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FROM TAXES TO POLITICS, FROM POLITICS TO TAXES: EVIDENCE OF YARDSTICK COMPETITION IN THE ITALIAN MUNICIPALITIES

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Abstract
Strategic interaction in local tax setting is motivated with yardstick competition only when the fiscal decision influences the incumbents' probability of being re-elected. Most of the previous analyses draw conclusions on yardstick competition without estimating this link or failing to find any empirical support for it.
This paper, on the contrary, conducts a comprehensive test of yardstick competition on Italian Municipalities during the period 1995-2004. First, a vote popularity function is estimated. The empirical findings verify the economic voting behavior and are robust to alternative empirical specifications of the dependent variable. Then, a spatial tax setting equation is estimated. The results show a pattern of mimicking driven by a positive spatial lag coefficient and a negative spatial error coefficient. Finally, the estimated spatial correlation coefficients in time are used to investigate the dynamics of strategic interaction. The results depict a quasi monotonic pattern of convergence of the coefficients towards the lowest levels of spatial interaction, suggesting that a progressive reduction of the mimicking behavior of the incumbents has taken place.

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 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

The study of strategic interactions in tax competition is a subject of great interest in the local public finance literature. Stemming from the contribution of Salmon (1987) and simultaneously to the industrial organization theories of learning from tax rates (Shleifer, 1985 and Benabou and Gertner, 1993), the political economics literature developed theoretical models of yardstick competition (Besley and Case, 1995a).

Yardstick competition is a type of strategic interaction driven by the electoral concerns of the incumbent. When voters update their electoral preferences with the information on the tax rates set in the domestic and in the nearby jurisdictions, the less competent incumbent is incentivized to set a tax rate similar to the tax rate of the neighbors to signal a good competence level to the voters and increase his probability of re-election.

The yardstick competition hypotheses has been tested on a variety of datasets and by means of different techniques, which confirmed that strategic interaction among neighboring jurisdictions is among the drivers of tax setting decisions during electoral years (for a comprehensive survey see Delgado et al., 2011).

This work contributes to this field of research by testing yardstick competition on a dataset of Italian Municipalities during the period 1995-2004. The time dimension allows us to relax the assumption that a long-run equilibrium has been already reached by all the observations and controls for transitory departures from the equilibrium path.

The innovations introduced in the analyses include a comprehensive test of both electoral concerns and strategic interactions, and an investigation of the dynamics of interaction in time.

First, the correlation between the popularity of the mayor and his main fiscal decision is estimated. Electoral concerns are modeled through the introduction on the right hand side of the equation the domestic tax rate, the spatial lag of the tax rate, and a new variable representing the tax distance between the domestic jurisdiction and its neighbors. This new variable improves the specification of the equation directly testing for fiscal performance comparisons.

Then, a tax setting equation has been estimated including both the spatial lag and the spatial error coefficient, allowing us to distinguish between the two sources of spatial interaction. Some controls have been included in addition to the usual covariates present in the literature, isolating the sources of asymmetric information (incumbents' competence and cost shock) in the error term.

Finally, the longitudinal dimension of the dataset has been exploited for an investigation of the dynamics of interactions in time. Since yardstick competition is a informational spillover, the asymmetric information generating incentives for mimicking may be solved in time or it may be exacerbated by voters' myopia and irrationality. This approach is new in the yardstick competition literature, but it is a necessary supplement to the analyses. The average panel correlation that previous studies estimated, in fact, is a poor indicator of interaction when using panel datasets because it leaves too much information aside and disregards the variation of the phenomenon in time, with the risk of giving erroneous policy advices.

The results find significant strategic interaction of the local house property tax rate, supported by electoral concerns of the incumbent. In particular, the spatial error correlation is negative and the spatial lag correlation is positive, suggesting mimicking as the main determinant of the interaction. The spatial correlation coefficients estimated on consequent time subsamples of the panel dataset converge towards the lowest level of correlation. This evidence, new in the yardstick competition literature, describes a decrease in time f the probability of pooling equilibrium.
The rest of the paper is organized as follows. Section 2 reviews the economic literature on yardstick competition. Section 3 introduces the empirical analyses by describing the methodology adopted and the dataset used. The estimation results of the tax setting and of the vote popularity function equation are presented respectively in Section 4 and Section 5. Finally, section 6 concludes.

