This version: September 15th, 2011

Fabio Padovano, *CREM-CNRS et Centre Condorcet, Université de Rennes 1, Rennes, France.*

Ilaria Petrarca, *IMT Lucca, Lucca Italy*[1].

A COMPREHENSIVE TEST OF YARDSTICK COMPETITION EXPLOITING AN ITALIAN NATURAL EXPERIMENT

Abstract

This paper provides two contributions to the empirical literature on yardstick competition. First, it performs a rigorous test of the link between the responsibility and the yardstick competition hypotheses, i.e., the assumption that voters decide to reelect a mayor by comparing his performance with those of neighboring jurisdictions, by estimating a vote popularity equation where voters' electoral decisions are based on the interjurisdictional comparisons described in yardstick competition theory. If this preliminary condition is not verified, strategic interactions among municipalities cannot be interpreted as proper yardstick competition. Second, the paper exploits a natural experiment made possible by the Italian reforms of local governments and finances, which in 1993 created from scratch an institutional setting favorable to yardstick competition, to analyze the evolution of yardstick competition among Italian municipalities in the 1995-2004 time interval. The analysis, performed on a newly assembled dataset of all Italian municipalities between 1995 and 2004 reveals that a) strategic interactions among Italian municipalities appear consistent with the predictions of yardstick competition theory; b) the evolution of the estimated coefficients suggest that in time the disciplining force of yardstick competition wanes off; yet, as the spatial errors become more similar, yardstick competition seems to have progressively selected a pool of better mayors.

Keywords Yardstick competition, vote popularity function, spatial panel regression.
JEL Classification C21, D72, H71.

---

[1] Corresponding author. Ilaria Petrarca, IMT Lucca, Piazza San Ponziano 6, 55100 Lucca Italy. Tel: +39-388-1123150. E-mail: i.petrarca@imtlucca.it. Paper present at the seminars of the IMT Lucca and the European Public Choice Society, Rennes, the Scientific Meeting of the Italian Society of Public Economics. The database was partly financed by a research grant of the IREF (Institut de Recherche Économiques et Fiscales), which we gratefully acknowledge. The authors wish to thank Eduardo Di Porto, Francesco Lagona, Antonello Maruotti, Sonia Paty, Marco Portman, Raffaella Santolini for comments on an earlier version of this paper. The usual caveat applies.

1. Introduction

Do fiscal decisions of incumbent mayors affect their probability of being re-elected? Do they consider the fiscal decisions of the neighboring mayors when they face an election? And do these strategic interactions remain stable over time, or do voters become more/less alert of, and incumbent mayors more/less reactive to, the decisions taken in nearby jurisdictions in successive electoral rounds?

An affirmative answer to the first question, known in the literature as the "responsibility hypothesis" (Lewis-Beck and Paldam, 2000), is the logical and necessary presupposition for the analysis of the second, the "yardstick competition hypothesis" (Salmon, 1987; Besley and Case, 1995; Brueckner, 2003). If voters do not include the mayor's fiscal choices in their electoral calculus, i.e., if these choices do not affect the incumbent mayor's probability of being re-elected, mayors have no reason to look at what their neighbors are doing when they take their fiscal decisions. Hence there will be no proper yardstick competition, at best some mimicking behavior hinging on different motivations. In the empirical literature on yardstick competition this presupposition is often neglected, as many studies draw conclusions about yardstick competition either without estimating this link (Elhorst and Frèret, 2008) or failing to find any empirical support for it (Bordignon et al., 2003).

The third question arises from the comparative static structure of theories that underlie both the responsibility and the yardstick competition hypotheses. In these models agents are supposed to implement their best response to other agents' actions so to immediately attain the new equilibrium. In the real world, instead, the dynamic adjustments to equilibrium situations entail a time dimension that is both relevant and variable. For instance, the cost for voters to extract information about the quality of their mayor from the performance of other jurisdictions may increase if 'bad' mayors become more effective at mimicking the 'good-type' behavior (Bordignon et al., 2003), or if they progressively obfuscate voters' possibilities to make comparisons by extending collusive behaviors (Charlot and Paty, 2010). Alternatively, yardstick competition may become more intense and widespread, as the circulation of information about mayors' fiscal performances improves (Franzese, 2001), or as voters "learn" how to implement the comparative electoral strategy envisaged in yardstick competition models (Meseguer, 2009). So far no paper in the literature has ever investigated the evolution of strategic interactions among jurisdictions through time. Previous panel studies have estimated the average panel correlation, which can be a misleading indicator of strategic interaction if the assumption that all observations reflect equilibrium values is in fact not verified. To avoid these problems, we exploit a unique "natural experiment" offered by the Italian sample. In Italy, 1993 witnessed the almost simultaneous introduction of the possibility for voters to directly elect their mayor and for mayors to decide the rate of the property tax to finance municipal expenditures. These reforms have created, from scratch, an institutional setting where inter-jurisdictional comparisons of fiscal performances became possible[2]. The analysis of the pattern of strategic interactions among municipalities in the years following this reform allows verifying how yardstick competition evolves in time from a situation where there is none. This natural experiment is structured much in a similar way to Putnam's et al. (1993) analysis of the introduction of the Ordinary Statute Regions in Italy in 1970. In that case the natural experiment was based on the creation, from scratch, of a government level with expenditure competencies immediately below the central one. Here, we analyze the assignment of the power to tax and the associated political accountability, at the lowest government level, again from an institutional setting where the fiscal and electoral incentives were altogether different.

This work contributes to this field of research by verifying whether the responsibility and the yardstick competition hypotheses are connected, i.e., they are both

[2] Before 1993 in Italy mayors were selected by the national parties and local revenues consisted almost entirely of transfers from the central government. It is no accident that research on yardstick competition in Italy began after this reform (Brosio et al., 2007).

driven by the same interjurisdictional comparative evaluation process. The test is performed on a newly assembled dataset of Italian municipalities for the 1995-2004 sample period, circa 80,000 observations per variable. The time dimension allows us to relax the assumption that all variables are on their long-run equilibrium steady state. By that we can control for transitory departures from the equilibrium path and investigate the evolution of strategic interactions.

The empirical strategy is organized in three steps. First, we estimate the correlation between the popularity of the mayor and his/her main fiscal decision. The voting decisions are modeled in a way consistent with yardstick competition theory, introducing the domestic tax rate, the spatial lag of the tax rate and a newly conceived variable that represents the tax difference between the domestic jurisdiction and its neighbors. By that we verify whether the responsibility hypothesis and the yardstick competition hypothesis are driven by the same comparative evaluation process that motivates voters' decisions. In this respect, the new tax difference variable is especially important, as it allows us to capture not only if two jurisdictions are becoming more or less different from each other, but also by how much. Some previous studies failed to find a link between responsibility and yardstick competition hypotheses because the inter-jurisdictional differences were too small to play a significant role in voters' electoral calculus. Second, we estimate a tax setting equation that distinguishes between the reactions of the domestic tax rates to the neighbors' tax rates ('spatial lag') and the spatial correlation of the unobservable variables in the error term ('spatial error'). Finally, we exploit the longitudinal dimension of the dataset and the "quasi natural experiment" peculiar to the Italian sample to investigate the evolution of the strategic interactions among jurisdictions from a situation where voters had no incentives to compare the fiscal performance of neighboring jurisdictions.

To anticipate the results, the analysis of the Italian municipalities shows that differences in fiscal performances among jurisdictions do affect the incumbent mayor's probability of being re-elected. These electoral concerns corroborate the interpretation of the main finding of the second step of the analysis, a statistically significant strategic interaction among the fiscal decisions of neighboring municipalities, as proper yardstick competition. Finally, the pattern of the spatial correlation coefficients estimated on subsequent time subsamples converges towards the lowest level of correlation. This suggests that the probability of pooling equilibrium decreases as time goes by, i.e., the disciplining force of yardstick competition wanes off; yet, as the spatial errors become more similar, yardstick competition seems to have selected a pool of better mayors through time. This is especially evident in regions with a higher density of municipalities, i.e., where there are more opportunities to make inter-jurisdictional comparisons.

The rest of the paper is organized as follows. Section 2 reviews the economic literature on the responsibility and the yardstick competition hypotheses. Section 3 introduces the empirical analyses, describing the methodologies adopted and the dataset. The estimation results of the vote popularity function and of the tax setting equation are presented respectively in Section 4 and Section 5. Section 6 examines the evolution of strategic interaction in time. Finally, Section 7 concludes.

2. Review of the literature

Yardstick competition has been proposed in the literature as a solution to the agency problem that arises when voters and incumbent officials have asymmetric information regarding the cost of public provision of goods and services (Besley and Case, 1995). When the cost shocks for the provision of a service are spatially correlated, voters may compare the fiscal performance in their jurisdiction with those in the neighborhood and thus draw information about the relative competence of their administrator. The decision to re-elect the incumbent depends on the outcome of this comparison; the fiscal decision of the incumbent in jurisdiction i represents the best reaction to the strategy played in the neighboring (or similar) jurisdictions $-i$. Formally, the incumbent in i maximizes an objective function that depends on the decisions taken in jurisdictions $-i$ (Brueckner, 2003).

The yardstick competition model, however, supports a pooling equilibrium in fiscal decisions. There is a range of values of the cost shock for which the bad incumbent finds it rational to reduce the amount of his rent seeking activity to signal good competence to the voters. Bordignon et al. (2003) solved this signaling problem and derived the formal conditions for successful mimicking to occur. In a mimicking equilibrium the fiscal instrument is no longer an informative signal of competence and the agency problem is not solved. In such case, the appeal of yardstick competition lies in its ability to limit the rent appropriation by a bad incumbent during electoral year, rather than in the revelation of information.

The empirical literature on yardstick competition tested the prediction of a pooling equilibrium in tax rates in the U.S. (Besley and Case, 1995), Switzerland (Feld and Reulier, 2005), France (Dubois and Paty, 2008), Spain (Solé Ollé, 2003), Netherlands (Allers and Elhorst, 2004), Belgium (Heyndels and Vuchelen, 1998), Norway (Fiva and Rattsø, 2007; Revelli and Tovmo, 2007), Sweden (Edmark and Agren, 2006) and Italy (Bordignon et al., 2003). Most of the empirical results, however, mix yardstick competition with tax competition *à la* Tiebout (1956). Both phenomena predict a reduction of tax rates for a given level of provision of public goods, but with two important differences. First, when the tax base is mobile, voters may simply relocate to jurisdictions with a better tax/services mix, taking advantage of the exit option (Hirschman, 1970). In this case, tax competition is predominant. Conversely, when the tax base is immobile, as is the case of the house tax, voters are left only with the voice option (Caplan, 2010). This situation reinforces the link between fiscal policy and voting decisions and the relevance of the yardstick competition model. Some empirical studies have also examined the strategic interactions between fiscal decisions and electoral results in samples where the fiscal instrument is partially mobile, such as the income tax rate or the business property tax (Bordignon at al., 2003; Padovano, 2008; Ermini and Santolini, 2007; Case and Rosen, 1992; Dubois et al., 2007; Buttner, 2001; Depalo and Messina, 2011), finding mostly interaction in the spatial error. The second difference is that yardstick competition is motivated by popularity concerns of the incumbent, rather than by the maximization of the tax base, as in tax competition. As such, yardstick competition occurs in connection with electoral events and provided that voters base their electoral decisions on inter-jurisdictional comparisons. Nonetheless, only in the last decade have scholars attempted to verify whether yardstick competition is supported by electoral popularity concerns[3] (Bordignon et al., 2003). Heyndels and Vuchelen (1998), Bosch and Solé-Ollé (2007) and Dubois and Paty (2010) find a significant impact of fiscal decisions on the electoral concerns of the incumbent, while Bordignon et al. (2003), in the context of the municipalities of the province of Milan, Italy, do not find evidence of a link of responsibility.

Another problem plaguing the literature is that all empirical analyses measure the popularity of the incumbent with the share of votes obtained at the elections. This is not very satisfactory when dealing with yardstick competition, because the incumbent's incentives to extract rents via fiscal policy are negatively correlated with his confidence of re-election. The vote share is a poor indicator of such confidence because the same share of votes can be obtained at different win margin levels. The empirical analyses confirm this view, as they found that the electorally-induced incentives to mimic are stronger when the incumbent is allowed to run for re-election (Besley and Case, 1995; Bordignon et al., 2003), when the executive is backed by a large majority or enjoys a large electoral win margin (Solé-Ollé, 2007) and when the degree of local fiscal autonomy and electoral accountability is not higher than a fixed threshold (Schaltegger and Küttel, 2002).

Another important difference among all the empirical studies refers to the time dimension. Some of the best-known studies make use of cross-sectional data (Bordignon et al., 2003; Allers and Elhorts 2005; Dubois et al.; 2007, Fiva and Rattsø, 2007), taking for granted a set of equilibrium conditions which may in fact not hold and, if so, invalidate the results. A variety of factors might produce transitory one-year variations in the use

[3] The early empirical literature estimated the effect of fiscal decisions on the re-election probability of the incumbent (Besley and Case, 1995). This variable is more generic than popularity because it does not specify the variation of the electoral support caused by a variation of the tax rate in case of re-election of the incumbent.

of the fiscal instrument without altering the incentives of the bad incumbent to behave strategically; two examples can be the changes in the amount of transfers received from higher levels of government and asymmetric shocks to local GDP. Panel datasets allow to relaxing the equilibrium assumption and control for unit and time specific effects; but although nowadays many tests of yardstick competition make use of panel data, none of them has ever attempted to examine the dynamics of interactions in time. By confining themselves to the estimation of the average interaction in time, these studies have actually extended the stability of the equilibrium hypothesis. Of course, as the time dimension increases interactions may vary their magnitude and/or direction, thus making the mean results less informative and less reliable for policy advices.

The size of the datasets is another source of concern, because scholars often choose samples of sub-national jurisdictions in an almost discretionary fashion. Bordignon et al., (2003) use 143 municipalities of the province of Milan; Ermini and Santolini (2007) consider the municipalities within the Marche region in Italy; Solé Ollé, (2003) examines the Spanish municipalities with more than 5000 inhabitants in Catalunya, Spain, and so on. As the yardstick competition is essentially a spatial phenomenon, borders of the subsample that do not coincide with the limits of the possibility for voters to make comparisons (as it may be the case when the sample is limited by national borders) may undermine the validity of the results, because some out-of-sample comparison are actually being made but not accounted for.

