our case, turns out to be approximately 1,500 inhabitants.[20] Therefore we restrict our sample to the interval 13,500-16,500 which implies using 1,018 (30% of the total) observations (547 at the left

[18]Results are displayed in Table C.5 of the Appendix C.

[19]See Tables C.6-C.7 of the Appendix C.

[20]This is implemented using the Stata command *rd* developed by Nichols (2007).

of the cut-off and 471 at the right). The *large* coefficient[21] is negative and significant (5% *total own revenue* and 10% for *current expenditure*), and the interactions have the right sign but are not significant (the drawback of estimating local linear regressions with so few observations can result in too high standard errors). The coefficients we get with the local linear regressions are very close to those we get with the polynomial specification from the forth polynomial order degree onwards. This should imply that our polynomial functions from the fourth degree are well specified (Pettersson-Lidbom, 2008). We also did estimates by changing bandwidths. In one case, by using two times the optimal ones (*2h*=3,000) and so enlarging the sample (in this case we face with 2,098 observations – 60% of the total – 1,286 at the left of the cut-off and 812 at the right) and in another by using half the optimal ones (*h/2*=750) and so restricting the sample (in this case we face with 515 observations – 15% of the total - 264 at the left of the cut-off and 251 at the right). In the case of the very restricted sample we get very significant coefficients for all dependent variables,[22] while in the larger one, whose width is very similar to that used for the polynomial estimates, only *total own revenue* turns out to be significant.[23]

Finally, we do a graphical analysis (Figure 3.2) for all the dependent variables used in the regression. The population is normalized at 15,000. The graphs report the fitted values from a regression model estimated separately on each side of the threshold, using the polynomial of the population that best fits the data. We choose to divide both sides of the cutoff in 50 bins, taking for each bin the average of the reported dependent variable.[24] The graphs related to *total own revenue* (Panel A), *taxes* (Panel B) and *charges*

[21]See Table C.8 and or Figures C.1 and C.2 of the Appendix C.

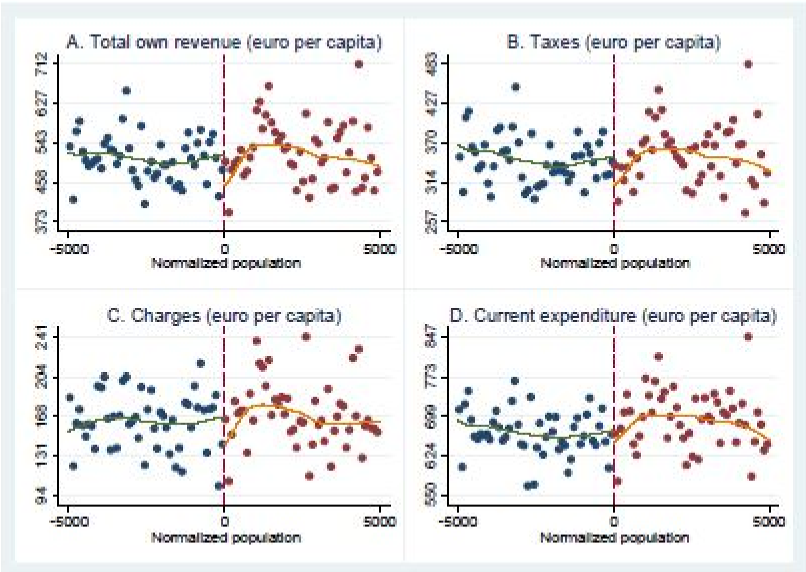
[22]See Table C.9 of the Appendix C.

[23]See Table C.10 of the Appendix C.

[24]Each bins on the left of the cutoff contains on average 48 observations, while each bins on the right of the cut-off includes, on average, 22 observations.

(Panel C) show a clear evidence of discontinuity around the cutoff; while for the *current expenditure* the discontinuity seems less clear-cut (Panel D).

Figure 3.2: RDD Graph Analysis.



Notes: Period 2001-2007; municipalities with population between 10,000 and 20,000 inhabitants. The solid line is the fitted value from a regression model estimated separately on each side of the cut-off point using the polynomial that best fits the data. Scatter points are averaged over a bandwidth of 50 bins at either side of the normalized population size (i.e, population minus 15,000). Each bins on the left of the cut-off contains, on average, 48 observations, while each bins on the right of the cut-off includes, on average, 22 observations.

3.9 Conclusions

We studied the impact of two different electoral systems on fiscal policies, based on the case of Italy's municipal elections. In Italy, municipalities with less than 15,000 inhabitants elect their mayor according to a plurality single-ballot system whereby only one list can support the candidate who is eventually elected mayor, and very often this list represents a coalition of parties converging in a single list. In municipalities with more than 15,000 inhabitants, the mayor is elected according to a plurality double-ballot system, whereby an officially-declared coalition of lists may support her/him. We use a 2001-2007 panel dataset of all Italian municipalities with financial, socio-economic and political data. We test through a RDD at the 15,000 population cutoff the impact of the runoff electoral system on public output and evaluate it for a given polarization of the electorate supporting the mayor (proxied by the number of lists supporting the mayor).

We find that municipalities under the double-ballot system have lower per capita total revenue and current expenditure than those municipalities where a single-ballot system holds. These differences become increasingly less robust, the greater the number of lists supporting the successful mayoral candidate in the first round of voting in double-ballot municipalities. The result confirms previous findings (Roubini and Sachs, 1989; Kontopoulos and Perotti, 1999) where coalitions can generate free-riding which, in the Italian case, leads to high level of expenditure and, given the tight financial constraints imposed to municipalities, also high level of taxes. The novelty of our result is that it is associated to the used electoral system (single ballot or double ballot) for given polarization. In fact it is reasonable to think that in single-ballot municipalities, for the ex-ante strong incentive of candidates to merge in coalitions (Bordignon et al., 2013), or in double-ballot municipalities with explicit numerous coalitions (the case when the electorate is highly polarized and so the candidates have incentive to merge), the incentive to free-ride is stronger than in double-ballot municipalities with no coalition, which is the case when the electorate polarization is low and there is no incentive for the candidates to merge.

Concluding remarks

In the dissertation we discussed three specific issues: the reform of the local property tax, the reform of the structure of Italy's public sector and the electoral system reform. The three studies composing the dissertation focus on the Italian case. This concluding chapter summarizes the main findings of the three studies and discusses the contribution of each of them.

In Chapter 1, we start from a local fiscal reform occurred in 2008 in Italy: the property tax on principal dwellings has been substituted by a central grant, whose per capita allocation followed a rule exogenous to municipalities. This quasi-natural experiment framework allowed us to investigate the existence of the flypaper effect in the spending behavior of Italian municipalities, comparing the expenditure of the same municipality according to two different financing system: one based on own revenue (before 2008) and the other one based on a vertical transfer (after 2008).

We set up a theoretical model in which the introduction of a political bias against taxation gives rise to the flypaper effect. If the public good is very important with respect to private consumption then an increase in the municipal size implies a decrease in the extent of the flypaper, the opposite happens if the public good is not very important with respect to the private consumption. The increase in size of the municipality let the public good cost less and this feature, when the public good is very important, increases the sensitivity of the public good to the grant less than the sensitivity of the public good to the tax. On the other side, when the public good is less important, the increase in the size of the municipality increases the sensitivity of the public good to the grant more than the sensitivity of the public good to the tax.

In the empirical analysis, based on a sample of Italian municipalities for the period 2006-2011, we focus on two groups of expenditures: the principal expenditure, which guarantees the minimum standard daily life of the municipality and, the rest, defined as residual expenditure. Our findings suggest that the flypaper effect holds for both principal and residual expenditure, but the extent of the flypaper effect is decreasing in population in the case of principal expenditure and increasing in population in the case of residual expenditure.

We believe that the contribution of this paper is twofold. On the one hand we use the exogenous change in fiscal policy that allows to clearly identify the flypaper effect since we can compare the spending behavior of the same municipalities according to two different financing systems. On the other hand we find that the flypaper effect shows up on principal expenditure for small municipalities and, in fact, for such expenditure, it decreases when the size of the municipality increases; moreover the flypaper effect appears to be increasing in the size of the municipalities for the residual expenditure. The intuition is that large municipalities have already fulfilled the public goods provision regarding the principal expenditure and so an increase in transfer does not affect or affect very little principal expenditure, but it will prompt on residual expenditure.

Chapter 2 discusses how infrastructure provision and its spillover can interact with the population size of the local government. The topic is particularly relevant in the present Italian debate about the possible economic and structural measures to let public finances facing the financial economic crisis. In particular in this chapter we put in evidence that providing infrastructures at municipal level can be inefficient, because the decision of each municipality does not take into account the benefit to other municipalities. This can give rise to a harmful strategic interaction in the decision about the infrastructure provision. However, we show that this interaction tends to disappear when the size of the municipality increases.

We model this framework by setting up a simple theoretical model in which two municipalities provide their own infrastructures, assuming that the inhabitants of both municipalities can use them. If local infrastructures are complement in their use, the municipality increases its expenditure on infrastructures in response to an increase in its neighbor's expenditure, while if local infrastructures are substitute in use, the municipality decreases its expenditure on infrastructures in response to an increase in its neighbor's expenditure. Our model also predicts that an increase in population decreases the size of the per capita reaction function slope.

We then test these results by using data on municipality of the Italian Province of Trento, finding that total infrastructures of a municipality are positively linked to neighbor's total infrastructure. This result holds also for some specific types of infrastructure, namely Road & Transport and Planning & Environment, for which the municipalities show a complementary relationship with their neighbors. Also the theoretical prediction about the impact of population on the per capita strategic response has been confirmed for the same type of infrastructures, since the size of the slope of the reaction function decreases in magnitude as population increases.