2. Economic literature on yardstick competition

Yardstick competition has been proposed in the literature as a solution to the agency problem arising from asymmetric information between voters and incumbents regarding the cost of public provision of goods and services (Besley and Case, 1995). When the cost shock is spatially correlated, voters compare the observed fiscal performance in their jurisdiction with the one in the neighborhood. The decision to re-elect the incumbent depends on the outcome of this comparison, and the fiscal decision of the incumbent in jurisdiction *i* represents the best reaction to the strategy played in *–i*. Formally, the incumbent maximizes an objective function dependent on the -*i*'s decision (Brueckner, 2003).
The yardstick competition model, however, proves the existence of a pooling equilibrium in tax rates. There is in fact a range of values of the cost shock such that the bad incumbent has an incentive to reduce the amount of his rent seeking activity to signal good competence to the voters. Bordignon et al. (2003) solved the signaling problem of yardstick competition and derived formal conditions for the successful mimicking to occur. Under those conditions the tax rate becomes an uninformative signal of competence and the agency problem is not solved. The appeal of the existing yardstick competition models, consequently, is not in the solution of asymmetric information, but in the efficiency in constraining to the rent of the bad incumbent during electoral year. This advantage, however, is limited to the electoral year only when yardstick competition is at work, leaving a bad incumbent free to increase his ego rent during the subsequent years of office.
The empirical literature on yardstick competition tested the prediction of a pooling equilibrium in tax rates in Us, Switzerland, France, Spain, Netherlands, Belgium, Norway, Sweden and Italy. Most of the empirical results, however, mix yardstick competition with tax competition. Both the phenomenon lead to a decrease of tax rates, but there are two main differences. First, when the tax base is mobile voters may simply move it and eventually 'vote with the feet' (Tiebout, 1956). On the contrary, when the tax base is immobile (as an example the home tax rate), voters are left only with the 'voice' option and the link between economic decisions and voting decision is stronger. Some of

the existing empirical analyses, however, consider a mobile tax base as the income tax rate or the business tax rate (Bordignon at al. (2003), Padovano (2004), Ermini and Santolini (2007), Case and Rosen (1992), Dubois et al. (2007), Buttner (2001), Depalo and Messina (2001)).

Then, yardstick competition, with respect to tax competition, is motivated by popularity concerns of the incumbent and occurs only before elections when the inter-jurisdictional comparison is tough and the reaction of the incumbent to the decision of the neighbors is quick and more significant. Early empirical analyses disregarded the existence of a link of responsibility between the local government and the voters. This link is a necessary prerequisite of yardstick competition since if voters hold the government responsible for fiscal decisions, their electoral preferences are affected by his the tax rate level. In the yardstick competition framework, the Responsibility Hypotheses (Lewis-Beck and Paldam, 2000) represents the incentive of the bad incumbent to mimic, and it necessarily need to hold to classify strategic interaction as yardstick competition. Nonetheless, only in the last decade scholars estimated vote popularity equations (VPE) describing the electoral outcome as dependent on economic decisions. Vermeir and Heyndels (2006) Bosch and Solé-Ollé (2007) and Dubois and Paty (2010) find significant electoral concerns of the incumbent, while Bordignon et al. (2003) does not find evidence of a link of responsibility. The proxy for the electoral popularity is the same for all the analyses, the share of votes obtained by the incumbent. The same share of votes, however, can be obtained with different win margin levels, therefore the confidence in re-election of the incumbent is misspecified and possible not robust to alternative measures of popularity.

The empirical tests found that the electoral 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 (Solè Ollè, 2008), when the degree of local fiscal autonomy and electoral accountability is not higher than a fixed threshold (Schaltegger and Küttel, 2002).

An important difference to stress among all the empirical studies refers to the time dimension exploited. Some of the most well-known analyses make use of cross-sectional data (Bordignon et al., 2003; Allers and Elhorts 2005; Dubois et al.; 2007, Fiva and Rattso, 2007), taking for granted a set of equilibrium conditions which may not hold and invalidate the robustness of the results. In fact, a variety of factors might tend to the long-run equilibrium and cause a transitory one-year variation in the tax rate without altering the incentive of the bad incumbent to behave strategically. The panel datasets allows to relax these assumptions and control for unit specific effects. Although nowadays there are many test of yardstick competition based panel datasets, it is interesting to note that any of them has attempted to draw the dynamics of interactions in time, confining themselves to the estimation of the average interaction in time. Of course, as the time dimension increases interactions may vary their magnitude and/or their direction, making the results less informative and policy advices less significant.

The size of the datasets is an interesting variable as well, since the scholars sometimes used samples of sub-national jurisdiction almost discretionally chosen (Bordignon et al., 2003 use 143 Municipalities around Milan; Ermini and Santolini, 2007 use the Marche

Region in Italy; Solè Ollè, 2003 uses Spanish municipalities with a population greater than 5000 inhabitants in the region surrounding Barcelona; and so on). Being yardstick competition a spatial phenomenon, the borders of the subsample may undermine the validity of the results.