Finally, the empirical literature is heterogeneous also with respect to the econometric methods adopted. The spatial lag of the dependent variable introduces endogeneity in the tax setting equation and makes OLS estimators biased and inconsistent and the estimate inefficient. Thanks to the work of Anselin (1988), the yardstick competition literature benefited from the development of the spatial econometrics research. The main innovation is the use of the simultaneous autoregressive (SAR) model, which introduces a spatially lagged dependent variable and the spatial correlation of the errors, both weighted by a matrix that describes the 'neighborhood network' among the observations. The weight matrix usually refers to geographical proximity, but it can refer to any relationship, such as the socio-economic or demographic similarities. The regression models have been traditionally estimated through Maximum Likelihood (Cliff and Ord, 1981), as in the papers of Besley and Case (1995), Revelli (2002), Bordignon et al. (2003), Delgado et al. (2011). In recent times the introduction of GMM estimation (Kelejian and Prucha, 1998; 2007) proved to be more efficient than ML, especially in large samples and more appropriate when the assumption of normality of the errors does not hold (Bartolini and Santolini, 2009). This is the model that we are going to mostly rely on in the second step of the analysis.

3. The data and the Italian municipalities' institutional setting.

This work exploits a newly assembled database that includes all the 8101 Italian municipalities, which represent the lowest level of local government in Italy. The database is the outcome of a research project on 'Tax Competition among Italian municipalities' (Padovano, 2007b), which aimed at collecting a set of data about Italian local jurisdictions that is both comprehensive and comparable. The format of the original series has been harmonized for the first time so that they can be directly compared[4]. The time span of the dataset covers the years from 1995 to 2004. Data availability, at the level of municipalities, conditions the time spam for some electoral variables (before 1994) and some economic ones (beyond 2004). Moreover, as we shall see, the dependent variable was introduced in 1995. Appendix A.1 provides a complete description of the dataset.

The municipalities that belong to the five special statute regions ('*Regioni a Statuto Speciale*') do not show a suitable degree of homogeneity with those of the remaining 15 regions, because of their different institutional and fiscal setting. In order to avoid

[4] The original data, coming from different institutional sources, are highly heterogeneous: for example, the Italian Ministry of Interior (which provides the electoral and political data) and the National Statistic Institute (which collects most of the remaining information) use different numerical codifications for the municipalities, which made it extremely difficult, and sometimes altogether impossible, to compare data coming from the two sources as the sample size became large. That is the likely reason why empirical analyses about Italian municipalities rarely go beyond cross sectional analyses of a limited sample size.

comparing incomparable observations, they have been excluded from the estimates[5]. The total number of cross sections is then 6695, i.e., 83% of the total of the Italian municipalities.

Italian municipalities represent a suitable environment for a joint test of the responsibility and the yardstick competition hypotheses, because the institutional reforms in the 1990s established a strong link of accountability between voters and local governments, especially in the domain of fiscal decisions. In 1993 the central government endowed the municipalities with the possibility to decide the house tax rate and, at the same time, allowed voters to directly elect the mayor. In particular, fiscal decentralization at the municipal level has been implemented mainly through the introduction in 1993 of the local property tax rate (*ICI*, *Imposta Comunale sugli Immobili*), a tax that features a level *b* of fiscal autonomy according to the OECD tax autonomy scale[6], which ranges from *a* (the highest) to *e* (OECD, 1999). The prerequisite of the ICI is property in the form of buildings, building land, agricultural land located inside the municipality area. The tax base is the value of the property, set by national laws that are uniform across all jurisdictions. The municipal Council sets the ICI tax rate with a resolution taken before the approbation of the yearly provisional budget. Each jurisdiction is free to choose the tax rate in a range between 4‰ and 7‰. Although such range may appear small, the large value of the tax base ensures that a marginal variation of the rate produces a consistent variation in the tax paid by the individual voter, as well as in the total revenues accruing to the municipality. Since the tax base is fixed and the reassessment of the property value is a decision of the central government, the discretion of the mayor is reduced to one single dimension, the rate. This makes it quite easy for voters to include this information in their electoral preferences. On average, the

---

[5] For the accuracy of the analyses also seven municipalities that do not border with anyone else (six single-municipality islands and Campione d'Italia, an *enclave* within Swiss territory) have also been removed from the estimations. Their inclusion, however, does not affect the results.

[6] The previous arrangement of Italian local finances was classified as a level *e*, as all fiscal decisions were taken by the central government and municipalities were almost entirely financed via transfers from the central government and revenue sharing schemes.

revenues from ICI represent more than 50% of the total revenues of the municipalities' revenue and cover more than 25% of local expenditures (ANCI).

In 1995 the central government introduced the possibility to differentiate the ICI tax rate between the 'house' tax rate, applied to the main living property of the family, and the 'business' tax rate, applied to holiday houses, offices, shops, and so on. The house ICI tax has been abolished in 2008 (Law 126/2008). In the period 1993-2007 the ICI house tax rate represented the most visible fiscal decision of Italian mayors because it is a cost that voters can directly link to the house and more than 80% of the Italian families are home-owner (ISTAT)[7]. As a consequence, the ICI tax rate can be considered a relevant yardstick to compare the fiscal performance and the competence of the mayors.

The following figures illustrate the dynamics of the house ICI tax rate in the period 1995-2004. Table 1 reports the descriptive statistics for the house ICI tax rate between 1995 and 2004. The average tax rate is 5.2‰, with the highest average tax rates in the central regions and the lowest in the north-eastern area. The standard deviation, on the contrary, is lower in the central area but higher in the south[8]. The analysis of the dynamics of the house ICI tax rate, reported in Table 2, shows an increasing but not monotonic trend, characterized by decreasing averages in 1999 and in 2001. The maximum average value is reached in 2004, which is also associated with the highest standard deviation. Graph 1 shows a positive mean-standard deviation relationship, which indicates a tendency toward greater homogeneity during the years when the tax rate is lower and to an increase in the volatility during the years in which the tax rate is higher. The initial year 1995 is an anomaly, as it likely reflects the lack of coordination between mayors when they had to choose the tax rate for the first time: the mean is lower than in other years but the volatility among the municipalities is not.

[7] In 2008 70,2% of the population owned the house in which they lived, 18,3% lived in a rental and 11,5% retained the usufruct of the house or lived rent-free. Source: ISTAT, *L'abitazione delle famiglie residenti in Italia - Anno 2008*, published in Spring 2010.

[8] Some municipalities in the North West and the South set a tax rate lower than the legal minimum, as they apply the provisions of a special law. These observations are only 16 (0.002% of the total dataset), referring to 7 municipalities. Their exclusion does not alter the estimates; yet, as the decision to apply a very low tax rate is a policy decision as well, we have kept them in the analysis.

Table 1-2 and Graph 1 about here

Since mimicking is driven by popularity concerns, it is interesting to match the fiscal data with electoral and political factors. The Italian electoral system for local elections was reformed in 1993 from proportional to majoritarian, with the explicit aim to increasing the government's accountability to voters. Since 1993 the mayor is directly elected by plurality rule in municipalities with less than 15000 inhabitants (less than 10% of the total) and by majority rule with runoff elections in municipalities with more than 15000 inhabitants. The legislature lasts five years and the term limit is fixed to two mandates. In case of motion of no confidence both the mayor and the council must resign and new elections are held. This provision has produced a significant dispersion of the years when Italian municipalities hold elections. Table 3 shows a concentration of local elections in 1995, 1999 and 2004. In the rest of the paper these three years are called 'first order electoral years', while 1997 and 2001 are called 'second order electoral years'.

According to rational political budget cycle models (Rogoff, 1990), when an election approaches, the mayor wishes to signal its competence to the voters by either increasing the public expenditure or decreasing the tax rate. Graph 2 confirms that in 1999, the second 'first order' electoral year in the dataset, the variation of the local property tax rate is negative. A negative variation is registered in 2001 as well, which is a 'second order' electoral year, and although in 1997, the other second order electoral year, the variation is positive its magnitude is less than one half of that of 1996. The positive variation in 2004 is unexpected: although it is a local minimum point the magnitude is positive and not significantly different from the variation in 2003.

Table 3 and Graph 2 about here

Municipal expenditures cover the provision of finances goods and services for the local community, mainly public transportation, garbage collection, services for the youngsters and the elderly, police and administrative costs,. In 1999 the introduction of the Domestic Stability Pact reduced local expenditure, imposed a balanced budget constraint and homogenized the budget design (Bartolini and Santolini, 2009). This fiscal discipline creates a potential problem for estimating the tax setting equation foreseen by yardstick competition theory. As local tax rates and expenditures are set simultaneously, the introduction of the local expenditure in the tax setting equation would create a problem of endogeneity. Furthermore, data on the local budget sheets are not available before 1999; since then the differences in observed expenditure levels are mainly driven by differences in grants received (correlation = 0.71). Hence the inclusion of grants in the tax setting equation ensures that the level of expenditure is also controlled for[9].

4. The empirical strategy and the first stage of the analysis: the vote popularity equation

4.1. Empirical strategy. A complete test of yardstick competition must detect strategic interaction in local tax setting once it is established that tax setting decision bear political consequences for the incumbents. In other words, the responsibility hypothesis must be confirmed to hold in the sample, before one can test for yardstick competition in the same sample. We thus organize the empirical strategy in the following three steps:

1. We estimate a vote popularity function, modeled according to the comparative process envisaged by yardstick competition theory, to test the responsibility hypotheses;
2. We estimate a local tax setting equation to analyze the determinants of tax decisions and the presence of strategic interaction in the data;
3. We analyze the dynamics of spatial interactions in time to examine the evolution of yardstick competition.

4.2. The vote-popularity equation. The VPE estimated in this work takes the form:

[1] $P_{it} = \beta X_{it} + v_{it}$

[9] The quality of the public expenditures, which could provide another way to tell the 'good' from the 'bad' incumbents cannot be used in empirical analysis, because the available data cannot properly identify it. Moreover even distinguishing between a 'responsive' and an 'excessive' share of expenditures would make the signal related to the tax rate uninformative, because voters would have to consider two, not just one choice dimension (Bordignon and Minelli, 2001). Hence the model assumes homogeneity in the quality of public goods and services provided.

The dependent variable P_{it} represents the electoral popularity of the mayor measured as the local win margin in jurisdiction *i* at time *t*. The choice between levels or differences is crucial in the estimation when the constant term and the trend change over time (Paldam and Nannestad, 1994). Since we deal with a panel dataset, we choose the specification in differences to control for the unobserved heterogeneity. The robustness of the results is tested in a subsequent set of regressions that adopts the share of votes obtained by the winner as an alternative measure of vote popularity.

The covariates included in the vector X represent both political and fiscal controls. The time lag of the share of votes (*votes_lag*) controls for an eventual persistent shock or the presence of an autoregressive process in the popularity of the elected mayors. A dummy for the mayor re-running for election (*rerun*) tests both the 'cost of ruling' (Paldam and Nannestad, 1994) and the 'incumbency advantage' (Lowry et al., 1998) hypotheses. An incumbent running for a second term has in fact an advantage in terms of efficiency in office, but he may also experience an erosion of the electoral popularity in case of unpopular decisions taken during the first term. Because of these contrasting effects, the expected sign of the *rerun* coefficient is uncertain. During the period 1995-2004 left wing and right wing coalitions have been alternately in and out of power at the national level in Italy, and a dummy for the ideological similarity between the local and the central governments (*alignment*) is included to control for the 'alignment effect' (Arulampalam et al., 2009). As it is standard in the literature, we control for indicators of the state of the economy, chiefly by means of the (provincial) rate of unemployment, commonly used in the literature for this purpose (Paldam and Nannestad, 1994). Inflation, being a national phenomenon, has been left out of the analysis.

The coefficient associated to the house property tax rate (*HICI*), which is one of the key variables in the equation, is expected to show a negative sign: an increase in the tax rate lowers the utility of the voters and reduces the electoral support of the mayor. This variable poses the main methodological issue in the estimation of the VPE. The tax rate is suspected to suffer from endogeneity caused by reverse causality between policy and vote decisions (Paldam, 1997): while voters choose a candidate on the basis of his economic performance, the incumbent takes fiscal decisions on the basis of his popularity. Following this reasoning, the incumbent decreases the tax rate to seek for votes when he feels unsecure about his re-election. This methodological problem has been solved in the literature through an instrumental variable estimation. Revelli (2002) proposed an alternative solution by estimating an Arellano and Bond (1991) type of GMM regression of the VPE, which uses as instruments the tax rate with the values of the endogenous tax variables lagged at least two periods. The most recent contribution comes from Aidt et al. (2011); they use a system of two simultaneous equations, a local expenditure and a VPE, estimated through GMM. In our case, because the electoral dataset does not allow calculating a sufficient number of lags for all the municipal elections, we resort to a 2SLS regression to tackle the endogeneity problem. Specifically, the local tax rate has been instrumented with the fitted values and the residuals from an OLS tax setting equation. The tax setting equation is specified as in Equation 2:

[2] $tax_{it} = \beta' Z_{it} + u_{it}$

The fitted values of the tax setting equation are the linear combination of the variables correlated with the tax rate but not with popularity (e.g. population). The residuals include unobserved factors, like the combination of the cost shock and the competency level, which are likely to be uncorrelated with the popularity, since the cost shock is random and the competency level is specific to the incumbent.

To verify the coherence between the responsibility and the yardstick competition hypotheses it is important to check that the popularity of the incumbent major is affected by the process of inter-jurisdictional comparisons that the yardstick competition model describes. The VPE must therefore include the variables foreseen by the yardstick competition model. This implies first, that the neighboring tax rate should affect the popularity of the incumbent mayor. A first way to proxy this variable is by introducing the spatial lag of the house tax rates. In the literature, a positive coefficient has been taken as evidence of comparison among jurisdictions performances; here, instead, an increase in the tax rate of the neighbors is expected to increase the popularity of the domestic incumbent. This fiscal variable may be endogenous, although it proved to be exogenous in other studies (Bosch and Solé Ollé, 2007). In the empirical analyses the fitted values and the residuals of a neighboring tax setting equation are used as instruments for it. A superior method to capture the effects of voters inter-jurisdictional comparison on mayors' popularity is the consideration of the difference from the tax rate of the neighbors (*tax difference*), which this study introduces for the first time. This covariate is the difference between the house tax rate in the domestic jurisdiction and the average house tax rate in the neighboring jurisdictions. The reasons to introduce this new variable are twofold. First, in the literature the domestic and the neighbors' tax rates are introduced separately and are therefore associated with two coefficients. In the real world, however, it is reasonable to believe that voters do not consider the variation of the single tax rates separately, but they evaluate the outcome of variations, viz., the tax difference. An increase of the domestic tax rate is associated to a decrease of the electoral popularity only if the average tax rate in the neighborhood remains constant or decreases, increasing the gap between the tax rate levels. Similarly, an increase of the neighbors' tax rate is associated to an increase of the electoral popularity of the domestic incumbent only if he does not increase the tax rate of the same proportion. Second, the separate variations of the domestic and the neighboring tax rates may result in a quantitatively small difference, too small to be relevant for the voters' electoral calculus. This might be a reason why some studies fail to find a correlation between inter-jurisdictional comparisons and mayors' probabilities of being reelected (e.g., Bordignon et al. 2003). The explicit consideration of the tax difference variable in the VPE allows verifying whether comparisons become electorally relevant only beyond a certain threshold. For these reasons the tax difference variable is consistent with the theory of yardstick competition and is more appropriate to estimate the inter-jurisdictional fiscal comparisons of the voters. The expected sign of this coefficient is negative, because the larger the tax difference, the lower the popularity of the incumbent. The VPE is estimated on the subset of electoral observations extracted by the dataset on the Italian municipalities. The dataset for the VPE includes observations referring to the years 1996-2004. The year 1995 has been dropped to obtain the lagged value of the dependent variable. Unobserved heterogeneity is controlled by including the first differences of the variables. Table A.2 in the Appendix shows the descriptive statistics of the explanatory variables and table A.3 reports the correlation matrix of the explanatory variables; the pairwise correlation of the covariates is never too large, excluding collinearity concerns.