Our main finding is the relationship between the effect of the spillover in local infrastructures and the population size of municipality receiving the spillover. We find that after a population threshold the spillover effect vanishes. The intuition for this result is that, realistically, a highly populated municipality is not very sensitive to changes in infrastructures of neighbors relatively less populated, since any given change in the per capita expenditure in the less populated neighbors produces negligible spillover impact with respect to the provided public infrastructure spillover of a large municipality. Finally, the paper provides a first attempt to build up a measure of infrastructure stock at the Italian municipal level since previous works have built a measure of infrastructure stock at the regional level (Marrocu and Paci, 2010).

In Chapter 3 we studied the impact of two different electoral systems on fiscal policies, based on the case of Italy's municipal elections. In Italy, municipalities with less than 15,000 inhabitants elect their mayor according to a plurality single-ballot system whereby only one list can support the candidate who is eventually elected mayor, and very often this list represent a coalition of parties converging in a single list. In municipalities with more than 15,000 inhabitants, the mayor is elected according to a plurality double-ballot system, whereby an officially-declared coalition of lists may support her/him. We use a 2001-2007 panel dataset of all Italian municipalities and we test, through a regression discontinuity analysis at the 15,000 population cutoff, the impact of the runoff electoral system on public policies (revenue and expenditure) and evaluate it for a given polarization of the electorate supporting the mayor (proxied by the number of lists supporting the mayor). We find that municipalities under the double-ballot system have lower per capita total revenue and current expenditure than those municipalities where a single-ballot system holds. These differences become increasingly less robust, the greater the number of lists supporting the successful mayoral candidate in the first round of voting in double-ballot municipalities. The result confirms previous findings (Roubini and Sachs, 1989; Kontopoulos and Perotti, 1999) where coalitions can generate free-riding, which, in the Italian case of the municipalities, leads to high level of expenditure and, given the tight financial constraints imposed to municipalities, also high level of taxes.

The main contribution of this paper is the empirical analysis of the impact of the single vs double-ballot system on fiscal policies for given polarization of the electorate, testing that the double-ballot system differs on the impact on fiscal policies from the single-ballot only if the number of lists supporting the mayor in the first ballot is very low. Hence, large coalitions in double-ballot elections will make the two system very close as their policy outcomes are concerned. It is in fact reasonable to think that in single-ballot municipalities - where candidates before the election have normally strong incentive to merge and form the only possible list backing the mayoral candidate - or in double-ballot municipalities - in the case when the electorate is highly polarized and so the candidates have incentive to merge (Bordignon et al., 2013) - the incentive to free-ride is stronger than in double-ballot municipalities with no coalitions, which is the case when the electorate polarization is low and there is no incentive for candidates to merge (Bordignon et al., 2013).

Bibliography

A. Alesina and A. Drazen. Why are stabilizations delayed? *The American Economic Review*, 81(5):1170–1188, 1991.

L. Anselin. *Spatial Econometrics: Methods and Models.* Boston: Kluwer Academic Publisher, 1988.

L. Anselin and R. Florax. Small sample properties of tests for spatial dependence in regression models: Some further results. *New Directions in Spatial Econometrics*, pages 75–79, 1995.

L. Anselin, K. Bera, R. Florax, and M. Yoon. Simple diagnostic tests for spatial dependence. *Regional Science and Urban Economics*, 26:77–104, 1996.

M. Arellano and S. Bond. Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *Review of Economic Studies*, 58(2):277–97, 1991.

M. Arellano and O. Bover. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1): 29–51, 1995.

F. Arestoff and C. Hurlin. Estimates of government net capital stocks for 26 developing countries, 1970-2002. *World Bank Policy research working paper*, (3858), 2006.

C. F. Baum. *An introduction to modern econometrics using Stata*. Stata press, 2006.

E. Becker. The illusion of fiscal illusion: Unsticking the flypaper effect. *Public Choice*, 86(1-2):85–102, 1996.

G. S. Becker and C. B. Mulligan. Deadweight costs and the size of government. *Journal of Law and Economics*, 46(2):293–340, 2003.

T. J. Besley and H. S. Rosen. Vertical externalities in tax setting: evidence from gasoline and cigarettes. *Journal of Public Economics*, 70(3):383–398, 1998.

F. Blanco. PhD thesis, PUC, Rio de Janeiro, 2006.

R. Blundell and S. Bond. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115–143, 1998. ISSN 0304-4076.

S. Bond. Dynamic panel data models: a guide to microdata methods and practice. CeMMAP working papers CWP09/02, Centre for Microdata Methods and Practice, Institute for Fiscal Studies, 2002. URL `l`.

M. Bordignon and S. Piazza. Who do you blame in local finance? an analysis of municipal financing in italy. CESifo Working Paper Series 3100, CESifo Group Munich, 2010.

M. Bordignon, T. Nannicini, and G. Tabellini. Moderating political extremism: Single round vs run-off elections under plurality rule. Discussion Paper 7561, IZA, Institute for the Study of Labor, 2013.

L. Bouton. A theory of strategic voting in runoff elections. *American Economic Review*, 103(4):1248–88, 2013.

E. Bracco and A. Brugnoli. Runoff vs. plurality. the effects of the electoral system on local and central government behaviuor. Economics Working Paper Series 37, The Department of Economics, Lancaster University MAnagement School, 2012. 2012-002.

D. F. Bradford and W. E. Oates. The analysis of revenue sharing in a new approach to collective fiscal decisions. *The Quarterly Journal of Economics*, 85(3):416–439, 1971.

J. Brueckner and L. Saavedra. Do local governments engage in strategic property tax competition? *National Tax Journal*, 44:203–229, 2001.

T. Buettner and D.E. Wildasin. The dynamics of municipal fiscal adjustment. *Journal of Public Economics*, 90(6-7):1115–1132, 2006.

T. Buttner, R. Schwager, and D. Ategarescu. Agglomeration, population size, and the cost of providing public services: An empirical analysis for german states. In *Center for European Economic Research*, 2004.

A. C. Case, H. S. Rosen, and J. R. Hines. Budget spillovers and fiscal policy interdependence: Evidence from the states. *Journal of Public Economics*, 52(3):285–307, 1993.

A.D. Cliff and J.K. Ord. *Spatial Autocorrelation.* London: Pion, 1973.

G. W. Cox. *Making votes count: strategic coordination in the world's electoral systems*, volume 7. Cambridge Univ Press, 1997.

H. Cremer, M. Marchand, and P. Pestieau. Investment in local public services: Nash equilibrium and social optimum. *Journal of Public Economics*, 65(1):23–35, 1997.

B. Dahlby. Fiscal externalities and the design of intergovernmental grants. *International tax and public finance*, 3(3):397–412, 1996.

B. Dahlby. The marginal cost of public funds and the flypaper effect. *International Tax and Public Finance*, 18(3):304–321, 2011.

M. P. Devereux, B. Lockwood, and M. Redoano. Do countries compete over corporate tax rates? *Journal of Public Economics*, 92:1210–1235, 2008.

M.P. Devereux, B. Lockwood, and M. Redoano. Horizontal and vertical indirect tax competition: Theory and some evidence from the usa. *Journal of Public Economics*, 91:451–479, 2007.

D.M. Drukker, P. Egger, and I. R. Prucha. On two-step estimation of a spatial autoregressive model with autoregressive disturbances and endogenous regressors. Technical report, Department of Economics, University of Maryland, 2010.

D.M. Drukker, I. R. Prucha, and R. Raciborski. A command for estimating spatial-autoregressive models with spatial-autoregressive disturbances and additional endogenous variables. Technical report, Stata, 2011a.

D.M. Drukker, I. R. Prucha, and R. Raciborski. Maximum-likelihood and generalized spatial two-stage least-squares estimators for a spatial-autoregressive model with spatial-autoregressive disturbances. Technical report, Stata, 2011b.

P. Egger and M. Koethenbuerger. Government spending and legislative organization: Quasi-experimental evidence from germany. *American Economic Journal: Applied Economics*, 2(4):200–212, 2010.

A. Esteller-Moré and L. Rizzo. Us excise tax horizontal interdependence: yardstick versus tax competition. *The Annals of Regional Science*, 52(3): 711–737, 2014.

A. Esteller-Moré and A. Solé-Ollé. Vertical income tax extrnalities and fiscal interdependence: Evidence from the us. *Regional Science and Urban Economics*, 31:247–272, 2001.

S. Fabbrini. Features and implications of semi-parliamentarism: The direct election of italian mayors. *South European Society and Politics*, 6(2): 47–70, 2001.

T. Fujiwara. A regression discontinuity test of strategic voting and duvergers law. *Quarterly Journal of Political Science*, 6(3-4):197–233, 2011.

S. Gagliarducci and T. Nannicini. Do better paid politicians perform better? disentangling incentives from selection. *Journal of the European Economic Association*, 11(2):369–398, 2013.

S. Gamkhar and A. Shaw. *Intergovernmental fiscal transfers. Principle and practice*, chapter The impact of intergovernmental fiscal transfers: a synthesis of the conceptual and empirical literature, pages 225–258. World Bank, 2007.

E. Gennari and G. Messina. How sticky are local expenditures in italy? assessing the relevance of the flypaper effect through municipal data. *International Tax and Public Finance*, 21(2):324–344, 2014.

R. W. Goldsmith. A perpetual inventory of national wealth. In *Studies in Income and Wealth*, volume 14 of *NBER Chapters*, pages 5–74. National Bureau of Economic Research, Inc, 1951.

E. M. Gramlich. State and local governments and their budget constraint. *International Economic Review*, 10(2):163–182, 1969.

E. M. Gramlich. *Intergovernmental grants: a review of the empirical literature*, pages 219–239. Lexington, MA, 1977.

J. Hamilton. The flypaper effect and the deadweight loss from taxation. *Journal of Urban Economics*, 19(2):148–155, 1986.

A. F. Haughwout. Public infrastructure investments, productivity and welfare in fixed geographic areas. *Journal of Public Economics*, 83(3):405–428, 2002.

J. M. Henderson. Local government expenditures: A social welfare analysis. *The Review of Economics and Statistics*, 50(2):156–163, 1968.