Finally, the empirical literature on yardstick competition is heterogeneous with respect to the econometric methods implemented. The spatial lag of the dependent variable introduces endogeneity in the tax setting equation and makes the OLS estimators biased and inconsistent, and the obtained estimate is inefficient. Stemming from 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 introduced a spatially lagged dependent variable and the spatial correlation of the errors, both weighted by a matrix describing the neighborhood network among the observations. The weight matrix usually refers to geographical nearness, but it can be applied to any type of distance as the socio-economic or the demographic distance. 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).

3. An empirical test of strategic interaction: methodology and data

A complete test of yardstick competition must detect strategic interaction in local tax setting once political consequences of tax setting have already been confirmed. With this purpose in mind, the present analyses follows three steps:

1. estimates a vote popularity function to test the Responsibility hypotheses;
2. estimates a local tax setting equation to analyze the determinants of tax decisions and the presence of strategic interaction in the data;
3. analyses the direction and the strength of spatial interactions in time to infer a pattern of yardstick competition.

This work exploits an original database including all the 8101 Italian Municipalities. The database is the outcome of a research project on 'Tax Competition among Italian Municipalities' (Padovano, 2007), which aimed at collecting a comprehensive database of local jurisdictions in Italy. This database is an essential tool because the format of the variables has been harmonized and they are directly comparable; the original data, coming from different institutional sources, are highly heterogeneous (for example, the Italian Ministry of Interiors and the National Statistic Institute use different numerical codifications for the Municipalities).

The dataset covers the years from 1995 to 2004. The choice of the time period is conditioned by some factors. In fact, at the moment of the estimations economic variables after 2005 and many electoral data before 1994 were still missing due to unavailability of the information. Moreover, the dependent variable was introduced in 1995.

Municipalities that belong to the five special regions (‘*Regioni a Statuto Speciale*’) do not show a suitable degree of homogeneity with the other 15 Regions because of their different institutional and fiscal setting. In order to avoid comparing incomparable observation they have been excluded from the estimations. For the accuracy of the analyses seven municipalities without any link (single-municipality islands and one *enclave*) have been removed from the estimations. However, running the regressions with their inclusion does not affect the results.

The total number of final observations is 6695, a share of 83% of the total Italian Municipalities. The dataset includes several categories of variables grouped as fiscal, economic, geo-demographic, political and institutional variables.

The choice of the dataset moves from the consideration that Italian Municipalities represent a suitable environment for a test of yardstick competition. Municipalities are the lowest tier of local government in Italy, and the institutional reforms in the 90s established a strong link of accountability between voters and local governments by both decentralizing local tax revenues and introducing the direct election of the Mayor.

Fiscal decentralization has been implemented in the Municipalities mainly through the introduction in 1993 of the local property tax rate (*ICI*, *Imposta comunale sugli Immobili*) showing a high degree of autonomy, specifically a level *b* in the OECD tax autonomy scale ranging from *a* to *e* (OECD, 1999)[2]. The previous setting was characterized by a lower degree of tax autonomy, level *e*, being the tax rate and the tax base both set by the central government. Each jurisdiction is free to choose the tax rate in range between the 4‰ and the 7‰. Although the tax interval is small, a marginal variation of the tax rate determines a consistent variation in the per capita tax paid by the citizen and in the overall tax revenue. Since the tax base is fixed and property value reassessment are nationally implemented, the discretion of the mayor is reduced to one single dimension, making it easier for voters to include this information in their electoral preferences. ICI tax revenue is more than 50% of total municipality revenue and more than 25% of local expenditure (ANCI).

In 1995 it has been introduced the possibility to differentiate the ICI tax rate between the ‘business’ tax rate applied to holiday houses, offices, shops, and so on, and the ‘house’ tax rate applied to the main living property. The house ICI tax rate accounted around 7% of total ICI tax revenue, and it has been abolished in 2008 (Legge 24 luglio 2008, n. 126). In the period 1993-2007 the ICI house tax rate represented the more 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 residents in Italy are home-owner (ISTAT)[3]. As a consequence, the ICI tax rate can be considered a relevant indicator of the jurisdictional performance used in local comparisons.

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[2] The prerequisite of the tax is property in the shape of buildings, building land, agricultural land located inside the Municipality area, regardless of their destination use. The tax base is the value of the property, set by national laws and procedure, homogeneously determined among jurisdictions. ICI tax rate is set with a Municipal Council resolution before the yearly provisional budget resolution.