4.3. Vote popularity estimation: the results. Table 4 shows the results of the second stage of the estimation of the vote popularity equation[10]. Five models have been estimated, differing among each other with respect of the specification of the endogenous variable and the instrument used to correct endogeneity. Specifically, Model 1 and Model 3 assume that only the domestic tax rate is endogenous; in Model 1 the domestic tax rate is instrumented with its own domestic fitted and residual values, while in Model 3 it is instrumented with the fitted and residual values of both the own and the neighbors' tax rates. Model 2 assumes also the neighbors' tax rate as endogenous, and implements the whole set of instruments. To improve the specification of the VPE, models 4-5 introduce the tax difference variable, instrumented, respectively, with only the domestic instruments and all the available instruments.

Table 4 about here

The dependent variable is the local win margin, computed as the difference between the share of votes of the winner and that of his first opponent. The win margin is considered a more appropriate measure of popularity than the share of votes obtained by the mayor, the variable commonly used in the literature. The larger the win margin, the larger the confidence in re-election of the incumbent.

Both the Anderson and the Cragg-Donald tests reject under-identification in all the models. However, the Sargan test for over-identifying restrictions rejects a correct specification of Model 5. Moreover, in Model 2 and Model 3 some excluded instruments are not statistically significant. The Pagan-Hall test rejects homoskedasticity in all the regressions, suggesting using the GMM efficient option of the IV estimation. The Hansen J statistic confirms the results from the Sargan test in the first stage regressions. Model 5 is over-identified. The fit of the models is about 0.14 and the coefficients of the

[10] The first stage regression are reported in Appendix A.4.

non fiscal variables are stable over the models and verify the theoretical predictions. The negative coefficient of the lagged share of votes can be taken as evidence of an increase of the electoral competition in time, since the share of votes obtained by the winners is reduced. The dummy *rerun* estimates the impact on popularity of running for re-election. The results support the 'incumbency advantage', since the incumbent who runs for re-election gains about 4.4% of the popularity. The alignment effect is always positive and significant, confirming the electoral advantage of belonging to the same coalition of the central government. The unemployment rate is negative as expected, consistent with the hypotheses that voters punish the government for bad economic outcomes.

Models 1-3 confirm the negative impact of a variation of the domestic tax rate, but the signs of the spatial lag of the tax rate are unexpectedly negative and significant, showing coefficients almost double than the domestic tax rate coefficients. This over-reaction of the incumbents' popularity to the neighbors' fiscal decisions – measured according to the standard practices in the literature - is difficult to interpret and is at odds with the theoretical prediction. On the contrary, when the tax difference is introduced (Model 4), the coefficient is negative and significant as expected, suggesting that a marginal increase in the difference generates a 0.55 decrease in the local win margin.

We have checked the robustness of these results by estimating a second set of VPEs, using as dependent variable the share of votes obtained by the winner candidate. The results from the first stage regression, presented in Appendix A.5, mirror the results obtained with the previous definition of popularity. The R^2 show very high fit of the models, always above 0.6, and a highly significant F statistic. Both the Anderson and the Cragg-Donald tests reject under-identification in all the models, and the Sargan test for over-identifying restrictions rejects a correct specification of Model 5. In Model 2 and Model 3 some excluded instruments are still not statistically significant. However, the Pagan-Hall test fails to reject homoskedasticity in all the regressions.

The results of the second stage regression, presented in Table 5, are very similar to the results of Table 4, both in terms of test significance and the signs of the coefficients obtained. However, the fit of the models increases to about 0.24, and the unemployment variable loses significance. The spatial lag of the tax rate is still negative but shows coefficients similar to the domestic tax rate coefficients. The coefficient associated to the tax difference in Model 4, finally, is negative and significant as expected, suggesting that a marginal increase in the tax difference generates a 9.5% decrease in the share of votes obtained by the incumbent.

Table 5 about here

As a general conclusion to the VPE estimation, the predictions of the theory are verified in the sample of the Italian municipalities. The findings show the expected correlation between the electoral popularity and the fiscal decisions of the mayor. Even more important for our purposes, the comparison of the neighboring jurisdictions' performances and not simply of the levels of the domestic tax rates affect the voters' decisions whether to reelect the incumbent. All in all, the responsibility hypothesis holds and voters seem to apply the electoral strategy described in the yardstick competition hypothesis. It is to its verification that we now turn.

5. The second stage of the analysis: the tax setting equation

5.1. Model specification. The spatial estimation follows the linear regression panel data model of Kapoor, Kelejian and Prucha (2007). Each observation $i=1,\ldots,N$ is observed for $t=1,\ldots,T$ periods. Data are generated according to the following process:

[3] $$tax_{it} = \beta' Z_{it} + u_{it}$$

where tax_{it} denotes the Nx1 vector of observations on the dependent variable in period t, Z_{it} denotes the NxK matrix of observations on exogenous regressors in period t, β' is the corresponding Kx1 vector of regression parameters, and u_{it} denotes the Nx1 vector of disturbance terms. The intercept is assumed to be included in the Zs. The disturbances are assumed to be both correlated over time and across spatial units, as well as heteroskedastic; moreover, they follow a Cliff and Ord first order spatial autoregressive process (Cliff and Ord, 1981):

[4] $$u_{it} = \varrho W_i u_{it} + \varepsilon_t$$

where ρ<1 is the spatial autoregressive coefficient, W_i is an NxN weighting matrix of known time independent constants whose diagonal elements are zero and the matrix (I-ρ W_i) is assumed to be non singular. Finally, ε is an Nx1 vector of innovations following a one-way error component model grouped by time periods:

[5] $\varepsilon_{it,N} = \mu_{i,N} + \nu_{it,N}$

where $\mu_{i,N}$ is the vector of unit specific error components and $\nu_{it,N}$ is the vector of error components varying over both cross-sectional units and time periods. By assumption the error components are independent and identically distributed with mean zero and constant variance. In the proposed methodology, first the parameter ρ and the variance components terms $\mu_{i,N}$ and $\nu_{it,N}$ are estimated through GMM, then the vector of parameters is estimated through GLS. The theoretical contribution of Kapoor, Kelejian and Prucha (2007) applies to random effects panel models, but the same procedure has been applied to fixed effects panel models by estimating an OLS on the within transformation and subsequently performing GMM on the OLS residuals. This approach allows the introduction of a lagged dependent variable on the right hand side of the tax equation, which enables testing for the significance of the spatial lag source of correlation.

Neighborhood is here specified as geographical proximity: the matrix of contiguity defines two jurisdictions as neighbors if they share at least one border. This specification presupposes that it is easier to share information with nearby jurisdictions than further ones. Many alternative specifications of the weight matrix have been suggested by the literature, based on income, population, or other socio-economic indicators. Previous works (Bordignon et al., 2003; Solé Ollé, 2003) have verified the universal suitability of the contiguity matrix, while the performance of alternative matrices has been proved to be specific to the tax rate analyzed. As a robustness check, we will use also a geographical distance weight matrix.

5.2. Independent variables. The vector of covariates Z includes fiscal, socio-demographic, political and electoral variables. Intergovernmental transfers are one of the main sources of revenues for Italian municipalities (about 45% of total revenue). This variable measures nominal values of transfers coming from the five funds created with D.Lgs.504/92, divided into current and investment grants. An increase in the amount of per capita transfers from the central government (*grants*) may be followed by a tax reduction or by an increase in the total expenditure, known in the literature as the 'flypaper effect' (Hines and Thaler, 1995). The rate of substitution between autonomous and non autonomous resources is not clear, therefore there is no prior on the sign of this coefficient. In 1999 the Domestic Stability Pact (*DSP*) was introduced to constrain the municipal budget deficits. The entry requirements are modified on a yearly basis according to population size and the municipalities included in the Pact must follow its guidelines. This budget constraint is supposed to reduce local expenditures (Bartolini and Santolini, 2009) with a consequent reduction of the revenues needed to finance expenditures. Other things being equal, the correlation between the *DSP* dummy and the dependent variable should be negative.

GDP per capita proxies the citizens' ability to pay, which should be positively correlated with the dependent variable. It refers to the provincial GDP real per capita in millions of euro[11]. GDP data are expressed at 'market prices', adding the VAT revenue and other indirect production taxes revenue (net of central government grants) to the value added. The demand for public provision is dependent on the size of the population (*pop*) and the size of the jurisdiction's territory (*area*)[12]. The composition of the population is a relevant issue in the tax setting decision because local governments are usually responsible for most of the services designed for youngsters and elderly people. To capture this we use the dependency ratio (*depratio*), the ratio between youngsters and elderly over adult population. The predicted sign is ambiguous, since it depends on the extent to which they show economies of scale (negative sign) or not (positive sign). To control for the demand for public services coming from the non-resident population we have considered a qualitative binary variable (*touristic*), which

[11] Data broken down at the municipal level are not computed in Italy, because the mobility of individuals make the geographical imputation difficult. Provincial data are the smallest disaggregation available.

[12] Surface area is measured in hm^2. Data are available until 2001 by the census; from 2002 on, data have been adjourned with yearly territorial changes.

denotes the nature of the municipality. Data come from the *ACI-CENSIS* report of 2001, where touristic municipalities are identified by the presence of sea, mountain or artistic and cultural amenities. Touristic municipalities are 3123 (38% of the total). The predicted effect on the dependent variable is negative, because the demand for holiday houses in many Italian touristic destinations may be quite price inelastic. The demand for houses expressed by outsiders remains high even though the business tax rate is set at a relatively stiff rate, which gives the mayor the possibility to compensate residents with a lower house tax rate. The provincial capital dummy (*provcap*) has also been included because provincial capitals are usually richer than other cities and can, in principle, count on a larger tax base. The expected sign is positive.

The number of neighbors (*n_neighbors*) should directly capture interactions in fiscal decisions: the higher the number of neighbors, the greater the flow of inter-jurisdictional information and the stronger the constraint on the incumbent's tax setting decision. Hence a negative sign is expected. Special attention is paid to the jurisdictions on the coast. First, given the geography of the Italian peninsula, many municipalities border with the sea. As the sea is a useless neighbor in terms of comparisons of fiscal performance, the information flow may be lower in coastal municipalities, supporting the expectation of a positive coefficient associated to the *coast* dummy. The coefficient of the local union dummy (*union*) is included in the estimation to control for the effect of agglomerations of jurisdictions (Ermini and Santolini, 2007). The members of a local union may exploit inter-jurisdictional economies of scale (a negative correlation) but they may also collude reducing the variance of the tax rate in the neighborhood (a positive correlation). The five macro-area dummies defined by ISTAT (named *north-west, north-east, center, south* and *islands*) have been included to control for the regional heterogeneity. Finally, time dummies control for the effect of yearly shocks to the dependent variable.

The introduction of a binary variable, *elec_year*, captures the electoral cycle in tax setting. The expected sign is negative, as incumbents are expected to reduce tax rates when elections are approaching (Rogoff, 1990). A year is considered electoral if the first ballot takes place in the last six months of the year or the first six months of the following year. The timeline of the approval of the municipal budget, which may occur between the end of the year and the first three months of the following year, motivates the specification of the electoral dummy variable. This process may influence the citizens' beliefs in case they are called to vote in the early months of the year. Of course, the election date is exogenously given and decided before the tax rate is chosen. The electoral status of the mayor is a relevant factor in the tax decision because, if the incumbent is term limited, he will not find it worthwhile to mimic the 'good neighbor incumbent' and will set a higher tax rate (Besley and Case, 1995; Bordignon et al., 2003). To account for that, we introduce a dummy (*term limit*) that takes the value of 1 if the mayor is elected for the second consecutive term, with a predicted positive sign. The interaction term between the electoral dummy and the term limit dummy (*elec_tl*) captures the fiscal behavior of the incumbent during the electoral year. Yardstick competition predicts that term limited incumbents set higher tax rates than non-term limited ones; the coefficient associated to the interaction term is again positive.

Several dummies referring to the partisanship of the executive have been included to control for the ideological affiliation of the incumbent. Since left-wing mayors (*left wing*) allegedly should spend more for redistributive policies than their right parties colleagues (*right wing*), the coefficient of this variable is expected to be positive (Alesina and Rosenthal, 1995); and vice versa, for right mayors. The local lists (*local list*) are generally ideologically neutral, and are usually municipality-specific. Their policy platforms usually concentrate on a single dimension, like an issue particularly relevant for the municipality or the support to a local charismatic leader. They are a quantitatively relevant phenomenon, as 37% of the observations in the panel dataset feature a civic list executive. Previous studies either did not include this variable or handled this problem poorly, either by associating all local lists with left wing parties or by splitting them evenly between the two coalitions. We treat them as they are, i.e., as separate lists from those associated with the national parties.

Table A.6 in the Appendix shows the descriptive statistics and table A.7 reports the correlation matrix of the explanatory variables; the pair wise correlation of the covariates is never too large, ruling out collinearity issues.

5.3. Tax setting equation: results. The spatial correlation among the observed units is inherent to the theoretical model of yardstick competition, where the mimicking behavior of the bad incumbent during the electoral year increases the correlation among the tax rates of the neighboring jurisdictions. The presence of spatial correlation in the data has been tested through the Lagrange Multiplier tests for panel datasets (Elhorst, 2010). The four LM statistics test the null hypotheses of a non significant spatial lag (spatial error), both unconditional and conditional on the presence of the other source of spatial correlation. The results are presented in Table 6[13].