J. R. Hines and Richard R.H. Thaler. Anomalies: The flypaper effect. *The Journal of Economic Perspectives*, 9(4):217–226, 1995.

G. Imbens and K. Kalyanaraman. Optimal bandwidth choice for the regression discontinuity estimator. CeMMAP working papers CWP05/10, Centre for Microdata Methods and Practice, Institute for Fiscal Studies, 2010.

G. W. Imbens and T. Lemieux. Regression discontinuity designs: A guide to practice. *Journal of Econometrics*, 142(2):615 – 635, 2008.

R.P. Inman. flypaper effect. In S.N.Durlauf and L.E. Blume, editors, *The New Palgrave Dictionary of Economics*. Palgrave Macmillan, 2009.

A. Kalb. The impact of intergovernmental grants on cost efficiency: theory and evidence from german municipalities. *Economic analysis and policy*, 40(1):23–48, 2010.

C. Kamps. New estimates of government net capital stocks for 22 oecd countries, 1960-2001. *IMF staff papers*, pages 120–150, 2006.

H.H. Kelejian and I. R. Prucha. A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances. *The Journal of Real Estate Finance and Economics*, 17:99–121, 1998.

B. Knight. Endogenous federal grants and crowd-out of state government spending: Theory and evidence from the federal highway aid program. *American Economic Review*, 92(1):71–92, 2002.

Y. Kontopoulos and R. Perotti. Government fragmentation and fiscal policy outcomes: Evidence from oecd countries. In *Fiscal institutions and fiscal performance*, pages 81–102. University of Chicago Press, 1999.

J.P. LeSage and R.K. Pace. *Introduction to Spatial Econometrics.* CRC Press Taylor and Francis Group, 2009.

R. Levaggi and R. Zanola. Flypaper effect and sluggishness: Evidence from regional health expenditure in italy. *International Tax and Public Finance*, 10(5):535–547, 2003.

J. A. List and D.M. Sturm. How elections matter: Theory and evidence from environmental policy. *The Quarterly Journal of Economics*, 121(4): 1249–1281, 2006.

E. Marrocu and R. Paci. The effects of public capital on the productivity of the italian regions. *Applied Economics*, 42(8):989–1002, 2010.

C. Martinelli. Simple plurality versus plurality runoff with privately informed voters. *Social Choice and Welfare*, 19(4):901–919, 2002.

S.B. Megdal. The flypaper effect revisited: An econometric explanation. *The Review of Economics and Statistics*, 69(2):347–351, 1987.

G. Meinen, P. Verbiest, and P. deWolf. Perpetual inventory method: Service lives, discard patterns and depreciation methods. Technical report, Statistics Netherlands, 1998.

J. Murdoch, M. Rahmatian, and M. Thayer. A spatially autoregressive median voter model of recreation expenditures. *Public Finance Quarterly*, 21:334–350, 1993.

R. B. Myerson. Theoretical comparisons of electoral systems. *European Economic Review*, 43:671–697, 1999.

A. Nichols. Rd: Stata module for regression discontinuity estimation. Statistical Software Components, Boston College Department of Economics, November 2007.

S. Nickell. Biases in dynamic models with fixed effects. *Econometrica*, 49 (6):1417–1426, 1981.

W.E. Oates. *Fiscal federalism.* New York: Harcourt Brace Jovanovich, 1972.

M. J. Osborne and A. Slivinski. A model of political competition with citizen-candidates. *The Quarterly Journal of Economics*, 111(1):65–96, 1996.

P. Pennings. The triad of party system change: votes, office and policy. In P. Pennings and J.E. Lane, editors, *Comparing party system change*, pages 79–100. Routledge, London, 1998.

P. Pettersson-Lidbom. Do parties matter for economic outcomes? a regression discontinuity approach. *Journal of the European Economic Association*, 6(5):1037–1056, 2008.

P. Pettersson-Lidbom. Does the size of the legislature affect the size of government? evidence from two natural experiments. *Journal of Public Economics*, 96:269 – 278, 2012.

G.B. Powell. *Contemporary democracies.* Harvard University Press, 1982.

K. N. Mustapha P.R. Agenor and T. M. Yousef. Public infrastructure and private investment in the middle east and north africa. *World Bank Policy research working paper*, (3661), 2005.

F. Revelli. Testing the taxmimicking versus expenditure spill-over hypotheses using english data. *Applied Economics*, 34(14):1723–1731, 2002.

F. Revelli. Reaction or interaction? spatial process identification in multi-tiered government structures. *Journal of Urban Economics*, 53(1):29–53, 2003.

F. Revelli. Tax mix corners and other kinks. *Journal of Law and Economics*, 56(3):741–776, 2013.

D. Roodman. How to do xtabond2: An introduction to difference and system gmm in stata. *The Stata Journal*, 9(1):86–136, 2009.

N. Roubini and J.D. Sachs. Political and economic determinants of budget deficits in the industrial democracies. *European Economic Review*, 33(5): 903–933, 1989.

G. Sartori. *Parties and party systems.* New York: Cambridge Univ Press, 1976.

R. Scarciglia. *Elezione diretta del sindaco*, chapter Poteri del sindaco e del presidente della Provincia, pages 99–106. Maggioli, 1993.

N. Singh and X. Vives. Price and quantity competition in a differentiated duopoly. *The RAND Journal of Economics*, 15(4):546–554, 1984.

A. Solé-Ollé. Expenditure spillovers and fiscal interactions: Empirical evidence from local governments in spain. *Journal of Urban Economics*, 59 (1):32–53, 2006.

Timothy T. Besley and Anne Case. Does electoral accountability affect economic policy choices? evidence from gubernatorial term limits. *The Quarterly Journal of Economics*, 110(3):769–798, 1995.

C. Volden. Intergovernmental grants: A formal model of interrelated national and subnational political decisions. *Publius: The Journal of Federalism*, 37(2):209–243, 2007.

F. Windmeijer. A finite sample correction for the variance of linear efficient two-step gmm estimators. *Journal of Econometrics*, 126(1):25–51, 2005. ISSN 0304-4076.

S. L. Winer. Some evidence on the effect of the separation of spending and taxing decisions. *Journal of Political Economy*, 91(1):126–140, 1983.

P. G. Wyckoff. A bureaucratic theory of flypaper effects. *Journal of Urban Economics*, 23(1):115 –129, 1988.

P.G. Wyckoff. The elusive flypaper effect. *Journal of Urban Economics*, 30: 310–328, 1991.

E.M. Zampelli. Resource fungibility, the flypaper effect, and the expenditure impact of grants-in-aid. *The Review of Economics and Statistics*, 68(1): 33–40, 1986.

Appendix A

Appendix to Chapter 1

The System GMM (SYS-GMM)

When lagged dependent variables are included as regressors, both OLS and fixed effect estimation are biased and inconsistent. In particular, one immediate problem in applying OLS is that the lagged dependent variable is correlated with the municipal fixed effects in the error term (Nickell, 1981). Even the fixed effects estimation causes a bias in the estimate of the lagged endogenous variables and in the estimate of the coefficient of the rest of regressors as long as they show some correlation with that lagged variable, due to the correlation of the lagged dependent variable with the individual specific effects (Nickell, 1981; Bond, 2002). For these reasons we use the system GMM dynamic panel estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). This estimator is an augmented version of the difference GMM (Arellano and Bond, 1991) and so more efficient than the latter one (Blundell and Bond, 1998). The system GMM, differently from difference GMM which just employs the difference equation, builds a stacked dataset, one in levels and one in differences. Then the differences equations are instrumented with levels, while the levels equations are instrumented with differences.

As far as it regards the differences equations, not all the available lags can be used as instruments. In fact, once the original equation is transformed in differences (for removing the municipal fixed effects), the lagged dependent variable is still endogenous. As a generic example, consider the following model in first difference: $\Delta y_{it} = \alpha \Delta y_{it-1} + \Delta x_{it}^{'} \beta + \Delta v_{it}$, then the term y_{it-1} in$\Delta y_{it-1}(\Delta y_{it-1} = y_{it-1} - y_{it-2})$ is correlated with the term v_{it-1} in Δv_{it} $(\Delta v_{it} = v_{it} - v_{it-1})$ so the choice of y_{it-1} as instrument would bias the estimates. Hence, for the equation in differences, we may use lagged values of y_{it} to form instruments as long as y_{it} is lagged two periods or more $(y_{it-2}, y_{it-3}, \ldots)$. Notice that, for other endogenous variables, the first natural candidate instrument for Δx_{it} is x_{it-2}, the second lag of endogenous variable, which again is not related to the error term Δv_{it}.

As concerns the level equations, the lagged endogenous variables (y_{it-1}) can be instrumented with Δy_{it-1} since it is not correlated with v_{it}. The assumption required for the validity of the instruments set is, indeed, that the first lagged difference used for the variables in level should not be correlated with fixed effects. As an example, consider the model in level $y_{it} = \alpha y_{it-1} + x_{it}^{'} \beta + v_{it}$ (where fixed effects are inside the error term) then the instrument $\Delta y_{it-1}(\Delta y_{it-1} = y_{it-1} - y_{it-2})$ should not be correlated with the error term v_{it}, as well as if x_{it} is endogenous, Δx_{t-1} should not correlate with the error term v_{it}.

In general, the crucial assumption for letting the system GMM estimator be consistent is that the error term v_{it} is serially uncorrelated, otherwise some of our instruments will be invalidated. Hence, to check for first-order serial correlation in levels, we need to look for second order correlation in differences.[1] In fact, by looking at the second order serial correlation in

[1]Since Δv_{it} is mathematically related to Δv_{it-1}via shared v_{it-1}term, negative first-order serial correlation is always expected in differences, that is why, in general, it is checked for serial correlation of order l in levels by looking for correlation of order $l+1$ in differences (Roodman, 2009).

difference we are able to detect first order serial correlation in level through v_{it-1} in Δv_{it} ($\Delta v_{it} = v_{it} - v_{it-1}$) and v_{it-2} in Δv_{it-2} ($\Delta v_{it-2} = v_{it-2} - v_{it-3}$). For this reason we test for first order (AR(1)) and second order (AR(2)) serial correlation in the residuals from the differenced estimating equation, where the null hypothesis is the absence of serial correlation (Arellano and Bond, 1991). Notice that rejection of the null hypothesis in second order serial correlation implies that the lags we are using are invalid instruments so we need to start by using longer lags.