[3] 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.

The following figures illustrate the dynamics of the house ICI tax rate during the period 1995-2004. Table 1 reports the descriptive statistics for the house ICI tax rate in the period 1995-2004. The average tax rate is 5.2‰, being the highest average tax rates in the central area 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[4].

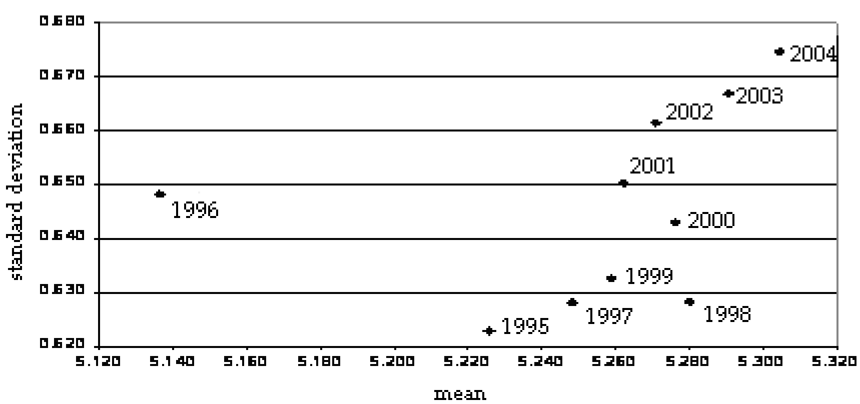
Table 1. Descriptive statistics, house ICI tax rate 1995-2004

	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.

When analyzing the house ICI tax rate dynamics in time, Table 2 shows an increasing but not monotonic trend in time characterized by decreasing averages in 1999 and in 2001. The maximum average value is reached in 2004, which is associated with the highest standard deviation. Graph 1 shows a positive mean-standard deviation relationship, evidence of the tendency to homogeneity during the years in which the tax rate is lower and an the tendency to an increase in the volatility during the years in which the tax rate is higher.

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



[4] In the north-west and the south there are some Municipalities setting a tax rate lower than the legal minimum, applying special law provisions. These observations are only 16 (0.002% of the total dataset), referring to 7 Municipalities of the dataset. Their exclusion does not alter the results of the analyses, and being the decision to apply a very low tax rate a policy decision as well, the inspiration of this work suggests to include them in the analyses.

There is an anomaly in 1995, motivated with the early introduction of the tax rate and it reflects the lack of coordination of the mayors when choosing the initial value: the mean is lower than in other years but the volatility among the Municipalities is not.
When analyzing the ICI tax rate dynamics in time, Table 2 shows an increasing but not monotonic trend in time characterized by decreasing averages in 1999 and in 2001. The maximum average value is reached in 2004, which is associated with the highest standard deviation.

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

Since mimicking is driven by popularity concerns, it is interesting to match the fiscal data with the electoral facts.
Regarding the institutional setting, the Italian local electoral rule has been reformed in 1993 from proportional to majoritarian, aiming at increasing the government's accountability and his responsiveness to citizens. Since 1993 the mayor is directly elected by the citizens according to the plurality rule in Municipalities with less than 15000 inhabitants (less than 10% of the total number of Municipalities) and according to the majority rule with runoff elections in the other Municipalities. The local legislature lasts five years and the term limit is fixed to two terms. In case of motion of no confidence both the mayor and the council must resign and new elections are held. Because of the early fall of many executives in the past, Italian Municipalities hold elections in different years. Table 3 shows a concentration of local elections in 1995, 1999 and 2004. In the following these three years are called 'first order electoral years', while 1997 and 2001 are called 'second order electoral years'.

Table 3. Number of local elections by year

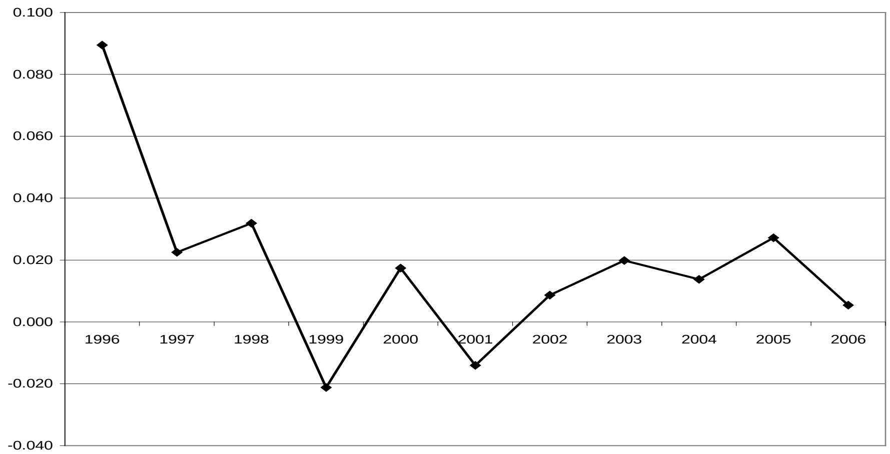
	Observations	*% Electoral obs.*
1995	4667	69.7
1996	246	3.7
1997	1243	18.6
1998	535	8.0
1999	4308	64.3
2000	315	4.7
2001	1062	15.9
2002	680	10.2
2003	300	4.5
2004	4054	60.5