As a robustness check, the Italian dataset has been split into the five macroareas and the LM tests have been computed on each macroarea. The smaller dimension of these dataset allow the implementation of a geographic distance matrix, to verify the robustness of the results once the different geographical areas of the country are examined separately. Specifically, while the contiguity matrix considers all the bordering jurisdictions as neighbors, the distance weight matrix used here considers only the 5 closest jurisdictions estimated at the level of the respective centers[14]. The results from Table 6 suggest that in the Italian dataset the absence of spatial error correlation cannot be rejected and a spatial regression analyses is appropriate. The results, as the disaggregation in macroareas suggest, are sensitive to the definition of neighborhood used.

Table 6 and 7about here

Table 7 shows the results of the tax setting estimations. The models presented are different in terms of the distinction between non spatial estimations (Model 1-3) and

---

[13] The spatial correlation is usually tested by means of the cross-sectional Moran test (Moran, 1950). Since the Moran test is a cross-sectional statistics and does not distinguish the spatial lag from the spatial error correlation, it is not an appropriate basis for this analyses. Nonetheless the Moran I has been computed as a robustness check and the results, presented in Appendix A.8, are consistent with those of the LM test.

[14] The choice of the 5 nearest neighbors is motivated by the fact that the average number of neighbors in Italy is 5,3.

spatial estimations (Model 4 and 5). Model 1 is obtained through an OLS estimation, Model 2 and 3 are the results from static non spatial panel estimations, and Model 4 and 5 are the results from static spatial estimations. Among them only Model 5 considers both the unobserved heterogeneity in the error term and the endogeneity caused by the spatial correlation of the observations. However, Model 1 has been used to test for the presence of heteroskedasticity and the normality of the residuals (post-estimation tests reject both homoskedasticity and the normality of the residuals[15]). The Hausman test comparing Model 2 and Model 3 gives mixed results[16] consistent with the presence of a non linear relationship between the error variances and the covariates, as the pattern of spatial dependence suspected in the data. Models 4 and 5 give unbiased and consistent coefficients. The choice between fixed and random effect is based upon the considerations that the Italian dataset includes observations belonging to a closed geographical area, a case in which the fixed effect approach is suggested by the spatial literature (Arbia et al., 2005). The econometric specification, moreover, includes both time fixed and space fixed effects, for example the region-based dummies for macro-areas, province capital, coast, and so on. The coefficients of Model 4 are therefore less reliable than those of Model 5, but they have included in Table 9 for the sake of completeness.

The results of the estimation of Model 5 are in line with the theoretical predictions. The socio-demographic variables are not significant, probably because of their limited variance in time, while the GDP per capita is associated with the expected significant and positive sign. The coefficient for right wing government is significantly negative; also the other political variables show the expected sign. In particular, the interaction term *elec*tl* confirms that term limited incumbents set higher taxes than non-term limited ones before elections. The prediction that incumbents allowed to run for re-election are associated with lower tax rates is one of the main tenets of yardstick competition theory. This result also reinforces the verification of the responsibility

[15] Breusch-Pagan studentized test value =4569.438, df = 29, p=0; Jarque-Bera X^2 = 12236.44, df = 2, p=0.

[16] Hausman test: X^2=3547.16, Prob>X^2=0; Breusch-Pagan test X^2 (1) = 92509.95, Prob > X^2 = 0.

hypotheses, showing that tax decisions are consistent with the prediction of the vote popularity estimation.

Although the spatial coefficients from Model 5 show opposite signs, their interpretation does not contradict the yardstick competition hypotheses. First, the positive and significant spatial lag coefficient is in line with the literature (Brueckner, 2003). Secondly, the coefficients associated to the electoral dummy and to the interaction term *elec*tl* are consistent with a pattern of yardstick competition. Third, the spatial error coefficient includes a variety of unobserved phenomena, some related with yardstick competition theory, such as the cost shock and the competence of the incumbent, but others altogether disconnected with it, like central government policies and/or bailing out interventions that target specific local governments (Bordignon and Turati, 2009), or asymmetric demand and output shocks; the latter two examples are quite ubiquitous in the data, given the territorial nature of Italian redistribution policies and the highly clustered productive structure of the economy (Padovano, 2007a)[17]. The power of the system of local political patronage is another phenomenon that may be captured in the spatial error and that is not only unrelated with yardstick competition but *in fact* reduces the mayors' autonomy in taking decisions (Golden, 2000).The negative coefficient (spatial error = -0.16), thus, may be driven by factors impossible to measure that determine unpredictable effects.[18]. Finally, in the real world, it is more reasonable to believe that voters observe the tax rate levels and update their beliefs about the mayor's competence using observable rather than unobservable information. As a consequence, the proximity of the tax rates in the neighborhood is the relevant indicator of strategic interaction

---

[17] Because of these reasons, we disagree with Bordignon's et al. (2003) interpretation of a positive spatial error coefficient as evidence of yardstick competition. Like the majority of the literature, we believe that the spatial lag is the most straightforward and reliable evidence of spatial interaction of the tax rates. The asymmetric information problem in the dataset is much more complex and severe than the model of Bordignon et al. (2003) maintain.

[18] Being the spatial error coefficient an average effect over the whole dataset, the role of the outliers in determining the negative sign of the coefficient cannot be excluded but unfortunately they cannot be empirically detected and excluded from the analyses.

The results of the analyses show that the domestic tax rate is positively correlated with the average tax rate in the neighborhood. The positive coefficient (spatial lag = 0.28) suggests that an increase of the average tax rate in the bordering municipalities is associated with a one-third increase of the domestic tax rate. This coefficient does not give insights on the variation of the tax difference, as it that depends on the sign of the difference. If difference was positive, a positive spatial lag increases it; if difference is negative, a positive spatial lag decreases it.

A set of spatial panel regressions have been estimated on the subsamples of the five macroareas to control for the dynamics of the spatial coefficients in different geographical areas, using alternatively the contiguity and the distance weight matrix. Table 8 reports the results; they roughly confirm the pattern of interaction already found at the national level. The spatial lag is always positive and significant in the Northwest, in the Northeast when using the contiguity matrix and in the South when using the distance matrix is used. The spatial error coefficient is negative and significant when using the contiguity matrix and the South dataset associated to the distance weight matrix; it is positive in north-eastern and central subsamples when the distance matrix is used. As a conclusion, these estimates suggest that the average national pattern of spatial correlation in the whole time period is determined mainly by the interaction among the Northern municipalities. Spatial correlation in the Central and Southern regions appears less intense. These results are evocative of Putnam's (1993) findings about civic traditions in Italian regions.

Table 8 about here

6. Third step: the time dynamics of strategic interactions

The longitudinal dimension of the dataset used allows us to investigate the evolution of strategic interaction over time. A number of factors may change the pattern of strategic interactions among jurisdictions as time goes by, like improvements in the diffusion of information, changes in the number of municipalities and therefore of the possibilities for voters to make comparisons, learning by voters to adopt comparative voting strategies and by incumbents to resort to mimicking. So far, all the empirical studies in the literature, even those that use long time series, have instead assumed that interactions among jurisdictions remain unchanged election after election, The informational spillover generating yardstick competition and mimicking, in particular, has always been implicitly assumed to expire after the election and every time voters repeat the process from scratch. If this assumption holds, the estimated coefficients should remain stable through time.

In this paper we relax this potentially implausible assumption and investigate the dynamics of strategic interaction in the ten years considered, looking for a pattern in the data. The natural experiment of the creation in 1993 at the level of municipalities of an environment apt for yardstick competition is especially suitable to examine the evolution of yardstick competition from a situation where there was none. For this purpose the spatial panel regression of Model 5 has been estimated on subsequent time subsamples of the dataset, to observe the variation of the estimated spatial coefficients. A progressive increase of the coefficients reveals an increase in strategic interaction; on the contrary, a decrease of the spatial coefficients over time is interpreted as a reduction of strategic interaction.

Table 9 shows the results of these set of estimates on the Italian dataset.

Table 9 about here

The spatial coefficients obtained are always statistically significant, safe for the spatial lag coefficient estimated on the sample 1995-2000. This result, apparently contradictory, is due to the consideration of the year 2000, a post-electoral year. As the year 2000 is the furthest away from the next election, the incentive for the incumbent to mimic in 2000 is lowest. As a consequence, the lack of significance of the coefficients is in line with theory.

The signs of the coefficients are robust to the time length of the dataset used, confirming the general pattern of interaction in the outcome and not in the residuals. The absolute value of the coefficients decreases as the time interval becomes longer. Graph 3 depicts the spatial coefficients of Table 9. The resulting pattern reveals that strategic interaction among municipalities decreases over time. Within such pattern especially remarkable is the drop of the coefficients when we move from the sample 1995-1998 to the sample 1995-1999, and from the sample 1995-2003 to the sample 1995-2004.

Graph 3 about here

This dynamics is consistent with the hypothesis of a progressive reduction of spatial interaction caused by reduced incentives to mimic. The reduction of the spatial lag coefficients indicates that a lower share of the domestic tax rate is determined by the neighbors' tax rate. Municipalities with high (low) tax rates are still observed near municipalities with high (low) tax rates, but these similarities become less evident. It is interesting to note that both 1999 and 2004 are 'first order' electoral years; the large reductions are likely to be due to the behavior of the incumbents governing the municipalities that face an election in those two years (more than 60% of the dataset).

On the other hand, the result on the spatial error coefficient is more complex to explain. The absolute value is always negative, but it decreases over time, especially in the first order electoral years. Assuming that the residuals include only the cost shock and the competence level of the incumbents, the increasing pattern of the spatial error coefficients could be explained either by increased economic integration (more similar cost shocks) or by increased spatial correlation of the competence levels, or both. As it is quite unlikely that economic integration changes especially in electoral years, the pattern must be driven by greater similarities in the behavior of the mayors. In other words, election after election we still observe incumbents of bordering municipalities characterized by different competence levels, but these differences decrease. In principle this result is consistent with the selection effect of yardstick competition predicted by the theory; but once more it highlights the limit of a static model, since selection occurs gradually and slowly in time[19]. The effect on political selection, however, is not

[19] Montesquieu observed that, at the birth of new polities, leaders mold institutions, whereas afterwards institutions mold leaders. In the context of the creation of the Ordinary Statute Regions in 1970 Putnam indeed found that at the early stages of the institutional reform it is the quality of politicians that determines the performance of the institutions, but, after two or three electoral rounds institutions begin to select and

conclusive and must be treated with caution, since residuals may include also other unobserved variables whose dynamics are not known *a priori*.

Overall the results suggest the presence of a decreasing pattern of mimicking over time and an increasing effectiveness of political selection. The reduction of the strategic interaction generates more and more separating equilibria at the municipal level and determines the re-election of good incumbents only.

The robustness and generality of the results of Table 9 has been tested by estimating the dynamics of the spatial coefficients on the geographic subsamples of the 15 Italian Ordinary Regions. Table 10 presents the results of the regional regressions on the dataset including subsequent time periods[20].

Table 12 about here

The spatial coefficients of the regional estimations are illustrated in panel from *a* to*n* of Appendix A.9. Most of the regions follow the national pattern (Piemonte, Lombardia, Emilia Romagna, Toscana, Abruzzo, Campania, Puglia and Calabria). Among them, there are the regions with the largest density of municipalities[21] (Piemonte and Lombardia) and the highest average of neighbors (Piemonte, Emilia Romagna). A large density of municipalities in a region is associated to a decrease of interaction. While in Piemonte the trend is monotonic after 1999, in Lombardia the decrease occurs in the 'first order' electoral years only. The regions with the lowest density of municipalities (Toscana, Basilicata and Puglia), on the contrary, show a much slower decrease of interaction. This evidence suggests that the density of municipalities intensifies the informational spillover, reducing mimicking and stimulating political selection.

---

determine the type of politician. Our results here confirm Putnam's findings (and Montesquieu's prediction) for a different government level.

[20] The region Umbria has not been included since it is the smallest region of the dataset and the matrix of spatial weights, once cut, showed more than one municipality without any neighbor.

[21] Measured as the number of municipalities per square kilometers. Table A.10 in the Appendix reports the classification of regions by number and density of municipalities and by the average number of neighbors per municipality.

The exceptions to this relationship are Molise, Liguria and Basilicata that follow an unclear pattern. The spatial coefficients obtained with the full time period (1995-2004) in those regions are similar to those obtained with the initial time period (1994-1998) after a temporary variation in the middle of the time period analyzed. The spatial coefficients estimated in the Marche, on the other hand, do not converge to lower absolute values. The same unexpected pattern, however, is found in Lazio, which takes a median position with respect the density of municipalities and the average number of neighbors per municipality. The presence of Rome in Lazio, Italy's capital and largest municipality, surrounded by much smaller municipalities, may explain this rather odd result.

All in all, this section illustrates that the pattern of strategic interaction, contrary to what the literature says, changes over time. Consistent with the theory, regions in which the potential informational spillover is larger are associated to a decreasing pattern of yardstick competition in time.

7. Concluding remarks

This work analyzed strategic interactions in tax competition using a newly built, comprehensive dataset of the Italian municipalities from 1995 to 2004. The Italian sample constitutes a unique "natural experiment" provided by the reforms of municipal politics and finances in 1993 that have created for the first time an institutional environment suitable for yardstick competition.

The empirical strategy adopted uncovered three closely related phenomena: the impact of mayors' fiscal decisions on their probability of being re-elected (responsibility hypothesis), the strategic interactions in local tax setting (yardstick competition) and the evolution of these strategic interaction through time.

The responsibility hypothesis has been verified by means of local vote popularity estimation. A set of specifications have been tested through non spatial IV regressions, suggesting the exogeneity of the spatial lag of the tax rate. A new variable of fiscal interaction, the *tax difference*, has been proposed to enhance the precision of the test. The results confirm a strong link between the popularity of the mayor and the fiscal decisions based on the comparative performance of the incumbent in the neighborhood and not just on the comparison of the same jurisdiction's/mayor's performance through time.

This result obtained, the spatial panel tax setting equation found evidence of strategic interaction among municipalities in tax setting decisions. The tax rates of nearby jurisdictions are positively correlated among each other although the spatial correlation of the residuals is negative. As it is impossible to disentangle the determinants of yardstick competition from other phenomena captured by the error term, the spatial error coefficient is a misleading indicator of spatial interaction. Since the popularity of the incumbent is affected significantly by the tax rate level, a positive spatial lag coefficient is interpreted as a direct and more robust source of spatial interaction.

Finally, we showed that the assumption of an informational spillover expiring after each election is not plausible by illustrating the pattern of strategic interaction in the ten years considered. The pattern of the spatial correlation coefficients estimated on subsequent time subsamples suggests that the disciplining force of yardstick competition wanes off, but, at the same time, that yardstick competition seems to have led to a selection of better mayors through time. This is especially evident in regions with a higher density of municipalities, i.e., where there are more opportunities to make inter-jurisdictional comparisons. From this result we conclude that the consequences of strategic interaction in tax setting decisions can be correctly evaluated only over time.