In order to check whether the instruments are not correlated with the residuals, we employ the standard Hansen test whose null hypothesis is that the corresponding instrument (or group of instruments) is exogenous. However, as Roodman (2009) points out, the power of the Hansen test might be weakened if the number of instruments is high. Due to this reason, we test the validity of subset of instruments (Esteller-Moré and Rizzo, 2014) by using a C-test (Baum, 2006). This test estimates system GMM with and without a subset of instruments allowing investigation of the validity of any subset of instruments. The null hypothesis of the C-test is that the specified variables are valid instruments: in other words they are exogenous. Finally we use a two-step system GMM since the covariance matrix is robust to panel specific autocorrelation and heteroskedasticty so the estimator is more efficient (Arellano and Bond, 1991).[2] However, by using the two-step procedure, the standard errors tend to be severely downward biased (Roodman, 2009), so in order to correct the bias we apply the correction made by Windmeijer (2005).

[2]The two-step estimator is more robust to autocorrelation and heteroskedasticity becasue the covariance matrix - necessary to implement GMM - is estimated by using estimated residuals from the one-step estimation.

Table A.1: Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Per capita current expenditure	33906	794.57	519.15	269.09	25996.78
Per capita current expenditure (-1)	33906	774.31	499.06	235.89	25996.78
Neighboring per capita current expenditure	33906	788.66	288.45	0.00	5750.50
Per capita principal current expenditure	33906	553.10	360.29	157.91	11107.39
Per capita principal current expenditure (-1)	33906	533.11	344.83	146.44	11107.39
Neighboring per capita principal current expenditure	33906	539.91	241.92	0.00	4641.49
Per capita residual current expenditure	33906	241.47	254.63	0.00	14968.78
Per capita residual current expenditure(-1)	33906	241.20	245.68	0.00	14889.39
Neighboring per capita residual current expenditure	33906	248.76	109.24	0.00	2673.00
icigrants	33906	48.66	58.88	0.00	3405.58
pop$\times 10^{-2}$	33906	5.44	8.40	0.04	97.06
post	33906	0.67	0.47	0.00	1.00
icigrants$\times$post	33906	27.38	27.40	0.00	238.10
icigrants$\times$pop	33906	302.40	666.31	0.00	31567.97
icigrants$\times$pop$\times$post	33906	182.11	453.72	0.00	9269.29
pop$\times$post	33906	3.65	7.37	0.00	97.06
ici2	33906	168.70	242.94	0.00	27321.85
netgrants	33906	279.50	241.56	2.52	14177.54
ipop$\times 10^{-2}$	33906	0.90	1.60	0.01	28.57
child	33906	0.05	0.01	0.00	0.12
old	33906	0.22	0.06	0.04	0.63
families	33906	0.43	0.06	0.25	0.83
density	33906	297.50	605.66	0.87	11309.75
income	33906	11114.08	3190.84	1689.84	45377.29
election	33906	0.20	0.40	0.00	1.00
termlim	33906	0.19	0.39	0.00	1.00
votshare	33906	0.59	0.16	0.00	1.00

Table A.2: Descriptive statistics.

Variable	Definition and measure	Avaialbale from-to	Source
Per capita current expenditure	Current expenditure per resident; 2011 Euros	2003-2011	Italian Ministry of Interior
Neighboring per capita current expenditure	Neighboring average value of per resident current expenditure	2003-2011	Our computation on Ministry of Interior data
Per capita principal current expenditure	Sum of the current expenditure per resident of the following spending functions: Administration and Management, Roads & Transport services and Planning and Environment; 2011 Euros	2003-2011	Italian Ministry of Interior
Neighboring per capita principal current expenditure	Neighboring average value of per resident primary current expenditure	2003-2011	Our computation on Ministry of Interior data
Per capita residual current expenditure	Sum of the current expenditure per resident of the following spending functions: Municipal police, Justice, Education, Culture, Sport, Tourism, Social welfare, Economic development and In-house productive services; 2011 Euros	2003-2011	Italian Ministry of Interior
Neighboring per capita residual current expenditure	Neighboring average value of per resident secondary current expenditure	2003-2011	Our computation on Ministry of Interior data
icigrants	Revenue per resident of property taxes on principal dwellings from 2006 to 2007 and compensating grants per resident for the corresponding missing revenue on principal dwellings from 2008 to 2011; 2011 Euros	2006-2011	Italian Ministry of Interior
post	Dummy variable equal to 1 for the years 2008, 2009, 2010 and 2011.	2006-2011	Our computation
pop	Population of the municipality	2003-2011	ISTAT
ici2	Revenue per resident of property tax on non-principal dwellings	2006-2011	Italian Ministry of Interior
netgrants	Total current transfers per resident net by compensating transfer from 2008 onwards	2003-2011	Italian Ministry of Interior
ipop	1/population	2003-2011	Our computation on ISTAT data
child	Share of the population aged between 0-5	2003-2011	ISTAT
old	Share of the population over the age of 65	2003-2011	ISTAT
families	Share of families	2003-2011	ISTAT
density	Numbers of citizens per area	2003-2011	ISTAT
income	Real personal income tax base per resident; 2011 Euros	2003-2011	Italian Ministry of Economy, Department of Finance
election	Dummy variable equal to 1 for each election year of the municipalities and zero otherwise	2003-2011	Italian Ministy of Interior, Department of Internal Affairs
termlim	Dummy variable equal to 1 when the mayor of the municipality cannot run for the next election because he/she is already in his/her second term of office, and zero otherwise	2003-2011	Italian Ministry of Interior, Department of Internal Affairs
voteshare	Percentage of votes obtained by the mayor when elected (the variable refers to the first round of voting for double-ballot municipalities	2003-2001	Italian Ministy of Interior, Department of Internal Affairs

Appendix B

Appendix to Chapter 2

Calculation details

From the first order condition in Eq. 2.3 we get:

$$(\alpha_1 - G_1 + \theta\phi G_2) - \left(\beta_1 - y_1 + \frac{G_1}{N_1}\right)\frac{1}{N_1} = 0.$$

Then we multiply each member for $\frac{1}{N_1 N_2}$ and we get:

$$\frac{1}{N_1 N_2}(\alpha_1 - G_1 + \theta\phi G_2) - \left(\beta_1 - y_1 + \frac{G_1}{N_1}\right)\frac{1}{N_1^2 N_2} = 0. \tag{B.1}$$

Let $g_1 = G_1/N_1$ denote the per capita level of public good (infrastructure) in jurisdiction 1 and $g_2 = G_2/N_2$ denote the per capita level of public good (infrastructure) in jurisdiction 2 so that Eq B.1 can be written as:

$$\frac{\alpha_1}{N_1 N_2} - \frac{g_1}{N_2} + \frac{\theta\phi g_2}{N_1} - (\beta_1 - y_1 + g_1)\frac{1}{N_1^2 N_2} = 0. \tag{B.2}$$

From Eq. B.2 we obtain the best respond function expressed in per capita terms:

$$\frac{\alpha_1}{N_1 N_2} - \frac{g_1}{N_2} + \frac{\theta\phi g_2}{N_1} - \frac{\beta_1}{N_1^2 N_2} + \frac{y_1}{N_1^2 N_2} - \frac{g_1}{N_1^2 N_2} = 0$$

$$\frac{g_1}{N_2}\left(1+\frac{1}{N_1^2}\right)=\left(\frac{\alpha_1}{N_1N_2}-\frac{\beta_1-y_1}{N_1^2N_2}+\frac{\theta\phi g_2}{N_1}\right)$$

$$g_1\left(1+\frac{1}{N_1^2}\right)=\frac{1}{N_1}\left(\alpha_1-\frac{\beta_1-y_1}{N_1}+\theta\phi g_2N_2\right)$$

$$g_1=\left(\alpha_1-\frac{\beta_1-y_1}{N_1}+\theta\phi g_2N_2\right)/\left(N_1+\frac{1}{N_1}\right)$$

Spatial econometric framework

The traditional empirical model for estimating public expenditures is given by the linear specification $y = X\beta + u$ where y is a vector of per capita public expenditures, X is a matrix of explanatory variables and u denotes an error term which is assumed to be identically and independently distributed across the observations. However, such a specification might lead to biased and inconsistent estimates of the parameters (Case et al., 1993; Revelli, 2002) since the level of public expenditures in a municipality is assumed to be unaffected by expenditures in neighboring municipalities. Indeed, any spatial autocorrelated variable that might have an influence on y is omitted from the model and it is translated into spatial dependence in the residuals Brueckner and Saavedra (2001). Furthermore, as Revelli (2003) points out it is also possible that shocks, such as income, might influence the expenditure decision and lead to spatial autocorrelated errors. In addition, a more serious problem might arise if the expenditure decision in a given municipality is affected by spending decisions in other municipalities, that is if local spending decisions are truly interdependent (Revelli, 2002). In light of the above consideration, the presence of either common shocks or spill-over effects requires explicit modeling of the spatial interdependencies.

The spatial econometrics literature has been built on the model of Cliff and Ord (1973), which first allows for cross-unit interactions. Starting from this design, much of the original literature was developed in order to handle spatial interactions, resulting in three basic models (Anselin, 1988; Kelejian and Prucha, 1998; LeSage and Pace, 2009; Drukker et al., 2010). Beginning with a linear regression scheme with independently and identically distributed error terms, the first model is extended to include a spatial lagged dependent variable that is: each observation of the spatial-lag variable is a weighted average of the values of the dependent variable observed for the other cross-section units.