Following the 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 also, which is a 'second order' electoral year, and although in 1997 the variation is positive its magnitude is less than half than in 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.

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

A. Absolute values

B. First differences



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

The expenditure of the Municipalities finances goods and services for the local community, mainly administrative costs, public transportation, services for the youngsters and the elderly, police. In 1999 the budget design has been constrained by the introduction of the Domestic Stability Pact, which reduced local expenditure (see Bartolini and Santolini, 2009). Local tax rates and local expenditures levels are set simultaneously and the introduction of the local expenditure in the tax setting equation obviously creates an endogeneity problem.

According to the yardstick competition model, the amount of expenditure that finances the rent-seeking activity of the bad incumbent decreases during electoral years. The quality of the public expenditure cannot be empirically determined and the model assumes homogeneous public provision. Including the total local expenditure as an explanatory generates endogeneity in the estimates because the 'excessive' share of expenditure cannot be disentangled from the 'responsive' share of the expenditure, and expenditure would be correlated with the error term.

As a technical point, data on the local budget sheets are not available before 1999 and the differences in observed expenditure levels are mainly driven by differences in the amount of grants per capita received (correlation = 0.71), which is an explanatory variable included in the empirical specification of this work.

4. The vote popularity equation

The VPE estimated in this work takes the form:

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

The dependent variable P_{it} represents the electoral popularity of the mayor measured as the share of votes obtained by the winner 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 in time (Paldam and Nannestad, 1994). Since we deal with a panel dataset, in what follows the difference specification is applied to control for the unobserved heterogeneity. The robustness of the results is tested in a subsequent set of regressions using the local win margin 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*) is introduced in the empirical specification to test the fit of the 'cost of ruling' hypotheses (Paldam and Nannestad, 1994) and the 'incumbency advantage' (Lowry, 1998). An incumbent running for a second term has in fact an advantage in terms of efficiency in office, but he may experience an erosion of the electoral popularity in case of unpopular decisions taken during the first term of office that lead voters to prefer a challenger to the incumbent. Consequent to this contrasting hypothesis, 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 alignment of the local executive with the central government partnership (*alignment*) is included to control for the 'alignment effect'.

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 the reverse causality between the policy decisions and the 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 a instrumental variable estimation. Revelli (2002) proposed an alternative solution by estimating a 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. (2008) in which a comprehensive analyses is conducted through a system of two simultaneous equations, a local expenditure and a VPE, estimated through GMM.

The structure of the electoral dataset used does not allow to calculate a sufficient number of lags for all the units, therefore the endogeneity problem has been tackled by a 2SLS regression. 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 as the combination of the cost shock and the competency level, which are reasonably uncorrelated with the popularity since the cost shock is random and the competency level is specific to the incumbent.

The yardstick competition hypotheses assumes that popularity is affected by the neighboring tax rate (*HICI_neighbors*). This variable is the spatial lag of the house tax rates, and a positive coefficient has been associated in the literature as evidence of the performance comparison. In fact, *ceteris paribus*, an increase in the tax rate of the neighbors is assumed 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 Solè-Ollè, 2008). In the empirical analyses the fitted values and the residuals of a neighboring tax setting equation are used as instruments for it.

Finally, this work introduces a new variable, the distance from the tax rate in the neighbors (*tax distance*). The tax distance has been estimated as the difference between the house tax rate in the domestic jurisdiction and the average house tax rate in the neighborhood. The expected sign of this coefficient is negative because the higher the domestic house tax rate with respect to the neighbors, the higher the tax distance, 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.1 in the Appendix shows the descriptive statistics of the explanatory variables and table A.2 reports the correlation matrix of the explanatory variables; the pairwise correlation of the covariates is never too large, ruling out collinearity issues.