REFERENCES

Aidt, T., Veiga F.J., and Veiga L.G. (2011). 'Election Results and Opportunistic Policies: A New Test of the Rational Political Business Cycle Model', *Public Choice*, 148: 21-44.

Alesina, A., and Rosenthal, H. (1995), *Partisan politics, divided government, and the economy*, Cambridge, Cambridge University Press.

Allers, M.A., and Elhorst, J.P. (2005), 'Tax mimicking and yardstick competition among local governments in the Netherlands', *International Tax and Public Finance*, 12: 493–513.

Anselin, L. (1988), *Spatial Econometrics: Methods and Models*, Dordrecht, Kluwer Academic Press.

Arbia, G., Basile, R., and Piras, G. (2005), 'Using Spatial Panel Data in Modeling Regional Growth and Convergence', *ISAE Working Paper* n. 55.

Arellano, M. and Bond S. (1991), 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equation', *Review of Economic Studies* 58: 277—98.

Arulampalam, W., Dasgupta, S., Dhillon, A., and Dutta, B. (2009), 'Electoral Goals and Centre-State Transfers in India', *Journal of Development Economics* 88:103-119.

Bartolini, D., and Santolini, R. (2009), 'Fiscal Rules and the Opportunistic Behaviour of the Incumbent Politician: Evidence from Italian municipalities', *CESifo Working Paper Series* 2605, CESifo Group Munich.

Besley, T., and Case, A. (1995a), 'Incumbent behaviour: vote seeking, tax setting, yardstick competition', *American Economic Review*, vol. 85: 25-45.

Besley, T., and Case, A. (1995b), 'Does electoral accountability affect economic policy choices? Evidence from gubernatorial term limits', *Quarterly Journal of Economics,* 110: 769-798.

Bordignon M., Cerniglia F. and Revelli F. (2003), 'In search for yardstick competition: property taxes, tax rates and electoral behavior in Italian cities', *Journal of Urban Economics,* 54: 199-217.

Bordignon M., and Turati G. (2003), 'Bailing out expectations and health expenditure in Italy', *Journal of Health Economics* 28: 305-321.

Bosch, N., and Solé-Ollé, A. (2007). 'Yardstick competition and the political costs of raising taxes: An empirical analysis of Spanish municipalities', *International Tax and Public Finance*, 14: 71-92.
Brueckner, J.K. (2003), 'Strategic interaction among governments: an overview of empirical studies', *International Regional Science Review* 26: 175-188.

Caplan, B. (2010), 'Standing Tiebout on His Head: Tax Capitalization and the Monopoly Power of Local Governments', *Public Choice*, 108: 101-122.

Case, A.C, and Rosen, H.S. (1992), 'Budget spillovers and fiscal policy interdependence evidence from the states', *Journal of Public Economics*, 52: 285-307.

Charlot S. and Paty S. (2010), 'Do Agglomeration Forces Strengthen Tax Interactions?', *Urban Studies:* 1099-1116.

Cliff, A. D., and Ord, J. K. (1981), *Spatial processes: models and applications*, London, Pion Limited.

Delgado, F. J., Lago-Peñas S., and Mayor M. (2011), 'On the determinants of local tax rate: new evidence from Spain', *IEB Working Paper*, 2011/4.

Dubois, E., Leprince, M., and Paty, S. (2007), 'The Effects of Politics on Local Tax Setting: Evidence from France', *Urban Studies* 44: 1603-1618.

Dubois, E., and Paty, S. (2010). 'Yardstick competition: which neighbors matter?', *The Annals of Regional Science*, 44: 433-452.

Edmark, K., and Agren, H. (2006), 'Identifying Strategic Interactions in Swedish Local Income Tax Policies', *Journal of Urban Economics*, 63: 849-857.

Elhorst, J. P. (2010), 'Spatial Panel Data Models', in Fischer, M. M. and Gethis, A. (eds.) *Handbook of Applied Spatial Analysis*, New York, Springer, 377-407.

Elhorst, J. P. and Fréret, S. (2009), 'Evidence Of Political Yardstick Competition In France Using A Two-Regime Spatial Durbin Model With Fixed Effects', *Journal of Regional Science*, 49: 931-951.

Ermini B., and Santolini R. (2007), 'Horizontal interaction on local councils' expenditures. Evidence from Italy', *Quaderni di Ricerca, Università Politecnica delle Marche*.

Feld, L., and Reulier, E. (2009), 'Strategic Tax Competition in Switzerland: Evidence from a panel of the Swiss Cantons', *German Economic Review* 10: 91-114.

Fiva, J.H., and Rattsø, J. (2007), 'Local choice of property taxation: evidence from Norway', *Public Choice,* 132: 457-470.

Franzese, R.J. (2001), 'Strategic Interactions of Monetary Policymakers and Wage/Price Bargainers: A Review with Implications for the European Common-Currency Area', *Empirica,* 28: 457-486.

Golden M. (2000), Political Patronage, Bureaucracy and Corruption in Postwar Italy, *mimeo*, UCLA.

Heyndels, B., and Vuchelen, J. (1998), 'Tax mimicking among Belgian municipalities', *National Tax Journal* 51: 89-101.

Hines J.R., and Thaler R. (1995), 'Anomalies. The Flypaper Effect', *Journal of Economic Perspectives*, 9: 217-226.

Hirschman, A.O. (1970), *Exit Voice and Loyalty. Responses to decline in Firms, Organisations and States*, Cambridge, Harvard University Press.

Kapoor M., Kelejian H.H. and Prucha I. (2007), 'Panel data models with spatially correlated error components', *Journal of Econometrics*, 140: 97–130.

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

Lewis Beck, M., and Paldam, M. (2000), 'Economic voting: an introduction', *Electoral Studies* 19: 113–121.

Lowry, R.C., Alt, J.E., and Ferree, K.E. (1998), 'Fiscal Policy Outcomes and Electoral Accountability in American States', *American Political Science Review*, 92: 759-774.

Meseguer C. (2009), *Learning, Policy Making, and Market Reforms*, Cambridge, Cambridge University Press.

Organisation for Economic Cooperation and Development (1999). 'Taxing Powers of State and Local Government', *OCSE Tax Policy Studies* No.1. Paris.

Padovano, F. (2007a), The Politics and Economics of Regional Transfers. Cheltenham, Edward Elgar.

Padovano F. (2007b), 'The Database on Tax Competition on Italian municipalities', *IREF Paris*.

Padovano F. (2008), 'Setting house taxes by Italian municipalities: what the data say', in Padovano, F. and Ricciuti, R. (eds.) *Italian Institutional Reforms: A Public Choice Perspective,* New York, Springer, 89-115.

Paldam M., and Nannestad P. (1997), 'The grievance asymmetry revisited: A micro study of economic voting in Denmark,1986–1992', *European Journal of Political Economy* 13: 81-99.

Paldam M., and Nannestad P. (1994), 'The VP-Function: A Survey of the Literature on Vote and Popularity Functions After 25 Years', *Public Choice,* 79: 213-245.

Putnam R. D., Leonardi, R. and Nanetti, R. Y. (1993) *Making democracy Work: Civic Traditions in Modern Italy,* New York, Princeton University Press.

Revelli F. (2002), 'Local Taxes, national politics and spatial interactions in English district election results', *European Journal of Political Economy*, 118: 1723-1731.

Revelli F., and Tovmo, P. (2007) 'Revealed Yardstick Competition: Local Government Efficiency Patterns in Norway', *Journal of Urban Economics*, 62: 121-134.

Rogoff, K. (1990), 'Equilibrium Political Budget Cycles', *American Economic Review* 80: 21-36.

Salmon, P. (1987), 'Decentralization as an incentive scheme', *Oxford Review of Economic Policy,* 3: 24-43.

Schaltegger C. and Kuttel D. (2002), 'Exit, Voice, and Mimicking Behavior: Evidence from Swiss Cantons', *Public Choice* 113: 1-23.

Solé Ollé, A. (2003). 'Electoral accountability and tax mimicking: the effects of electoral margins, coalition government, and ideology', *European Journal of Political Economy*, 19: 685-713.

Tiebout C. (1956), 'A pure Theory of Local Expenditures', *Journal of Political Economy,* 64: 416-424.

Table 1. Descriptive statistics, house ICI tax rate 1995-2004

	Obs	Mean (*1000)	Std	Min (*1000)	Max (*1000)
Italy	66950	5.255	0.647	3.5	7
North-east	9220	5.192	0.622	4	7
North-west	29860	5.243	0.627	3.5	7
Centre	9990	5.369	0.590	4	7
South	17880	5.244	0.712	3.5	7

Note. Italy: all the Ordinary Regions included in the following macro-areas; North-east: Veneto, Emilia Romagna; North-west: Piemonte, Lombardia, Liguria; Centre: Toscana, Marche, Lazio, Umbria; South: Abruzzo, Campania, Molise, Basilicata, Puglia, Calabria.

Table 2. House ICI tax rates by year, 1995-2004

	Obs	Mean	Std. Dev.	Min	Max
1995	6695	5.136	0.648	4	7
1996	6695	5.226	0.623	4	7
1997	6695	5.248	0.628	4	7
1998	6695	5.280	0.628	4	7
1999	6695	5.259	0.633	4	7
2000	6695	5.276	0.643	4	7
2001	6695	5.262	0.650	3.5	7
2002	6695	5.271	0.661	3.5	7
2003	6695	5.291	0.667	3.5	7
2004	6695	5.304	0.675	3.5	7

Graph 1. Yearly mean-standard deviation, ICI tax rate, 1995-2004

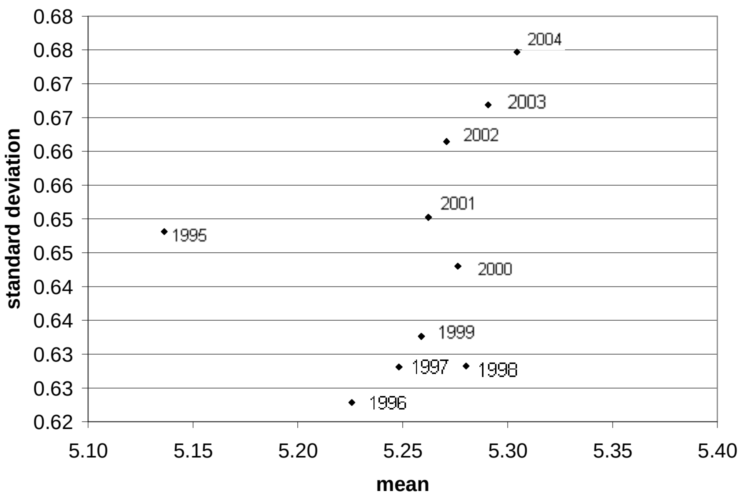
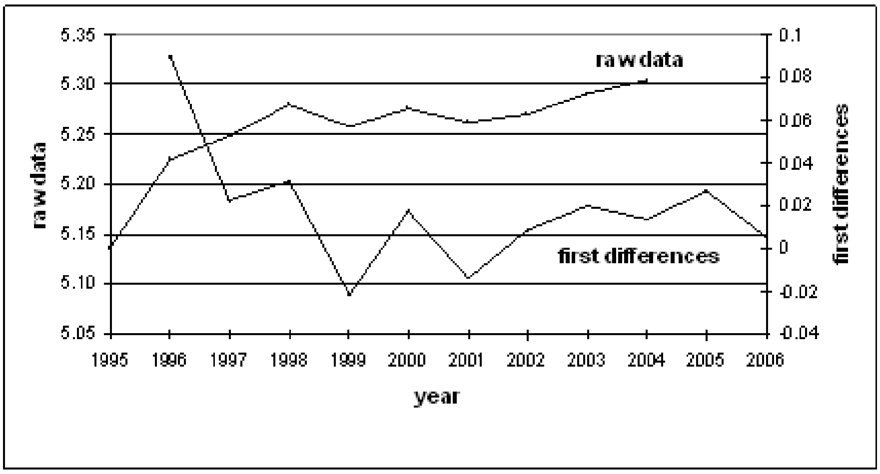


Table 3. Number of electoral Municipalities by year

	Obs.	% Electoral Obs.
1995	4667	69.7
1996	246	3.7
1997	1243	18.6
1998	535	8.0
1999	4308	64.3
2000	315	4.7
2001	1062	15.9
2002	680	10.2
2003	300	4.5
2004	4054	60.5

Graph 2. Average yearly ICI tax rate, 1995-2004.



Note: Yearly average ICI variation computed as yearly average of ICI(i,t)-ICI(i,t-1).