The spatial lag model, frequently referred to as spatial-autoregressive model (SAR) assumes that the expenditures of municipalities depend on the expenditures in neighboring municipalities and on a set of observed characteristics:

$$y = \lambda W y + X\beta + \epsilon, \quad E(\epsilon) = 0, \quad E(\epsilon\epsilon') = \sigma^2 I_N \tag{B.3}$$

where y is a $N \times 1$ vector of observations of the dependent variable, that is one observation for every spatial unit ($i = 1, ..., N$) and X denotes a $N \times K$ matrix of exogenous explanatory variables. $\epsilon = (\epsilon_1, ..., \epsilon_N)'$ is the disturbance or innovations term, where ϵ_i are independently and identically distributed error terms for all i with mean zero and variance σ^2. In addition, I_N is an identity matrix of size N, W represents an $N \times N$ spatial-weighting matrix with zeros on the diagonal. Finally, Wy is a $N \times 1$ vector typically referred to as spatial lags and λ is the corresponding scalar parameter usually referred to as spatial-autoregressive coefficient. As a consequence, a significant coefficient λ can be interpreted as evidence of spill-overs across municipalities.

The spatial error model, on the other hand, allows for the disturbance to be generated by a spatial autoregressive process, that is municipalities' expenditures depend upon a set of observed characteristics and the error terms are correlated across space:

$$y = X\beta + u, \quad u = \rho W u + \epsilon \quad E(\epsilon) = 0, \quad E(\epsilon\epsilon') = \sigma^2 I_N \tag{B.4}$$

where $u = (u_1, ..., u_N)'$ is a disturbance term and Wu is is a $N \times 1$ vector typically referred to as spatial lags and ρ is the corresponding scalar parameters usually referred to as spatial-autoregressive coefficient. The spatial error model is consistent with a situation where determinants of the expenditures omitted from the model are spatially autocorrelated and also, unobserved shocks follow a spatial pattern.

Finally, the combined spatial autoregressive model with spatial autoregressive disturbance is often referred to as a SARAR model (Anselin and Florax, 1995; Drukker et al., 2011b). The SARAR model can be written as:

$$y = \lambda W y + X\beta + \rho W u + \epsilon, \quad E(\epsilon) = 0, \quad E(\epsilon\epsilon') = \sigma^2 I_N \tag{B.5}$$

Obviously, when $\rho = 0$ the model in equation (B.5) collapses to a spatial-autoregressive model as described in equation (B.3). On the other hand, if $\lambda = 0$, the model in equation (B.5) reduces to as spatial autoregressive error model (B.4). Setting $\rho = 0$ and $\lambda = 0$ causes the model in equation (B.5) to reduce the classical linear regression model with exogenous variables.

Table B.1: Data Description and data source.

Variables	Description	Source
Total per capita expenditure	Per capita stock of expenditure on infrastructure over the period 1990-2007 expressed in 2007 base year values by using deflator for gross fixed capital formation.	Province of Trento (PAT)
Neighbouring total per capita expenditure	Neighbouring average value of Total per capita expenditure on Infrastructure.	Our computation on PAT data
Administration & Management per capita expenditure	Per capita stock on Administration and Management expenditure function over the period 1990-2007 expressed in 2007 base year values by using deflator for gross fixed capital formation.	PAT
Neighbouring Administration & Management per capita expenditure	Neighbouring average value of Road and Traffic per capita expenditure.	Our computation on PAT data
Roads & Transport per capita expenditure	Per capita stock on Road and Traffic expenditure function over the period 1990-2007 expressed in 2007 base year values by using deflator for gross fixed capital formation.	PAT
Neighbouring Roads & and Transport per capita expenditure	Neighbouring average value of Road and Traffic per capita expenditure.	Our computation on PAT data
Planning & Environment per capita expenditure	Per capita stock on Planning and Environment expenditure function over the period 1990-2007 expressed in 2007 base year values by using deflator for gross fixed capital formation.	PAT
Neighbouring Planning & Environment per capita expenditure	Neighbouring average value of Road and Traffic per capita expenditure.	Our computation on PAT data
Neighbors spending population*	Neighbouring total per capita expenditure and neighbouring per capita expenditure related to Administration and Management, Road and Traffic, Planning and Environment functions *population*10^{-3}	Our computation on PAT data
Grants	Stock of total per capita grants over the period 1990-2007 and stock of per capita grants related to Administration and Management, Road and Traffic, Planning and Environment functions.	Our computation on PAT data
Population	Average population over the period 2001-2007.	ISTAT
Children	Average population between 0-5 years old over the period 2001-2007 divided by population	ISTAT
Altitude	Height of municipality above the level of the sea	ISTAT
Aged	Average population over 65 years old over the period 2001-2007 divided by population.	ISTAT
Houses	Number of houses in 2001 divided by population.	ISTAT
Population Density	Population divided by area.	Our computation
Total Employees	Number of public and private employees in 2001 divided by population.	ISTAT
Local Unit	Number of local productive unit in 2001 divided by population.	ISTAT
Outliers Dummy	Outliers dummy=1 if the municipality is an outliers with respect to per capita expenditure. See Table A3.	Our computation
Metropolitan Dummy	Metropolitan dummy=1 if the municipality is either Trento or Rovereto.	Our computation
Population Growth	Average population over the period 2001-2007 divided by average population over the period 1991-1997 minus one.	Our computation

Table B.2: Descriptive statistics.

Variables	Obs	Mean	Std. Dev.	Min	Max
Total per capita expenditure	223	16,671.01	9,987.06	4,377.21	77,057.88
Neighboring total per capita expenditure	223	15,920.16	5,047.97	6,487.54	28,237.72
Neighboring total per capita expenditure*population*10^{-3}	223	3,093.01	10,417.03	148.06	147,749.70
Administration & Management per capita expenditure	223	3,625.57	3,395.87	513.22	24,825.35
Neighboring Administration & Management per capita expenditure	223	3,521.14	1,783.10	1,032.28	9,032.59
Neighboring Administration & Management per capita expenditure*population*10^{-3}	223	734.35	3,201.84	15.11	46,962.10
Roads & Transport per capita expenditure	223	4,688.47	3,928.27	589.79	25,643.57
Neighboring Roads & Transport per capita expenditure	223	4,277.21	2,047.51	1,156.27	11,686.00
Neighboring Roads & Transport per capita expenditure*population*10^{-3}	223	781.91	2,466.72	39.05	34,585.22
Planning & Environment per capita expenditure	223	4,172.41	3,836.61	577.56	39,446.68
Neighboring Planning & Environment per capita expenditure	223	3,903.58	1,485.85	1,211.78	8,986.70
Neighboring Planning & Environment per capita expenditure*population*10^{-3}	223	739.80	2,159.21	29.84	28,659.04
Total per capita grants	223	10,072.23	7,925.70	2,352.13	70,388.19
Administration & Management per capita grants	223	1,729.18	1,238.74	23.93	10,450.14
Roads & Transport per capita grants	223	2,189.10	2,157.26	264.42	17,314.44
Planning & Environment per capita grants	223	2,229.67	2,582.99	90.81	31,624.64
Altitude	223	709.40	294.15	85.46	1,491.12
Population	223	2,224.06	7,865.26	108.29	109,334.90
Houses	223	0.77	0.41	0.36	3.18
Aged	223	0.19	0.03	0.12	0.32
Children	223	0.06	0.01	0.03	0.10
Population Density	223	105.27	264.90	3.72	3,699.05
Population Growth	223	0.07	0.07	-0.18	0.31
Total employees	223	0.26	0.16	0.06	0.98
Local Unit	223	0.08	0.04	0.03	0.37

Notes: The spatial matrix used to compute the neighboring variables is a binary contiguity-based one, according to which two municipalities are neighbors if they share a border, and is row-standardized

Table B.3: Municipalities outliers.

	Total		Administration & Management		Roads & Transport		Planning & Environment	
Q1	9507.48		1645.68		2255.12		2047.08	
Q3	20498.20		4212.22		5691.41		5134.31	
IQR	10990.72		2566.54		3436.28		3087.24	
Q1 –1.5*IQR e Q3 + 1.5*IQR	-6978.60	36984.28	-2204.13	8062.03	-2899.30	10845.83	-2583.78	9765.17
Number of mild outliers	9		10		6		3	
Q1 –3*IQR e Q3 + 3*IQR	-23464.68	53470.36	-6053.94	11911.84	-8053.73	16000.26	-7214.64	14396.03
Number of severe outliers	2		7		7		6	
Municipalities	ALBIANO	44965.76	ALBIANO	24825.35	AMBLAR	15036.89	CENTA SAN NICOLO'	15202.88
	BRESIMO	41930.06	BOCENAGO	11175.95	BRESIMO	19096.17	DAONE	11027.09
	BRIONE	37741.92	BRIONE	13511.83	CAGNO'	15326.98	LARDARO	18115.57
	CASTEL CONDINO	42865.77	CADERZONE	8814.79	CASTEL CONDINO	17584.93	LUSERNA	12485.57
	GARNIGA	43060.11	CASTEL CONDINO	9132.70	DARE'	10885.35	MASSIMENO	20114.78
	GRAUNO	40976.11	CASTELFONDO	9509.00	GRAUNO	24137.27	PALU' DEL FERSINA	18117.79
	MASSIMENO	44222.98	CINTE TESINO	12137.98	MASSIMENO	12692.81	SAGRON MIS	11081.02
	PALU' DEL FERSINA	66917.53	DON	14464.66	PALU' DEL FERSINA	25643.57	TERRES	16701.57
	PIEVE TESINO	39948.09	GARNIGA	20772.40	PRASO	11988.20	VIGNOLA FALESINA	39446.68
	SAGRON MIS	44057.73	GIUSTINO	8306.35	PREZZO	17483.32		
	VIGNOLA FALESINA	77057.88	GRUMES	11120.82	SAGRON MIS	22423.47		
			LONA-LASES	12860.40	STREMBO	12627.79		
			MASSIMENO	10839.78	VIGNOLA FALESINA	19491.20		
			PIEVE TESINO	22963.56				
			RONZONE	9163.028				
			TIARNO DI SOTTO	10135.25				
			VIGNOLA FALESINA	8643.582				

Table B.4: Non spatial model - OLS regression.