Table 4. Vote popularity equation, expected signs of the coefficients

Variable	*Definition*	*Expected sign*
Popularity lag	Lagged share of votes (ln)	?
Rerun	Incumbent running for re-election dummy	?
Alignment	Alignment with central government dummy	+
Unemployment	Provincial unemployment rate (ln)	-
HICI	Domestic house ICI tax rate (ln)	-
HICI_neighbors	Spatial lag of house ICI tax rate (ln)	+
Tax distance	Difference between domestic house tax rate and neighbors' house tax rate	+

4.1 Vote popularity estimation: the results

Table 5 shows the results of the first stage regression. 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 only the domestic tax rate as endogenous, but in Model 1 the domestic tax rate is instrumented with the domestic fitted and residuals, while in Model 3 it is instrumented with both the domestic and the neighbors fitted and residuals. 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 distance variable, instrumented respectively with only domestic instruments and all the available instruments. The tax distance variable detects yardstick competition in a more precise fashion. In fact, in a yardstick competition framework voters consider the relative fiscal performance of their incumbent as the distance from the neighbor's tax rate. In such a situation an increase of the spatial lag of the tax rate does not increase the domestic incumbents' popularity if the domestic tax rate is still above the average in the neighborhood.

The results from the first stage regression show a good 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. 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 to use the GMM efficient option of the IV estimation.

Table 5. Vote popularity function, first stage regression

	Model 1		Model 2				Model 3		Model 4		Model 5	
	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Dep-Var.	*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 6 presents the results of the second stage regression. The Hansen J statistic confirms the results from the Sargan test in the first stage regressions. In fact, Model 5 is over-identified.

The fit of the models is about 0.24, and the coefficients of the non fiscal variables are stable over the models and verify the theoretical predictions. A negative shock to the popularity of the incumbent is observed, as the negative coefficient of the lagged share of votes suggests. Moreover, the evidence is in favor of 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. The unemployment rate is negative as expected but it is never statistically significant.

Modes 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 in Model 1 and Model 3. Since the identification of Model 5 has been rejected by the over-identification tests, the comments focus of Model 4. The coefficient associated to the tax distance is negative and significant as expected, suggesting that a marginal increase in the tax distance generates a 9.5% decrease in the popularity of the incumbent.

Table 6. Vote popularity function, second stage regression

	Model 1		Model 2		Model 3		Model 4		Model 5	
	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 regressor	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%.*

The robustness of the presented results has been checked by estimating a second set of VPE using as dependent variable the local win margin (*wm*). The local win margin is computed as the difference between the share of votes obtained by the winner and the share of votes obtained by his first opponent, and it is considered a stronger measure of popularity than the share of votes obtained by the mayor. In fact, the larger the win margin the higher the electoral support and the confidence in re-election of the incumbent.

Table 7 presents the results of the robustness check.

The results from the first stage regression mirror the results obtained with the previous definition of popularity. The R^2 show very high fit of the models, always above 0.7 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. Table 8 presents the results of the second stage regression.

Table 7. Vote popularity function, robustness check, first stage regression

	Model 1		Model 2				Model 3		Model 4		Model 5	
	Coef.	p	Coef.	P	Coef.	p	Coef.	p	Coef.	p	Coef.	p
Dep-Var.	*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		-0.000010		-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		0.790	***	0.000				-1.000	***
Δ neighbors tax setting equation residuals											-1.000	***
Constant	0.000	***	-0.00001	***	0.014	***	-0.00001	***	-0.004	***	-0.00001	***
Obs	5793		5793		5793		5793		5793		5793	
R^2	1.000		1.000		0.615		1.000		0.787		1.000	
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		0.940				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%.*

The results are very similar to the results of Table 6, both in terms of test significance and the signs of the coefficients obtained. However, the fit of the models decreases to about 0.14, and the unemployment variable gains significance.

The spatial lag of the tax rate is still negative and shows a coefficient almost double than the domestic tax rate coefficient, suggesting an over-reaction of the popularity to the neighbors' fiscal decisions. This result is difficult to interpret and it is completely at odds with the theoretical prediction. On the contrary, when the tax distance is introduced in Model 4, the coefficient is negative and significant as expected, suggesting that a marginal increase in the distance generates a 54.9% decrease in the local win margin.

As a general conclusion to the VPE estimation, the predictions are verified and the findings show the expected correlation between the electoral popularity and the fiscal decisions of the mayor.

In particular, voters' electoral preferences are affected by the comparison of the performances and not simply by the levels of the tax rates. An increase of the domestic tax rate significantly reduces the popularity of the incumbent, but an increase in the spatial lag of the tax rate does not increase the popularity of the domestic incumbent, because the domestic tax rate may still be above the average level in the neighborhood.