Table 4. Vote popularity function

	Model 1 Instrumental Variable		Model 2 Instrumental Variable		Model 3 Instrumental Variable		Model 4 Instrumental Variable		Model 5 Instrumental Variable	
Dep. Var. : win margin	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Δ popularity lag	-0.195	***	-0.195	***	-0.194	***	-0.194	***	-0.193	***
Δ rerun	0.445	***	0.444	***	0.444	***	0.448	***	0.449	***
Δ alignment	0.059	**	0.059	**	0.059	**	0.068	**	0.068	**
Δ HICI	-0.470	**	-0.467	**	-0.469	**				
Δ HICI_neighbors	-0.899	**	-0.944	*	-0.899	**				
Δ unemployment	-0.194	***	-0.194	***	-0.193	***	-0.182	**	-0.183	**
Δ tax distance							-0.549	**	-0.240	
Constant	0.009		0.009		0.009		0.004		0.004	
Obs	5793		5793		5793		5793		5793	
R^2	0.138		0.138		0.138		0.136		0.137	
Identification/IV relevance test Anderson canon. Corr. LR statistic	70000	***	5314	***	70000	***	8943	***	71000	***
Overidentification test of all instruments Hansen J statistic	0.901		0.901		0.913		0.924		9.445	**
Endogenous regressors	HICI		HICI HICI_neighbors		HICI		Tax distance		Tax distance	
IV	domestic		All		All		All		All	

*Notes: dependent variable first difference of natural log of local win margin. Significance levels: *10%, **5%,***1%.*

Table 5. Vote popularity function, robustness check

	Model 1 Instrumental Variable		Model 2 Instrumental Variable		Model 3 Instrumental Variable		Model 4 Instrumental Variable		Model 5 Instrumental Variable	
Dep. Var: share of votes	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Δ popularity lag	-0.437	***	-0.437	***	-0.437	***	-0.437	***	-0.436	***
Δ rerun	0.043	***	0.043	***	0.043	***	0.044	***	0.044	***
Δ alignment	0.005	*	0.005	*	0.005	*	0.006	*	0.006	*
Δ HICI	-0.085	***	-0.085	***	-0.085	***				
Δ HICI_neighbors	-0.085	**	-0.075		-0.085	**				
Δ unemployment	-0.006		-0.006		-0.006		-0.005		-0.005	
Δ tax distance							-0.095	***	-0.056	***
Constant	0.002		0.002		0.002		0.001		0.003	
Obs	6355		6355		6355		6355		6355	
R^2	0.245		0.245		0.245		0.243		0.244	
Identification/IV relevance test										
Anderson canon. Corr. LR statistic	15000	***	5919	***	15000	***	8293	***	16000	***
Overidentification test of all instruments										
Hansen J statistic	0.434		0.433		0.508		0.408		13.006	***
Endogenous regressors	HICI		HICI HICI_neighbors		HICI		tax distance		tax distance	
IV	domestic		all		All		domestic		All	

*Notes: dependent variable first difference of natural log of share of votes. Significance levels: *10%, **5%,***1%*

Table 6. LM tests of spatial correlation on the panel dataset

contiguity weight matrix											
	Null Hypotheses	ITALY		Northwest		Northeast		Center		South	
LM spatial lag	spatial lag coeff not significant	2890.48	***	569.29	***	326.18	***	338.42	***	320.28	***
LM spatial error	spatial error coeff not significant	2874.83	***	563.77	***	318.15	***	335.27	***	317.86	***
robust LM spatial lag	spatial lag coeff not significant conditional on spatial lag	27.97	***	15.48	***	18.18	***	5.75	**	4.70	**
robust LM spatial error	spatial error coeff not significant conditional on spatial error	12.32	***	9.96	***	10.15	***	2.60	ns	2.28	ns
distance weight matrix											
	Null Hypotheses	ITALY		Northwest		Northeast		Center		South	
LM spatial lag	spatial lag coeff not significant	na		204.38	***	167.87	***	327.28	***	251.57	***
LM spatial error	spatial error coeff not significant	na		203.37	***	179.88	***	322.90	***	247.30	***
robust LM spatial lag	spatial lag coeff not significant conditional on spatial lag	na		3.05	*	1.83		10.84	***	12.88	***
robust LM spatial error	spatial error coeff not significant conditional on spatial error	na		2.05		13.84	***	6.47	**	8.61	***

Note: test based on space-time fixed effects regression on the panel 1996-2004

Table 7. Estimation of the tax setting equation

	Non spatial estimations						Spatial estimation			
	Model 1		Model 2		Model 3		Model 4		Model 5	
Dep. Var.: ICI tax rate	OLS		Random Effects		Fixed Effects		Random Effects		Fixed Effects	
BICI lag	0.584	***	0.298	***	0.219	***	0.286	***	0.226	***
Grants	0.001	***	0.0004	***	0.0004	***	0.0005	***	0.0003	***
Area	0.001		0.0002		0.017	***	0.004	**	-0.003	
Pop	-0.014	***	-0.015	***	0.003		-0.014	***	-0.003	
Depratio	0.025	***	0.009	**	-0.006		0.005	.	-0.0003	
Tur	-0.010	***	-0.004				-0.005	*		
GDP per capita	-0.019	***	0.008	**	-0.024	***	-0.026	***	0.006	.
Left wing	-0.003	**	0.002		0.003	*	0.001		0.001	
Right wing	-0.007	***	-0.007	***	-0.009	***	-0.012	***	-0.007	***
Local list	0.003	*	0.003	**	0.001		-0.002		0.002	.
Elec_year	-0.008	***	-0.006	***	-0.004	***	-0.005	***	-0.006	***
Term limit	-0.001		-0.003	***	-0.004	***	-0.005	***	-0.004	***
Elec*tl	0.005		0.003	*	-0.0003		-0.0002		0.003	*
Union	0.012	***	0.005	***	0.001		0.0001		0.003	*
Dsp	-0.027	***	-0.024	***	-0.009	***	-0.011	***	-0.021	***
N_neighbors	0.0004		0.001				-0.001			
Provcap	0.003		0.012				0.012			
Coast	-0.034	***	-0.017	***			-0.023	***		
Time dummies	yes		yes		no		no		No	
North-west	-0.009	***	-0.017	***						
Nort-east	-0.009	**	-0.013	***						
Center	-0.010	***	0.002							
Constant	-1.880	***	-3.639	***	-4.042	***	-2.979	***		
Spatial lag							0.083	***	0.280	***
Spatial error							0.225		-0.160	
Obs	60255		60255		60255		60255		60255	
R-squared	0.377									
within			0.081		0.080					
between			0.443		0.201					
Overall			0.350		0.171					
Hausman test (p-value)					0.000					

*Notes: dependent variable natural log of ICI house tax rate, continuous variables in log. 6695 observations per year. Robust estimations. Significance levels: *10%, **5%,***1%.*

Table 8. Tax setting equation, robustness check, spatial panel regression with time and space fixed effects

	Northwest				Northeast				Center				South			
Dep. Var.: ICI tax rate	Contiguity		Distance		Contiguity		Distance		Contiguity		Distance		Contiguity		Distance	
BICI lag	0.163	***	0.174	***	0.156	***	0.161	***	0.193	***	0.194	***	0.346	***	0.346	***
Grants	0.000	**	0.000	**	0.001		0.001		0.001	**	0.001	**	0.000	.	0.000	.
Area	-0.009		-0.010		0.004		0.004		0.038		0.032		0.008		0.006	
Population	0.002		0.003		-0.005		-0.006		-0.029		-0.029		-0.081	***	-0.080	***
Depratio	-0.001		0.000		0.001		0.000		0.000		-0.002		-0.035	**	-0.035	**
GDP	0.044	***	0.056	***	0.002		0.001		-0.005		0.001		0.016		0.018	
Left wing	0.002		0.002		-0.004		-0.005		0.006	.	0.006		-0.002		-0.002	
Right wing	-0.007	***	-0.008	***	-0.008	*	-0.008	*	-0.006		-0.006		-0.007	**	-0.008	**
Local list	0.003	**	0.003	*	-0.002		-0.003		0.003		0.003		-0.006	*	-0.006	*
Elec_year	-0.005	***	-0.005	***	-0.009	***	-0.009	***	-0.006	**	-0.006	**	-0.006	***	-0.006	***
Term limit	-0.004	***	-0.004	***	-0.003	*	-0.003	.	-0.003	.	-0.003	.	-0.004	*	-0.004	*
Elec*tl	0.005	**	0.005	*	0.003		0.003		0.000		0.000		0.002		0.002	
Union	0.009	***	0.009	***	0.003		0.004		0.003		0.004		-0.011	**	-0.011	***
DSP	-0.020	***	-0.021	***	-0.009	***	-0.009	***	-0.020	***	-0.020	***	-0.025	***	-0.025	***
Spatial lag	0.427	***	0.322	***	0.356	*	0.192		0.032		0.036		0.208	**	0.213	
Spatial error	-0.412		-0.220		-0.134		0.024		0.073		0.072		-0.162		-0.182	
LM error test		***		ns	***		***		ns			***		ns		***
Obs	2986		2986		922		922		999		999		1788		1788	

*Notes: dependent variable natural log of ICI house tax rate, continuous variables in log. 6695 observations per year. Significance levels: *10%, **5%,***1%.*

Table 9. Estimation results of the spatial correlations coefficients in time, Italian dataset

	Spatial lag		Spatial error	
	Coeff.	p	Coeff.	LM robust error test
1995-1998	0.799	***	-0.783	***
1995-1999	0.479	***	-0.354	***
1995-2000	0.414		-0.317	***
1995-2001	0.471	***	-0.351	***
1995-2002	0.459	***	-0.337	***
1995-2003	0.431	***	-0.307	***
1995-2004	0.280	***	-0.160	***

*Notes: Spatial Fixed effects with time and space fixed effects. Dependent variable natural log of ICI house tax rate, continuous variables in log. 6695 observations per year. Years before 1997 have been dropped to build instruments for the regression. Significance levels: *10%, **5%,***1%.*

Graph 3. The dynamics of the spatial correlations coefficients in time

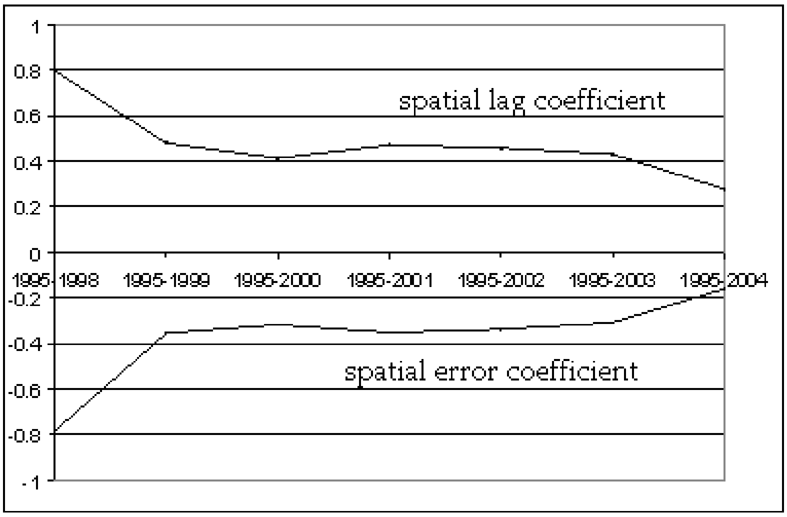


Table 10. Estimation results of the spatial correlations coefficients in time by Region

Region	1995-1998 spatial lag	1995-1998 Spatial error	1995-1999 spatial lag	1995-1999 spatial error	1995-2000 spatial lag	1995-2000 spatial error	1995-2001 spatial lag	1995-2001 spatial error	1995-2002 spatial lag	1995-2002 spatial error	1995-2003 spatial lag	1995-2003 spatial error	1995-2004 spatial lag	1995-2004 spatial error
Piemonte	0.531	-0.464	0.758	-0.713	0.640	-0.555	0.341	-0.272	0.294	-0.226	0.225	-0.117	0.210	-0.085
Lombardia	0.289	-0.146	-0.298	0.214	-0.185	0.178	0.148	-0.056	0.451	-0.345	0.453	-0.382	0.328	-0.284
Veneto	-0.037	0.095	-0.164	0.171	0.062	0.033	0.261	-0.089	0.609	-0.350	0.796	-0.563	0.702	-0.507
Liguria	0.287	-0.103	0.461	-0.248	0.383	-0.188	0.753	-0.556	0.791	-0.624	0.668	-0.484	0.426	-0.235
Emilia Romagna	1.159	-1.105	0.742	-0.301	0.783	-0.349	0.166	0.018	0.318	-0.096	0.474	-0.226	0.358	-0.143
Toscana	-0.564	0.311	0.555	-0.296	0.448	-0.206	0.419	-0.211	0.469	-0.260	0.350	-0.146	0.280	-0.094
Marche	0.387	-0.204	0.403	-0.194	0.420	-0.215	0.105	-0.004	-0.070	0.092	-0.211	0.179	-0.287	0.208
Lazio	0.092	0.056	-0.001	0.057	0.193	-0.080	0.545	-0.359	-0.643	-0.462	0.574	-0.407	0.503	-0.353
Abruzzo	0.636	-0.310	0.486	-0.240	0.557	-0.417	0.379	-0.307	0.263	-0.238	0.271	-0.284	0.289	-0.294
Molise	0.916	-0.459	0.380	-0.255	-0.014	0.076	0.421	-0.149	-0.347	0.213	0.650	-0.016	-0.152	0.069
Campania	0.427	-0.230	0.336	-0.159	0.584	-0.445	0.154	-0.067	0.140	-0.072	0.133	-0.072	0.086	-0.032
Puglia	1.183	-0.957	0.943	-0.767	0.773	-0.545	0.645	-0.553	0.464	-0.434	0.370	-0.361	0.356	-0.351
Basilicata	1.057	-0.768	0.705	-0.508	0.561	-0.298	0.905	-0.469	0.834	-0.636	0.771	-0.579	0.813	-0.594
Calabria	0.652	-0.497	-0.348	0.174	0.401	-0.317	0.270	-0.223	0.219	-0.163	0.207	-0.153	0.178	-0.146

Notes: Spatial Fixed effects with time and space fixed effects, contiguity neighborhood criterion. Dependent variable natural log of ICI house tax rate, continuous variables in log. Years before 1997 have been dropped to build instruments for the regression. Umbria Region dropped because of technical issues.