	Total	Administration & Management	Roads & Transport	Planning & Environment
	(1)	(2)	(3)	(4)
Grants	0.87***	0.38**	0.82***	0.72***
	(0.09)	(0.17)	(0.14)	(0.14)
Altitude	5.09***	1.17	2.09***	0.69
	(1.40)	(0.90)	(0.72)	(1.00)
Population	-0.07*	-0.06*	-0.03**	-0.03*
	(0.04)	(0.03)	(0.02)	(0.02)
Houses	2,620.32***	321.17	585.34	1,287.76**
	(910.86)	(535.36)	(379.05)	(500.74)
Aged	2,814.87	2,279.31	-2,118.45	7,334.39
	(9,310.60)	(6,303.39)	(4,681.13)	(5,380.26)
Children	8,782.41	-6,071.13	-8,850.30	10,936.83
	(30,648.31)	(18,043.98)	(20,418.58)	(16,040.36)
Population Density	-0.96	-0.30	0.33	-0.30
	(0.87)	(0.46)	(0.38)	(0.47)
Population growth	3,748.01	-2,319.11	-2,362.06	-411.85
	(4,317.05)	(3,293.26)	(2,347.50)	(3,111.54)
Total employees	4,471.62	1,862.30	1,032.61	103.64
	(3,204.03)	(2,092.94)	(1,218.65)	(1,670.92)
Local unit	16,134.72	6,497.92	-355.68	240.67
	(12,747.64)	(7,280.13)	(5,619.08)	(7,940.58)
Outliers dummy	9,698.34**	8,416.57***	7,551.73***	8,579.50***
	(4,124.96)	(1,247.66)	(1,049.15)	(1,661.39)
Metropolitan dummy	3,700.99	1,266.15	963.65	453.63
	(2,435.73)	(1,379.38)	(1,120.07)	(1,083.12)
Constant	-2,795.09	-479.78	1,198.57	-1,299.48
	(2,968.83)	(2,009.99)	(1,728.93)	(1,734.73)
Communities dummy	YES	YES	YES	YES
Observations	223	223	223	223
R-squared	0.91	0.72	0.86	0.82
Robust LM test for spatial error dependence	0.84	0.43	6.05**	5.44**
Robust LM test for spatial lag dependence	3.53*	0.60	9.50***	2.10

Notes: Robust standard errors are shown in parentheses. The spatial weights matrix used to compute the test is a binary, contiguity-based one, according to which two municipalities are neighbors if they share a common border and it is row-standardized. *** significant at 1%; ** significant at 5%; * significant at 10%.

Table B.5: Non spatial model and interaction with population - OLS regression.

	Total	Administration & Management	Roads & Transport	Planning & Environment
	(1)	(2)	(3)	(4)
Neighbors spending * Population	-0.17	0.06	-0.48*	-0.26
	(0.15)	(0.20)	(0.27)	(0.17)
Grants	0.86***	0.38**	0.81***	0.71***
	(0.09)	(0.17)	(0.14)	(0.14)
Altitude	5.39***	1.12	2.40***	0.67
	(1.39)	(0.92)	(0.75)	(1.00)
Population	0.17	-0.09	0.13	0.04
	(0.22)	(0.09)	(0.09)	(0.05)
Houses	2,586.13***	324.51	520.00	1,282.95**
	(912.68)	(534.95)	(379.75)	(502.05)
Aged	2,950.51	2,244.79	-2,456.38	7,579.84
	(9,329.84)	(6,338.17)	(4,698.42)	(5,331.12)
Children	9,516.40	-6,226.33	-8,470.91	11,118.14
	(30,790.85)	(18,158.54)	(20,440.38)	(16,034.68)
Population Density	-1.08	-0.28	0.26	-0.35
	(0.89)	(0.46)	(0.40)	(0.48)
Population growth	3,624.18	-2,326.46	-2,505.92	-445.23
	(4,315.08)	(3,303.50)	(2,342.38)	(3,114.20)
Total employees	4,394.32	1,899.96	1,037.81	109.83
	(3,213.64)	(2,123.14)	(1,208.27)	(1,665.94)
Local unit	16,959.44	6,358.39	-81.32	632.79
	(12,973.07)	(7,326.33)	(5,673.08)	(7,972.03)
Outliers dummy	9,645.76**	8,424.25***	7,541.33***	8,521.32***
	(4,133.69)	(1,252.12)	(1,047.43)	(1,667.64)
Metropolitan dummy	2,142.87	1,522.80	-121.78	-165.00
	(3,052.42)	(1,590.26)	(1,264.99)	(916.63)
Constant	-2,895.81	-395.41	1,230.17	-1,159.33
	(2,996.47)	(2,053.22)	(1,737.68)	(1,753.69)
Communities dummy	YES	YES	YES	YES
Observations	223	223	223	223
R-squared	0.91	0.72	0.86	0.82

Notes: Robust standard errors are shown in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

Appendix C

Appendix to Chapter 3

Data Appendix

The data was acquired from various sources. The Local Public Finance Directorate of the Interior Ministry, publishes data on financial variables ((http://finanzalocale.interno.it/apps/floc.php/in/cod/4). The Internal and Territorial Aairs Directorate publishes data on city councillors and mayors, including their party aliation (http://amministratori.interno.it). The same directorate (http://elezioni.interno.it) publishes national election data. The Ministry of Finance keeps the record of Income Tax base by municipality (http://www1.finanze.gov.it/dipartimentopolitichefiscali.htm). The National Statistical Office (ISTAT) publishes data on the demographic composition of each municipality, both for each census, and for the socalled "intercensus reconstructions", i.e. the yearly data obtained integrating the yearly net migration data of municipality to the census data (http://demo.istat.it/).

The Internal and Territorial Affairs Directorate publishes data on financial variables

Financial variables:

- *tax*es: total real direct taxes by municipality (year 2008 costant euros per capita);
- *charges*: total real charges and profits (year 2008 costant euros per capita);
- *total own revenue*: total real revenue net of borrowing (year 2008 costant euros per capita);
- *current expenditure*: total real public current expenditure (year 2008 costant euros per capita)

Political variables:

- *large*: dummy variable equal to one when the municiplaity has certified population of more than 15,000 inhabitants, and zero otherwise;
- *termlim*: dummy variable equal to one when the mayor of the municiplaity cannot run for the next election because he/she is already in his/her second term office, and zero otherwise;
- *votshare*: percentage of votes obtained by the mayor when elected (the variable refers to the first round of voting for double-ballot municipalities);
- *list*: number of list supporting (at first ballot) the sucessful mayoral candidate in a large municipality (with a certified population of more than 15,000 inhabitants)

Demographic and socio-economic variables:

- *income*: real personal income tax base (year 2008 constant euros per capita);

- *pop*: state population;
- *aged*: share of population over the age of 65;
- *child*: share of the population aged between 0 and 14;
- *foreign residents*: share of the foreign residents population;
- *dens*: the number of citiziens per area

Table C.1: Small and large municipalities by year.

Year	Small	Large	Total
2001	375	117	492
2002	382	120	502
2003	385	124	509
2004	384	131	515
2005	375	129	504
2006	372	123	495
2007	371	143	514
Total Observations	2,644	887	3,531
Mean	378	127	504

Table C.2: Small and large electoral regimes for switching municipalities.

Municipality	2001	2002	2003	2004	2005	2006	2007	Years of election
Adelfia	small	small	small	small	small	large	large	2001 and 2006
Arona	large	large	large	large	small	small	small	1998,2002 and 2005
Bareggio	small	small	large	large	large	large	large	1998 and 2003
Baronissi	small	small	large	large	large	large	large	1998 and 2003
Bellaria-Igea Marina	small	small	small	large	large	large	large	1999 and 2004
Budrio	small	small	small	small	small	small	large	1997,2002 and 2007
Bussolengo	small	small	large	large	large	large	large	1998 and 2003
Calenzano	small	small	small	large	large	large	large	1999 and 2004
Campagna	small	small	large	large	large	large	large	1998 and 2003
Casagiove	large	large	large	large	large	small	small	2001 and 2006
Casamassima	small	small	large	large	large	large	large	2001 and 2003
Caselle Torinese	small	small	small	small	small	small	large	1998, 2002 and 2007
Castel Maggiore	small	small	small	large	large	large	large	1999 and 2004
Castellanza	large	large	large	small	small	small	small	1999, 2004 and 2006
Cerea	small	small	small	small	small	small	large	1998, 2002 and 2007
Corciano	small	small	small	large	large	large	large	1999 and 2004
Fiesole	large	large	large	small	small	small	small	1999 and 2004
Frattaminore	small	small	small	small	large	large	large	1998,2002,2005 and 2007
Ghedi	small	small	small	large	large	large	large	1999 and 2004
Gualdo Tadino	small	small	small	large	large	large	large	2000 and 2004
Impruneta	large	large	small	small	small	small	small	1998 and 2003
Malnate	small	small	small	small	small	small	large	1997,2002 and 2007
Maranello	small	small	small	large	large	large	large	1999 and 2004
Mentana	.	small	small	small	small	large	large	2002 and 2006
Monte Sant'Angelo	.	large	large	large	large	large	small	2002 and 2007
Negrar	small	small	small	large	large	large	large	1999 and 2004
Palagiano	.	small	small	small	small	small	large	2002 and 2007
Pavullo nel Frignano	small	small	small	small	small	large	large	2001 and 2006
Pianoro	small	small	small	large	large	large	large	1999 and 2004
Policoro	small	small	small	small	small	large	.	2001 and 2006
Rosarno	small	small	large	large	large	large	large	1998,2003 and 2006
Sabaudia	small	small	small	small	small	small	large	1998,2002 and 2007
Signa	small	small	small	large	large	large	large	1999 and 2004
Spoltore	.	small	small	small	small	small	large	2002 and 2007
Tarquinia	small	small	small	small	small	small	large	1998,2002 and 2007
Terzigno	small	small	small	large	large	large	large	1999,2004 and 2007
Trecate	small	small	small	small	small	large	large	2001 and 2006
Umbertide	small	small	small	large	large	large	large	1999 and 2004

Table C.3: Number of lists by small and large municipalities.