Table 8. Vote popularity function, robustness check, second stage regression

	Model 1		Model 2		Model 3		Model 4		Model 5	
	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	70000.000	***	5314	***	70000	***	8943	***	71000	***
Overidentification test of all instruments										
Hansen J statistic	0.901		0.901		0.913		0.924		9.445	**
Endogenous regressor	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%.*

5. The tax setting equation

The spatial estimation follows the linear regression panel data model of Kapoor, Kelejian and Prucha (2007).

Each observation i=1,…,N is observed for t=1,…,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 1973, 1981):

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

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-ρW_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 the cross-sectional units and time periods. By assumption the error components are independent and identically distributed with mean zero and constant variance and they are independent to each other.

In the proposed methodology estimates 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 model, but the same procedure has been applied to fixed effects 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 has been introduced to test for the significance of the spatial lag source of correlation.

Neighborhood is here specified as geographical closeness: the matrix of contiguity defines two jurisdictions as neighbors if they share at least one border. This specification is motivated by the fact that it is easier to share information with near jurisdictions than further ones. For example, the spread of news through local social networks as families, workers commuting in the region, political groups, and action of the local press stimulate an intense but short-range information spillover. Many other specifications of the weight matrix have been suggested by the literature to better identify the yardstick competitors, defining closeness based on income, population, or other socio-economic indicators. However, the results obtained by previous works (Bordignon et al., 2003; Solè Ollè, 2003) verify the universal suitability of the contiguity matrix and the relevance of other matrices specific to the tax rate analyzed. As a robustness check, a geographical distance weight matrix will be used in what follows.

The vector of covariates *Z* includes fiscal, socio-demographic, political and electoral variables.

Intergovernmental transfers are one of the main sources of local resources and represent a measure of resources available to the local government (about 45% of the available resources). An increase in the amount of the received per capita transfers from the central government (*grants*) may be followed by a tax reduction or 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 a priori, therefore there is no prior on the sign of this coefficient. This variable measures nominal values of transfers coming from the five funds created with D.Lgs.504/92, divided into current and investment grants.

In 1999 a normative instrument was introduced in Italy to constrain the municipal budget deficit, the Domestic Stability Pact (*DSP*). The entry requirements are yearly modified on the basis of the population size, and the eligible Municipalities are forced to respect the guidelines of the Pact. The local budget constraints are expected to reduce the size of the local government (Bartolini and Santolini, 2009); as a consequence, the tax revenue needed to finance the expenditures decreases. Ceteris paribus, the correlation between the *DSP* dummy and the dependent variable is expected to be negative.

The citizen's ability to pay the tax is proxied by income per capita (*income*), and it is expected to be positively correlated with the dependent variable. Income refers to the provincial GDP *per capita* nominal income in millions of euro. 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 population size (*pop*) and the surface size of the jurisdiction (*area*)[5]. The composition of the population is a relevant issue in the analyzed tax setting decision because local governments are usually responsible for most of the services designed for youngsters and elderly people, as childcare and leisure centers. The variable representing this factor is the dependency ratio (*depratio*), the ratio between youngsters and elderly over adult population. These geo-demographic variables have been included among the covariates, although the predicted sign of their coefficients is ambiguous, since it depends on the extent to which they show economies of scale (negative sign) or not (positive sign).

A qualitative binary variable has been included to control for the demand for public provision coming from non resident population, the tourists (to*uristic*). Touristic area because of the presence of sea, mountain or artistic and cultural amenities in its territory. Touristic municipalities are 3123 (38% of the total). The predicted effect on the dependent variable is negative, because in many Italian touristic destinations the market for holiday houses may show a non elastic demand function. In such a case, although

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

the business tax rate is high the demand coming from outsiders increases and the mayor has an incentive to compensate the residents with lower house tax rates.