APPENDIX

A1. Dataset description

Variable	Definition	Source
HICI	Domestic house ICI tax rate	IFEL, Institute for Local Public Finance and Economics
HICI_neighbors	Spatial lag of house ICI tax rate	Own calculations on IFEL data
Tax distance	Difference between domestic house tax rate and neighbors' house tax rate	Own calculations on IFEL data
BICI	ICI business tax rate one period	IFEL, Institute for Local Public Finance and Economics
Grants	Transfers from the central government	Italian Ministry of the Interiors
Area	Surface area	ISTAT, Italian Institute of Statistics
Pop	Population	ISTAT, Italian Institute of Statistics
Depratio	Dependency ratio	Own calculation on ISTAT data
Touristic	Touristic dummy	ACI - Censis 2001 survey
GDP per capita	GDP per capita	Institute G. Tagliacarne
Unemployment	Provincial unemployment rate	Institute G. Tagliacarne
Union	Union dummy	ISTAT, Italian Institute of Statistics
DSP	Domestic Stability Pact dummy	Own calculations on ISTAT data
N_neighbors	Number of neighbors	ISTAT, Italian Institute of Statistics
Provcap	Province capital dummy	ISTAT, Italian Institute of Statistics
Coast	Coast dummy	ISTAT, Italian Institute of Statistics
Mayor	Name and Surname of the winner candidate	Italian Ministry of the Interiors
Share votes 1	Share of votes of the local winner candidate	Italian Ministry of the Interiors
Share votes 2	Share of votes of the first main opponent	Italian Ministry of the Interiors
Win margin	Difference between the share of the votes of the local winner and the share of the votes of his first opponent	Own calculations on Italian Ministry of the Interiors data
Rerun	Incumbent running for re-election dummy	Own calculations on Italian Ministry of the Interiors data
Right wing	Partisanship of executive dummies	
Left wing		
Center wing		
Local list		Own calculations on Italian Ministry of the Interiors data
Alignment	Alignment with central government dummy	Own calculations on Italian Ministry of the Interiors data
Elec_year	Electoral year dummy	Own calculations on Italian Ministry of the Interiors data
Term limit	Re-elected incumbent dummy	Own calculations on Italian Ministry of the Interiors data

Table A.2. Descriptive statistics, 12743 electoral observations, 1996-2004

Variable	Obs	Mean	Std. Dev.	Min	Max
Δ popularity (share of votes)	6355	-0.018	0.191	-0.710	0.714
Δ popularity (win margin)	6298	-0.135	1.572	-8.455	6.908
Δ rerun	6355	-0.293	0.857	-1.000	1.000
Δ unemployment	6355	-0.022	0.033	-0.169	0.163
Δ alignment	6355	0.362	0.648	-1.000	1.000
Δ tax distance	6355	0.000	0.104	-2.245	0.635
Δ domestic tse fitted	6355	0.017	0.060	-0.255	0.482
Δ domestic tse residuals	6355	-0.013	0.088	-0.523	0.488
Δ neighbors tse fitted	6355	0.016	0.031	-0.120	0.182
Δ neighbors tse residuals	6355	-0.012	0.046	-0.362	0.268
Δ HICI	6355	0.003	0.099	-2.303	0.559
Δ HICI_neighbors	6355	0.004	0.047	-0.371	0.405

Table A.3. Correlation among the explanatory variables, vote popularity equation

	% Votes*	Wm*	% Votes lag*	Wm lag*	Rerun	Unemp*	Align	Tax distance	Dom. fitted	Dom. residuals	Neigh. fitted	Neigh. residuals	HICI	HICI_neigh
% Votes*	1.00													
Wm*	0.67	1.00												
% Votes lag*	-0.44	-0.31	1.00											
Wm lag *	-0.15	-0.26	0.41	1.00										
Rerun	0.25	0.24	-0.11	0.01	1.00									
Unemp*	0.00	-0.02	-0.04	-0.06	-0.03	1.00								
Alignment	0.03	0.04	0.02	0.00	0.07	-0.01	1.00							
Tax distance	-0.03	-0.01	0.01	-0.05	-0.02	0.01	0.00	1.00						
Domestic Fitted	-0.02	-0.03	0.00	-0.02	-0.03	0.06	-0.15	0.35	1.00					
Domestic Residuals	-0.05	-0.01	0.01	-0.04	-0.03	-0.04	0.05	0.70	-0.25	1.00				
Neighbors Fitted	-0.02	-0.02	0.00	0.02	-0.01	0.02	-0.19	-0.12	0.18	-0.06	1.00			
Neighbors Residuals	-0.04	-0.03	0.01	-0.02	-0.06	-0.03	0.03	-0.28	-0.06	0.13	-0.31	1.00		
HICI	-0.06	-0.03	0.01	-0.05	-0.05	0.00	-0.05	0.89	0.41	0.78	0.06	0.08	1.00	
HICI_neighbors	-0.05	-0.04	0.00	-0.01	-0.06	-0.02	-0.10	-0.35	0.06	0.08	0.37	0.77	0.12	1.00

Note: all variables are in first-differences; the asterisk indicates that it is the variation in the log (Δlog) of the variable.

Table A.4. Vote popularity function, robustness check, first stage regression

	Model 1-IV		Model 2-IV				Model 3-IV		Model 4-IV		Model 5-IV	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Dep. Var.: win margin	*HICI*		*HICI*		*HICI_neighbors*		*HICI*		*Tax distance*		*Tax distance*	
Δ popularity lag	0.000002		0.000002		0.0002		0.000002		0.0001		0.000002	
Δ rerun	-0.000005		-0.000005		-0.0003		-0.000005		0.003	***	-0.000005	
Δ alignment	-0.000003		-0.000003		-0.008	***	-0.000003		0.006	***	-0.000003	
Δ ICI_neighbors	0.000068						0.000041					
Δ unemployment	-0.000009		-0.00001		-0.005	***	-0.000009		0.008	***	-0.000009	
Δ domestic tax setting equation fitted	0.999	***	0.999	***	0.075	***	0.999	***	0.941	***	0.999	***
Δ domestic tax setting equation residuals	0.999	***	0.999	***	0.007		0.999	***	0.945	***	0.999	***
Δ neighbors tax setting equation fitted			0.0001		0.79	***	0				-1	***
Δ neighbors tax setting equation residuals											-1	***
Constant	0	***	-0.00001	***	0.014	***	-0.00001	***	-0.004	***	-0.00001	***
Obs	5793		5793		5793		5793		5793		5793	
R^2	1		1		0.615		1		0.787		1	
F (all instruments)	72000000	***	72000000	***	725	***	63000000	***	8943	***	91000000	***
F (excluded variables)	250000000	***	170000000	***	1667	***	170000000	***	21331	***	180000000	***
Pagan-Hall heteroskedasticity test	2.435		2.365				2.435		2.138		2.147	
Underidentification tests:												
Anderson	69908.36	***	5314.29	***			69908.49	***	8943.13	***	70712.29	***
Cragg-Donald	1000000000	***	8705.05	***			10000000000	***	21331.36	***	1200000000	***
Test of overidentifying restrictions												
Sargan N*R-sq test	0.941		0.94				0.957		0.925		12.623	***
Endogenous regressors	HICI		HICI		HICI				Tax distance		Tax distance	
			HICI_neighbors									
IV	domestic		all		All				domestic		All	

*Notes: popularity specified as the local win margin. Significance levels: *10%, **5%,***1%.*

Table A.5. Vote popularity function, first stage regression

	Model 1-IV		Model 2-IV				Model 3-IV		Model 4-IV		Model 5-IV	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Dep. Var.: share of votes	*Δ HICI*		*Δ HICI*		*Δ HICI_neigbors*		*Δ HICI*		*Δ tax distance*		*Δ tax distance*	
Δ popularity lag	0.001		0.001		-0.001		0.001		0.002		0.001	
Δ rerun	-0.0001		-0.0001		-0.0005		-0.0001		0.003	***	-0.0001	
Δ alignment	0.001		0.001		-0.007	***	0.001		0.007	***	0.001	
Δ HICI_neighbors	0.012						0.015					
Δ unemployment	0.001		0.001		-0.007	***	0.001		0.009	***	0.001	
Δ domestic tax setting equation fitted	1.002	***	1.003	***	0.075	***	1.002	***	0.944	***	1.002	***
Δ domestic tax setting equation residuals	0.998	***	0.998	***	0.002		0.998	***	0.944	***	0.998	***
Δ neighbors tax setting equation fitted			0.008		0.801	***	-0.004				-0.985	***
Δ neighbors tax setting equation residuals											-0.989	***
Constant	-0.001		-0.001		0.013	***	-0.001		-0.004	***	-0.001	
Obs	6355		6355		6355		6355		6355		6355	
R^2	0.914		0.914		0.630		0.914		0.729		0.930	
F (all instruments)	5600000	***	7000000	***	783	***	4800000	***	2832	***	5000000	***
F (excluded variables)	19000000	***	1600000	***	1812	***	12000000	***	8484	***	9500000	***
Pagan-Hall heteroskedasticity test	12.949	***	12.093	***			12.951	***	11.641	***	10.079	***
Underidentification tests:												
Anderson	15486.68	***	5918.51	***			15486.76	***	8292.59	***	16278.80	***
Cragg-Donald	6632.56	***	9773.02	***			66333.48	***	17077.75	***	75981.02	***
Test of overidentifying restrictions												
Sargan N*R-sq test	0.394		0.393				0.466		0.371		12.881	***
Endogenous regressor	HICI		HICI HICI_neighbors				HICI		tax distance		tax distance	
IV	domestic		All				All		domestic		all	

*Notes: popularity specified as the winner's share of votes. Significance levels: *10%, **5%,***1%.*

Table A.6. Tax setting equation dataset, descriptive statistics, 66950 observations, 1995-2004

	Mean	Minimum	Maximum
Grants	118695.2	0	439000000
BICI	0.0056	0.004	0.007
HICI	0.00525	0.0035	0.007
GDP	18407.8	6964.22	35865.3
Population	7235.26	30	2653253
Depratio	0.540	0.002	17.634
Area	3388.813	10	130771
Left wing	0.286	0	1
Center wing	0.136	0	1
Right wing	0.205	0	1
Local list	0.373	0	1
Elec_year	0.208	0	1
Term limit	0.314	0	1
N_neighbors	5.832	1	30
Touristic	0.352	0	1
Union	0.045	0	1
North-west	0.446	0	1
North-east	0.138	0	1
Center	0.149	0	1
South	0.267	0	1
Provcap	0.013	0	1
Coast	0.065	0	1
DSP	0.317	0	1

Table A.7. Correlation among the explanatory variables, tax setting equation

	BICI lag	Grants	Area	pop	depratio	Tur	GDP	Left wing	Right wing	Local list	Elec	DSP	Term limit	Union	N_neigh	Provcap	Coast
BICI lag	1																
Grants	-0.03	1															
Area	0.07	-0.28	1														
Pop	0.08	-0.12	0.39	1													
Depratio	0.02	-0.20	0.19	-0.44	1												
Tur	0.10	-0.13	0.41	0.11	0.13	1											
GDP	0.18	0.24	-0.15	-0.03	-0.14	-0.16	1										
Left wing	-0.02	-0.11	0.18	0.23	-0.04	0.06	-0.15	1									
Right wing	0.09	-0.01	0.05	0.16	-0.04	0.04	0.08	-0.32	1								
Local list	0.03	0.10	-0.13	-0.27	0.08	-0.07	0.19	-0.49	-0.39	1							
Elec	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.06	-0.10	0.00	1						
DSP	0.19	-0.07	0.11	0.30	-0.09	0.05	0.10	0.01	0.05	0.06	-0.10	1					
Term limit	0.14	0.00	-0.03	-0.03	0.04	-0.02	0.15	-0.03	-0.03	0.15	-0.02	0.26	1				
Union	0.09	-0.01	-0.08	-0.07	0.06	-0.06	0.09	-0.08	0.06	0.08	0.01	-0.03	0.06	1			
N_neigh	0.06	0.00	0.42	0.30	0.01	0.12	0.04	0.05	0.04	-0.05	0.00	0.08	-0.01	-0.03	1		
Provcap	0.05	-0.03	0.21	0.32	-0.04	0.12	-0.01	0.06	0.05	-0.07	0.00	0.07	0.00	-0.02	0.30	1	
Coast	0.12	-0.16	0.12	0.25	-0.05	0.34	-0.21	0.06	0.07	-0.10	0.01	0.08	-0.01	-0.02	-0.15	0.12	1

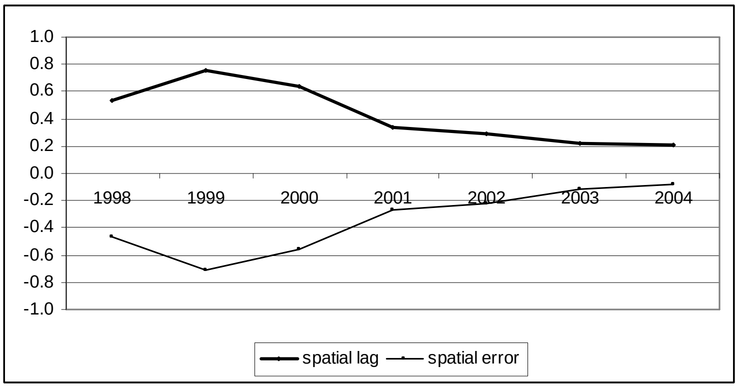
Table A.8. Spatial correlation tests: Moran I

	Contiguity spatial weights matrix										Distance spatial weight matrix							
	Based on raw HICI																	
	Italy		North West		North East		Centre		South		North West		North East		Centre		South	
1995	0.199	***	0.178	***	0.244	***	0.158	***	0.159	***	0.194	***	0.255	***	0.132	***	0.155	***
1996	0.19	***	0.179	***	0.261	***	0.146	***	0.162	***	0.187	***	0.280	***	0.132	***	0.161	***
1997	0.179	***	0.173	***	0.282	***	0.176	***	0.145	***	0.181	***	0.303	***	0.156	***	0.148	***
1998	0.187	***	0.178	***	0.303	***	0.205	***	0.139	***	0.184	***	0.331	***	0.199	***	0.149	***
1999	0.190	***	0.19	***	0.322	***	0.226	***	0.121	***	0.196	***	0.350	***	0.212	***	0.134	***
2000	0.194	***	0.2	***	0.315	***	0.232	***	0.105	***	0.202	***	0.340	***	0.218	***	0.116	***
2001	0.209	***	0.216	***	0.334	***	0.228	***	0.122	***	0.214	***	0.357	***	0.207	***	0.122	***
2002	0.214	***	0.216	***	0.368	***	0.232	***	0.123	***	0.219	***	0.369	***	0.216	***	0.130	***
2003	0.216	***	0.225	***	0.396	***	0.212	***	0.117	***	0.232	***	0.393	***	0.198	***	0.126	***
2004	0.223	***	0.234	***	0.398	***	0.177	***	0.142	***	0.240	***	0.391	***	0.171	***	0.144	***
	Based on residual from OLS HICI equation																	
	Italy		North West		North East		Centre		South		North West		North East		Centre		South	
1996	0.122	***	0.089	***	0.146	***	0.066	***	0.139	***	0.085	***	0.157	***	0.054	***	0.144	***
1997	0.106	***	0.095	***	0.184	***	0.131	***	0.081	***	0.106	***	0.189	***	0.112	***	0.092	***
1998	0.121	***	0.108	***	0.200	***	0.133	***	0.088	***	0.121	***	0.201	***	0.140	***	0.090	***
1999	0.129	***	0.135	***	0.218	***	0.165	***	0.065	***	0.142	***	0.212	***	0.151	***	0.068	***
2000	0.122	***	0.13	***	0.219	***	0.161	***	0.039	***	0.129	***	0.204	***	0.153	***	0.035	**
2001	0.146	***	0.154	***	0.251	***	0.157	***	0.068	***	0.154	***	0.233	***	0.146	***	0.063	***
2002	0.152	***	0.158	***	0.281	***	0.169	***	0.062	***	0.163	***	0.250	***	0.156	***	0.068	***
2003	0.163	***	0.168	***	0.318	***	0.173	***	0.064	***	0.178	***	0.288	***	0.154	***	0.068	***
2004	0.171	***	0.173	***	0.304	***	0.165	***	0.094	***	0.183	***	0.275	***	0.153	***	0.085	***