Small				Large			
N°lists	Obs	N° of municipalities (average across 2001-2007)	%	N°lists	Obs	N° of municipalities (average across 2001-2007)	%
1	2,644	378	100	1	164	23	18
				2	65	9	7
				3	192	27	22
				4	166	24	19
				5	136	19	15
				6	108	15	12
				>7	56	8	6
Total	2,644	378	100		887	127	100

Table C.4: Specification test of whether covariates have an effect at the discontinuity cutoff point.

Polynomial order	Estimations without covariates						
	child	old	dens	income	votshare	termlim	foreign residents
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1st							
large	-0.18	-0.27**	-7.10	167.41	-0.83	-0.18	-0.55*
	(0.17)	(0.13)	(8.46)	(118.64)	(2.99)	(0.18)	(0.31)
large*list	0.01	0.01	0.88	6.73	-0.94*	0.05*	0.11**
	(0.02)	(0.02)	(1.08)	(19.65)	(0.50)	(0.03)	(0.05)
2nd							
large	-0.27	-0.22*	-3.28	189.30**	-1.43	-0.22	-0.57*
	(0.17)	(0.13)	(5.57)	(93.97)	(2.97)	(0.18)	(0.29)
large*list	0.01	0.02	0.93	7.26	-0.95*	0.05*	0.10**
	(0.02)	(0.02)	(1.09)	(19.83)	(0.50)	(0.03)	(0.05)
3rd							
large	-0.25	-0.23*	-1.56	194.80**	-1.83	-0.22	-0.56*
	(0.18)	(0.13)	(5.46)	(96.80)	(3.03)	(0.19)	(0.31)
large*list	0.01	0.02	0.99	7.05	-0.96*	0.05*	0.10**
	(0.02)	(0.02)	(1.09)	(19.90)	(0.50)	(0.03)	(0.05)
4th							
large	-0.34	-0.23	0.64	202.10*	-3.88	-0.13	-0.44
	(0.22)	(0.15)	(7.52)	(114.90)	(3.47)	(0.20)	(0.34)
large*list	0.01	0.02	1.00	7.23	-0.99**	0.05*	0.10**
	(0.02)	(0.02)	(1.11)	(20.06)	(0.50)	(0.03)	(0.05)
5th							
large	-0.38*	-0.23	-6.41	201.23*	-3.37	-0.18	-0.51
	(0.22)	(0.14)	(6.44)	(119.09)	(3.37)	(0.20)	(0.32)
large*list	0.01	0.02	0.84	6.89	-0.97**	0.05*	0.10**
	(0.02)	(0.02)	(1.09)	(19.76)	(0.49)	(0.03)	(0.05)
6th							
large	-0.38	-0.21	-8.42	177.27	-3.89	-0.20	-0.47
	(0.23)	(0.15)	(6.84)	(137.59)	(3.42)	(0.21)	(0.33)
large*list	0.01	0.02	0.87	7.49	-0.96*	0.05*	0.10**
	(0.02)	(0.02)	(1.09)	(19.86)	(0.49)	(0.03)	(0.05)
Overall Observations	3,531	3,531	3,531	3,531	3,531	3,531	3,531
Observations small municipalities	2,644	2,644	2,644	2,644	2,644	2,644	2,644
Observations large municipalities	887	887	887	887	887	887	887
R-squared	0.97	0.99	0.99	0.98	0.70	0.42	0.94

Notes: Period 2001-2007; municipalities with a resident population of between 10,000 and 20,000 inhabitants. Estimation methods: polynomial approximation to the 1st,2nd,3rd,4th,5th and 6th degrees. All estimates include municipality and year fixed effects. The variables *child*, *old* and *foreign* residents have been rescaled by multiplying by 100. Robust standard errors, clustered at municipal level, are reported in brackets. The R-squared is obtained by taking the average R-squared of each polynomial order across regressions. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.5: Specification test of whether large is as good as randomly assigned.

Dependent variable: large	1st	2nd	3rd	4th	5th	6th
polynomial order	(1)	(2)	(3)	(4)	(5)	(6)
termlim	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
child	-0.09	-0.55	-0.43	-0.83	-0.81	-0.82
	(0.92)	(0.84)	(0.82)	(0.83)	(0.79)	(0.80)
old	-1.98**	-1.47*	-1.48*	-1.12*	-0.97	-0.87
	(0.83)	(0.80)	(0.79)	(0.67)	(0.61)	(0.60)
dens	-0.87	-0.48	-0.30	-0.06	-0.52	-0.63*
	(0.74)	(0.47)	(0.42)	(0.51)	(0.35)	(0.37)
income	0.07	0.07	0.07	0.06	0.05	0.05
	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
votshare	-3.08	-3.86	-4.50	-5.47	-4.54	-5.12
	(5.53)	(4.78)	(4.93)	(4.47)	(3.84)	(3.91)
foreign resident	-0.80*	-0.56	-0.57	-0.20	-0.23	-0.19
	(0.48)	(0.43)	(0.43)	(0.39)	(0.37)	(0.37)
F-test	1.64	1.17	1.27	1.1	1.56	1.41
p-value	0.1227	0.3193	0.2652	0.3647	0.1462	0.1979
Overall Observations	3,531	3,531	3,531	3,531	3,531	3,531
Observations small municipalities	2,644	2,644	2,644	2,644	2,644	2,644
Observations large municipalities	887	887	887	887	887	887
R-squared	0.96	0.96	0.97	0.97	0.98	0.98

Notes: Period 2001-2007; municipalities with a resident population of between 10,000 and 20,000 inhabitants. Estimation methods: polynomial approximation to the 1st,2nd,3rd,4th,5th and 6th degrees. The variables *votshare*, dens and *income* have been rescaled by dividing by 10,000. All estimates include municipality, year fixed effects and the interaction term (large*list). Robust standard errors, clustered at municipal level, are reported in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.6: Placebo tests on fiscal policy outcome at the “fake” threshold of 12,057 inhabitants.

	Median below (12,057)							
	A. Estimations without covariates				B. Estimation with covariates			
Polynomial order	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1st								
large	-0.97	13.23	-14.21	-17.15	-0.34	14.44	-14.77	-18.35
	(24.13)	(11.99)	(20.99)	(21.43)	(23.20)	(11.91)	(20.50)	(20.82)
large*list	-8.59	-9.34*	0.75	1.84	-8.63	-9.51*	0.88	3.30
	(6.56)	(4.87)	(5.02)	(6.55)	(6.51)	(4.91)	(4.95)	(6.28)
2nd								
large	-0.28	11.20	-11.48	-11.32	-1.69	11.78	-13.47	-12.53
	(26.62)	(14.14)	(22.05)	(22.55)	(25.77)	(14.04)	(21.73)	(21.95)
large*list	-8.04	-8.87*	0.83	2.02	-8.14	-9.07*	0.94	3.38
	(6.58)	(4.88)	(5.04)	(6.53)	(6.57)	(4.93)	(4.99)	(6.28)
3rd								
large	-0.27	15.61	-15.88	-21.29	-0.65	16.25	-16.89	-23.94
	(28.04)	(16.99)	(21.89)	(23.12)	(27.31)	(16.91)	(21.68)	(22.55)
large*list	-7.99	-8.82*	0.83	1.96	-8.14	-9.05*	0.91	3.26
	(6.57)	(4.86)	(5.06)	(6.55)	(6.57)	(4.91)	(5.01)	(6.31)
4th								
large	16.00	32.68	-16.69	-14.29	11.91	32.04	-20.13	-19.71
	(30.44)	(20.31)	(22.03)	(24.00)	(29.69)	(20.30)	(21.71)	(23.25)
large*list	-8.02	-8.83*	0.81	1.94	-8.17	-9.08*	0.91	3.25
	(6.56)	(4.87)	(5.04)	(6.62)	(6.57)	(4.93)	(4.98)	(6.37)
5th								
large	10.20	22.11	-11.92	-5.97	4.80	21.09	-16.29	-12.90
	(32.62)	(23.13)	(22.28)	(24.65)	(31.68)	(23.20)	(21.77)	(23.63)
large*list	-8.97	-9.09*	0.12	1.22	-8.99	-9.30*	0.30	2.64
	(6.45)	(4.85)	(5.01)	(6.61)	(6.49)	(4.91)	(5.00)	(6.40)
6th								
large	4.57	25.02	-20.45	0.17	-0.83	25.04	-25.88	-8.36
	(36.02)	(26.77)	(22.95)	(25.86)	(34.89)	(26.99)	(22.27)	(25.01)
large*list	-9.25	-9.05*	-0.19	1.16	-9.28	-9.26*	-0.02	2.57
	(6.54)	(4.84)	(4.96)	(6.61)	(6.60)	(4.89)	(4.96)	(6.40)
Overall Observations	2,423	2,423	2,423	2,423	2,423	2,423	2,423	2,423
R-squared	0.88	0.89	0.76	0.87	0.88	0.89	0.76	0.88

Notes: Period 2001-2007; municipalities with a resident population of between 10,000 and 15,000 inhabitants. Estimated discontinuities in fiscal policy outcome at fake threshold (median below the true 15,000 threshold). Estimation methods: polynomial approximation to the 1st, 2nd, 3rd, 4th, 5th and 6th degrees. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. The R-squared is obtained by taking the average R-squared of each polynomial order across regressions. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.7: Placebo tests on fiscal policy outcome at the "fake" threshold of 16,957 inhabitants.