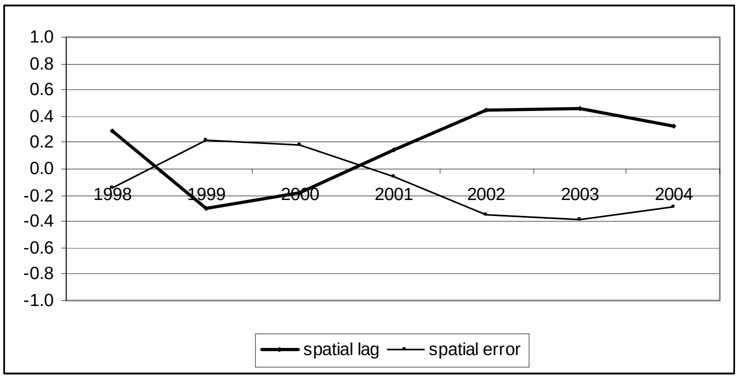
*Note: OLS regression includes as covariates: lagged Business Tax Rate, Grants, Area, Pop, Depratio, Tur, GDP, Left wing, Right wing, Local list, Elec, Term limit, Elec*term limit, Union, Dsp, N_neighbors, Provcap, Coast, Time dummies, macroarea dummies. Distance weight matrix computed with the 5knn criterion of neighborhood.*

Appendix A.9. The dynamics of the spatial correlations coefficients in time by Region

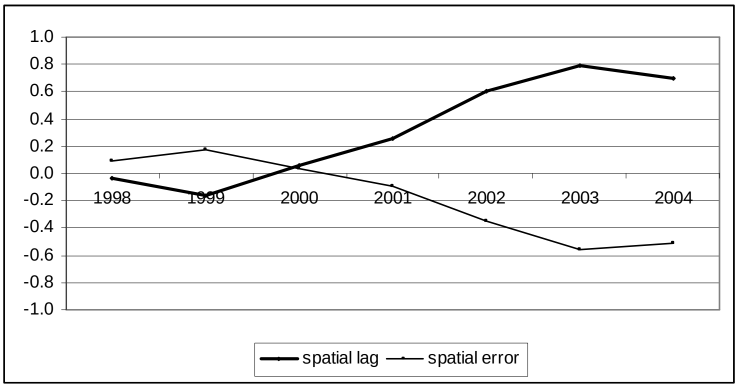
a. Piemonte



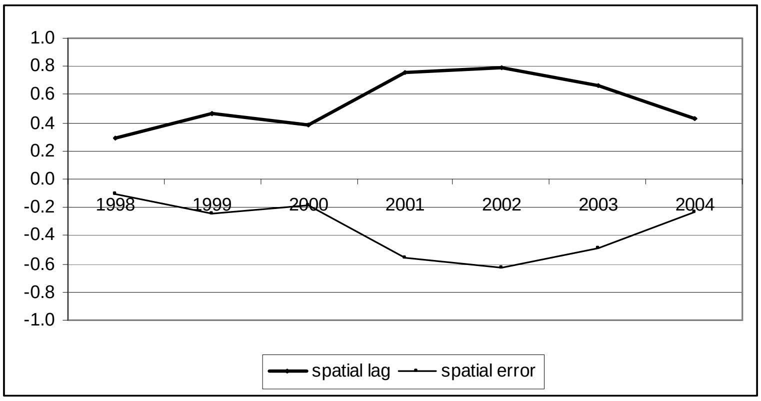
b. Lombardia



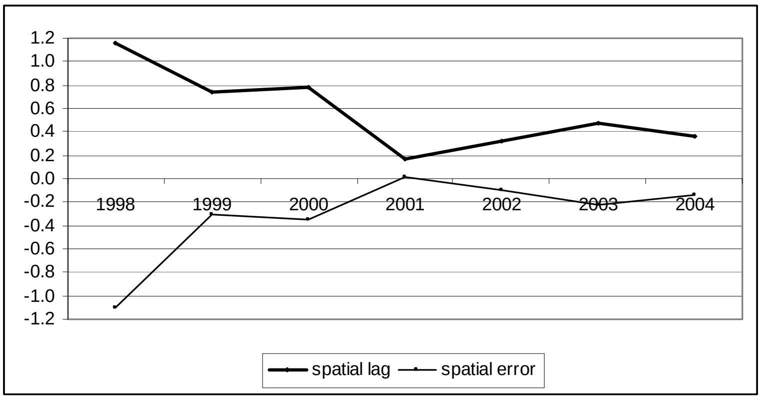
c. Veneto



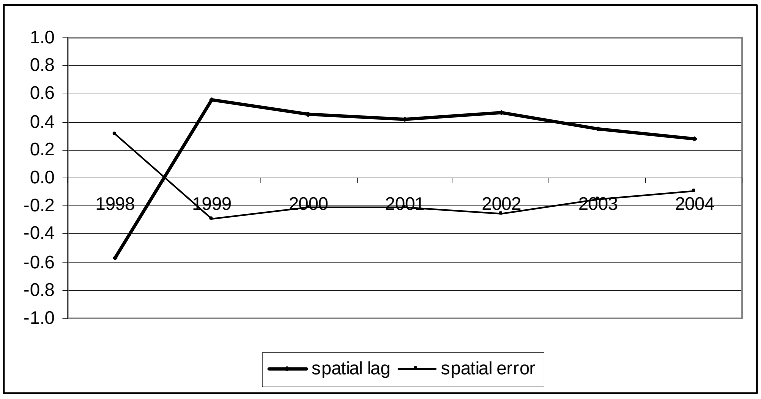
d. Liguria



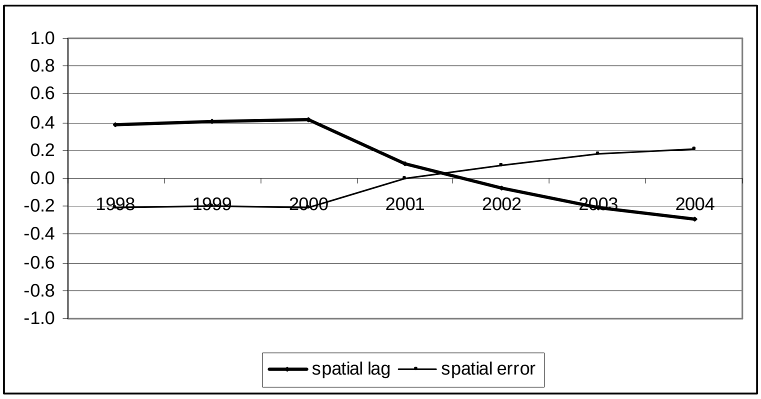
e. Emilia Romagna



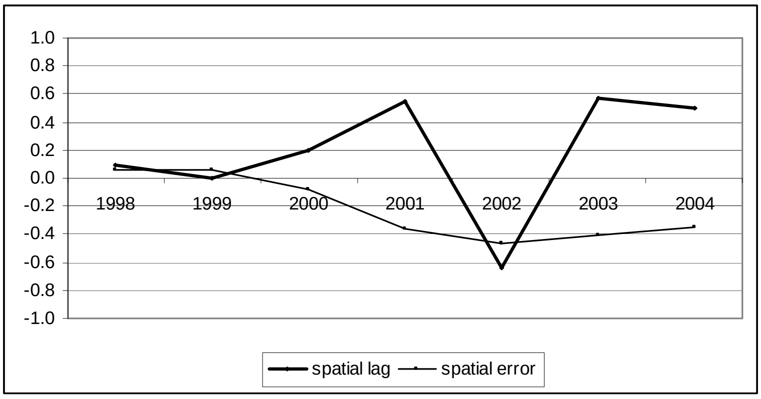
f. Toscana



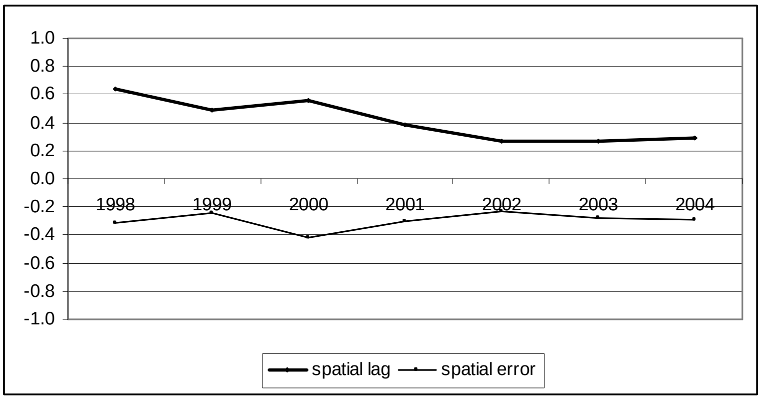
g. Marche



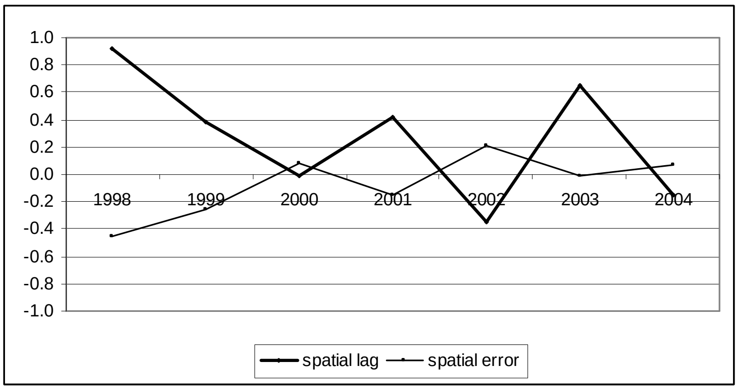
h. Lazio



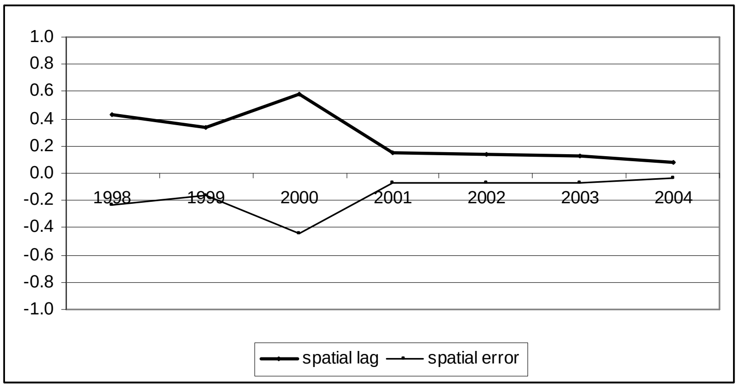
i. Abruzzo



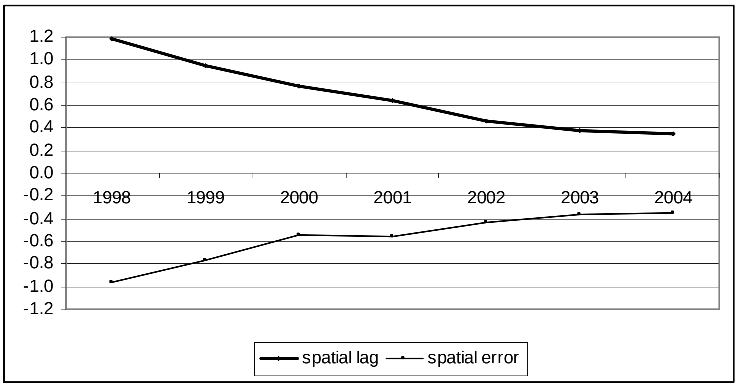
j. Molise



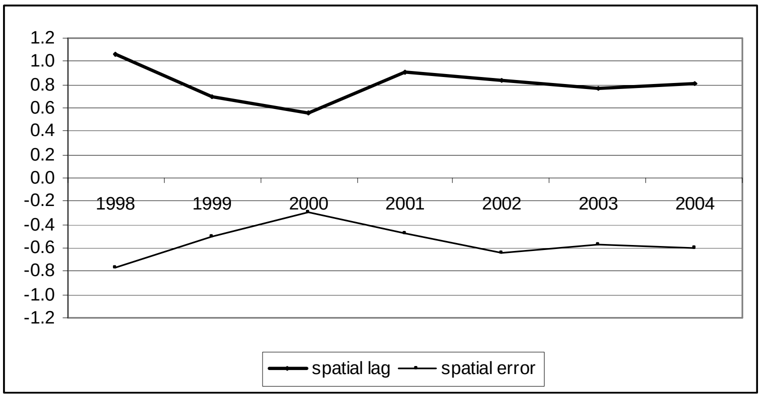
k. Campania



l. Puglia



m. Basilicata



n. Calabria

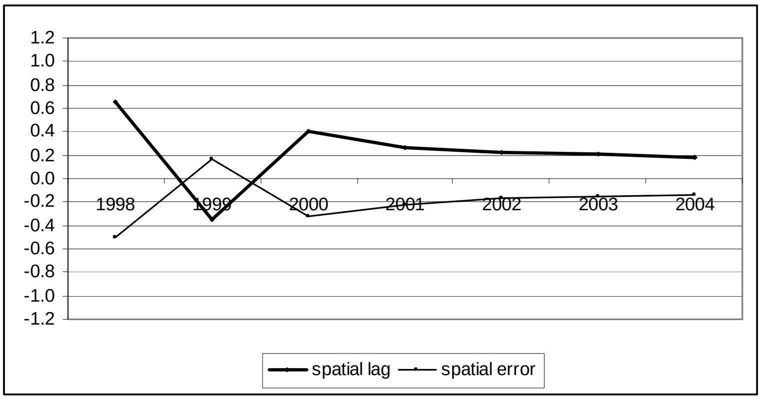


Table A.10 Classification of Regions number and density of municipalities and by the average number of neighbors per Municipality

	Number of municipalities			Density of municipalities			Average number of neighbors per Municipality	
1	Lombardia	1545	1	Lombardia	0.065	1	Basilicata	6.115
2	Piemonte	1206	2	Piemonte	0.047	2	Umbria	5.989
3	Veneto	581	3	Liguria	0.043	3	Emilia-Romagna	5.988
4	Campania	550	4	Campania	0.040	4	Molise	5.971
5	Calabria	409	5	Veneto	0.032	5	Piemonte	5.949
6	Lazio	376	6	Molise	0.031	6	Marche	5.947
7	Emilia-Romagna	341	7	Abruzzo	0.028	7	Abruzzo	5.944
8	Abruzzo	305	8	Calabria	0.027	8	Veneto	5.907
9	Toscana	285	9	Marche	0.026	9	Lazio	5.891
10	Puglia	257	10	Lazio	0.022	10	Lombardia	5.860
11	Marche	246	11	Emilia-Romagna	0.015	11	Toscana	5.811
12	Liguria	235	12	Puglia	0.013	12	Campania	5.685
13	Molise	136	13	Basilicata	0.013	13	Puglia	5.533
14	Basilicata	131	14	Toscana	0.012	14	Calabria	5.472
15	Umbria	92	15	Umbria	0.011	15	Liguria	5.336