	Median above (16,957)							
	A. Estimations without covariates				B. Estimation with covariates			
Polynomial order	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1st								
large	-8.09	17.33	-25.42	-0.48	-18.02	13.66	-31.68*	-8.64
	(20.05)	(14.98)	(15.55)	(22.59)	(19.39)	(13.88)	(17.20)	(25.40)
large*list	6.92	-0.87	7.79*	5.27	8.70*	-0.20	8.90**	6.13
	(5.00)	(2.46)	(3.99)	(5.34)	(4.75)	(2.12)	(4.17)	(5.66)
2nd								
large	2.55	21.11	-18.56	3.44	-7.81	16.91	-24.72	-2.10
	(22.86)	(16.81)	(18.55)	(26.40)	(21.51)	(14.83)	(19.27)	(28.83)
large*list	6.91	-0.91	7.81**	5.30	8.66*	-0.22	8.88**	6.11
	(4.93)	(2.47)	(3.92)	(5.31)	(4.66)	(2.13)	(4.09)	(5.61)
3rd								
large	2.21	23.79	-21.58	13.47	-2.15	22.74	-24.89	12.52
	(29.49)	(18.39)	(25.38)	(33.34)	(28.19)	(17.42)	(25.93)	(35.69)
large*list	6.95	-0.92	7.87**	5.22	8.69*	-0.23	8.92**	6.07
	(4.97)	(2.47)	(3.95)	(5.37)	(4.67)	(2.13)	(4.09)	(5.65)
4th								
large	-21.37	6.93	-28.29	29.85	-20.46	8.70	-29.16	32.57
	(34.50)	(21.17)	(29.18)	(39.98)	(32.68)	(20.02)	(29.44)	(41.30)
large*list	6.96	-0.90	7.86*	5.06	8.71*	-0.21	8.92**	5.87
	(5.01)	(2.46)	(3.99)	(5.51)	(4.72)	(2.13)	(4.12)	(5.77)
5th								
large	-38.47	9.03	-47.50	23.03	-41.16	6.50	-47.66	22.01
	(39.36)	(24.93)	(32.25)	(44.54)	(37.30)	(23.86)	(31.50)	(46.63)
large*list	7.06	-0.91	7.97**	5.08	8.85*	-0.19	9.04**	5.90
	(4.99)	(2.47)	(3.98)	(5.51)	(4.69)	(2.13)	(4.10)	(5.78)
6th								
large	-27.84	16.80	-44.63	41.93	-30.46	16.59	-47.05	41.08
	(47.75)	(28.72)	(41.83)	(53.88)	(45.60)	(27.44)	(40.73)	(55.75)
large*list	6.90	-0.85	7.75*	4.62	8.69*	-0.22	8.91**	5.50
	(5.02)	(2.47)	(4.04)	(5.53)	(4.74)	(2.12)	(4.17)	(5.83)
Overall Observations	1,108	1,108	1,108	1,108	1,108	1,108	1,108	1,108
R-squared	0.89	0.86	0.81	0.88	0.90	0.87	0.81	0.89

Notes: Period 2001-2007; municipalities with a resident population of between 15,000 and 20,000 inhabitants. Estimated discontinuities in fiscal policy outcome at fake threshold (median above the true 15,000 threshold). Estimation methods: polynomial approximation to the 1st, 2nd, 3rd, 4th, 5th and 6th degrees. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. The R-squared is obtained by taking the average R-squared of each polynomial order across regressions. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.8: Local Linear Regression results using optimal bandwidth of 1,500.

LLR	A. Estimations without covariates				B. Estimations with covariates			
	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
large	-59.72**	-30.82	-28.90	-44.39*	-73.73**	-38.75*	-34.98*	-51.39**
	(29.68)	(22.21)	(17.98)	(26.33)	(30.90)	(23.12)	(18.89)	(25.15)
large*list	6.80	4.72	2.07	6.53	9.43**	5.77	3.66	9.92**
	(4.13)	(3.97)	(2.50)	(4.94)	(3.88)	(4.00)	(3.61)	(3.84)
Overall Observations	1,018	1,018	1,018	1,018	1,018	1,018	1,018	1,018
R-squared	0.91	0.89	0.84	0.90	0.91	0.89	0.84	0.91

Notes: Period 2001-2007; municipalities with a resident population of between 13,500 and 16,500 inhabitants. Estimation methods: local linear regression with bandwidth h=1,500. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.9: Local Linear Regression results using optimal bandwidth of 750.

LLR	A. Estimations without covariates				B. Estimations with covariates			
	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
large	-80.58***	-48.63**	-31.96*	-73.87***	-94.01***	-60.17***	-33.84	-74.77***
	(27.29)	(19.61)	(19.10)	(27.00)	(29.13)	(17.54)	(22.24)	(25.52)
large*list	11.56***	9.32**	2.23	11.94**	14.46***	10.56***	3.90	15.69***
	(4.08)	(4.40)	(2.30)	(5.38)	(4.07)	(3.34)	(3.94)	(4.21)
Overall Observations	515	515	515	515	515	515	515	515
R-squared	0.91	0.89	0.87	0.91	0.92	0.90	0.87	0.91

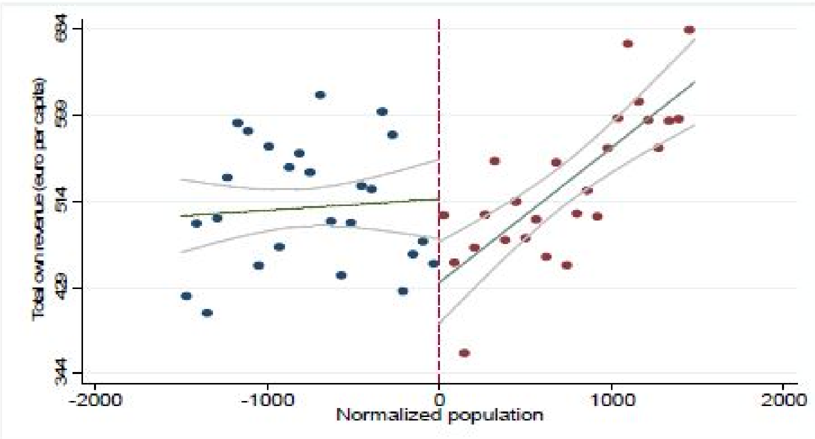
Notes: Period 2001-2007; municipalities with a resident population of between 14,250 and 15,750 inhabitants. Estimation methods: local linear regression with bandwidth h/2=750. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table C.10: Local Linear Regression results using optimal bandwidth of 3,000.

LLR	A. Estimations without covariates				B. Estimations with covariates			
	total own revenue	taxes	charges	current expenditure	total own revenue	taxes	charges	current expenditure
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
large	-41.48*	-23.72	-17.76	-30.03	-54.28**	-28.21	-26.06	-40.94*
	(23.92)	(17.91)	(16.77)	(23.01)	(23.45)	(17.77)	(17.29)	(21.97)
large*list	4.91	1.98	2.93	4.25	6.66*	2.25	4.41	6.16
	(3.86)	(3.11)	(3.07)	(4.18)	(3.71)	(3.05)	(3.20)	(3.95)
Overall Observations	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098
R-squared	0.86	0.86	0.77	0.86	0.87	0.86	0.77	0.87

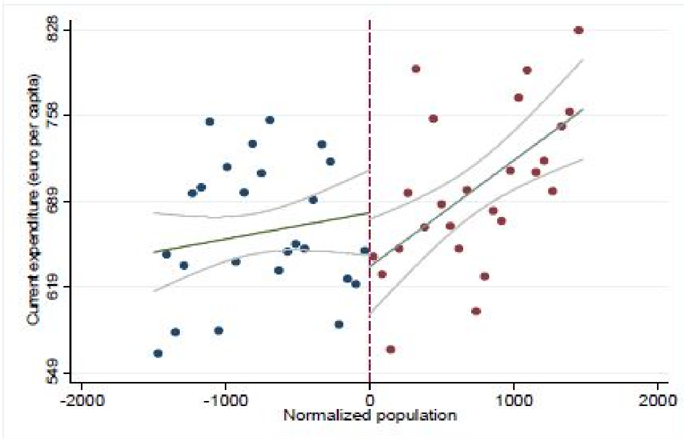
Notes: Period 2001-2007; municipalities with a resident population of between 12,000 and 18,000 inhabitants. Estimation methods: local linear regression with bandwidth 2h=3,000. All estimates include municipality and year fixed effects. The estimations in panel B also includes the following covariates: mayor's lame-duck dummy, percentage of votes obtained by the mayor when elected (for the double ballot we consider the votes obtained at the first round), share of population aged between 0 and 14, share of population over 65 years, share of foreign residents, population density computed as the ratio between population and area, per capita personal income tax base. Robust standard errors, clustered at municipal level, are reported in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Figure C.1: Per capita total own revenue (taxes+charges) using optimal bandwidth of 1,500.



Notes: Period 2001-2007; municipalities with population between 13,500 and 16,500 inhabitants. Dependent variable: per capita total own revenue (taxes+charges). The solid line is the fitted value from a linear regression model estimated separately on each side of the cut-off. Scatter points are averaged over a bandwidth of 25 bins at either side of the normalized population size (i.e, population minus 15,000). Each bins on the left of the cut-off contains on average 21 observations, while each bins on the right of the cut-off includes on average 19 observations.

Figure C.2: Per capita current expenditure using optimal bandwidth of 1,500.



Notes: Period 2001-2007; municipalities with population between 13,500 and 16,500 inhabitants. Dependent variable: per capita current expenditure. The solid line is the fitted value from a linear regression model estimated separately on each side of the cut-off. Scatter points are averaged over a bandwidth of 25 bins at either side of the normalized population size (i.e, population minus 15,000). Each bins on the left of the cut-off contains on average 21 observations, while each bins on the right of the cut-off includes on average 19 observations