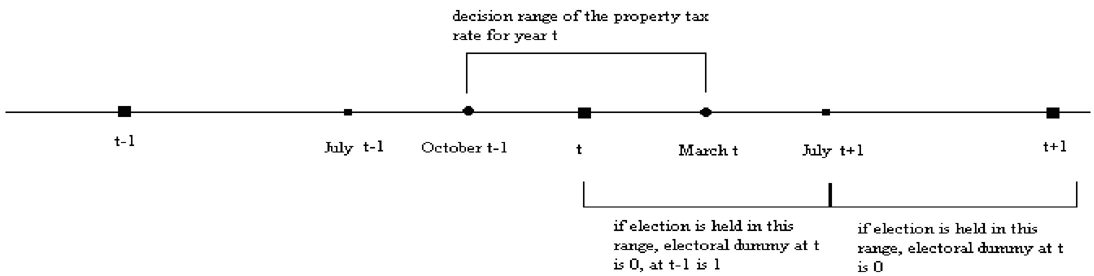
The provincial capital (*provcap*) dummy has been included to control for the effect of being a province capital jurisdiction. Provincial capital are usually richer than other cities, and although the correlation coefficient between this dummy and income per capita is very low and negative (-0.01), a positive sign is expected since they can, in principle, hinge on a larger tax base. The number of neighbors (*n_neighbors*) directly observes some interaction in fiscal decisions: the higher the number of neighbors, the higher the inter-jurisdictional information flow, the stronger the constraint on the tax rate setting for the incumbent. Following this reasoning, the expected sign of this coefficient is negative. Special attention is paid to the jurisdictions on the coast. First, many Municipalities border with the sea given Italy's geography. Then, the information flow may slow down in the coastal Municipalities because the sea is an useless neighbor in fiscal performance comparisons, 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 (negative coefficient) but they may collude reducing the variance of the tax rate in the neighborhood (positive coefficient).

Finally, the five macro-area dummies defined by ISTAT have been included to control for the regional heterogeneity due to geographical affiliation of the local governments and time dummies to control for the effect of yearly shocks to the level of the dependent variable. These dummies refer to the location of the municipality in one of the five macro-areas in which Italy is divided. They are named *north-west, north-east, center, south* and *islands*.

The electoral political cycle in tax setting is captured by the introduction of a binary variable, *elec_year*. The expected sign of the coefficient is negative because incumbents are expected to reduce tax rates when election is approaching (Rogoff, 1990). The electoral year dummy has been computed as a binary variable showing the presence of executive election in the selected municipality for the selected year. It is assumed that the year is an electoral one if the first ballot takes place in the last six months of the year or the first six months of the following year. In other words, value '1' signals that a local executive election has taken place between 01/07 and 31/12 of the current year, or between the 1/01 and 30/06 of the following year. This choice is motivated by the local budget approval process, which takes place at the very end of the year and may last until the first three months of the following year. This process may influence the citizen's beliefs in case they are called to vote in a early months of the year, and elections in the dataset range from April to November according to the individual electoral schedule. Of course, the election date is exogenously given and decided before the tax rate is chosen. Graph 3 depicts the timing of the fiscal decision.

Graph 3. Timing of election and local property tax rate decision



The electoral status of the mayor is a relevant factor in determining the tax setting because if the incumbent is term limited he will not find it worthwhile to behave strategically and mimic the good neighbor incumbent (Besley and Case, 1995; Bordignon et al., 2003). A dummy (*term limit*) taking value 1 if the mayor is elected for the second consecutive term is then introduced in the empirical specification and its predicted sign is positive. 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 term limited incumbents setting higher tax rates than non term limited incumbents, therefore the coefficient associated to the interaction term in positive.

Several dummies referred to the partisanship of the executive have been included in the equation to control for the effect of the ideological affiliation of the incumbent. Since the mayors belonging to left parties (*left wing*) are allegedly associated to a stronger preference for redistributive policies than their right parties colleagues (*right wing*), the coefficient of this variable is expected to be positive (Alesina and Rosenthal, 1995); vice versa, the coefficient for ideologically right mayors is expected to be negative. The local lists (*local list*) are ideologically neutral lists, usually running only in one Municipality. They usually focus their policy platforms on a single dimension such as the utmost importance of municipal issues or the support to the electoral program of a local charismatic leader. Previous studies either did not include this variable or applied questionable definitions, associating them with left wing parties or splitting them away the two coalitions leading to dubious specification of the variable. The relevance of the phenomenon in the dataset (37% of the observations in the panel dataset show a civic list executive) make it interesting to distinguish their behavior from the ideologically polarized local executives.

Table A.3 in the Appendix shows the descriptive statistics and table A.4 reports the correlation matrix of the explanatory variables; the pairwise correlation of the covariates is never too large, ruling out collinearity issues. Table 9 below presents the expected signs of the coefficients.

Table 9. Tax setting equation, expected signs of the coefficients

Variable	Definition	Expected sign
BICI lag	ICI business tax rate lagged one period	+
Grants	Transfers from the central government	?
Area	Surface area	?
Pop	Population	?
Depratio	Dependency ratio	?
Touristic	Touristic dummy	-
Income	Income per capita	+
Right wing	Partisanship of executive dummies	-
Left wing		+
Center wing		?
Local list		?
Elec_year	Electoral year dummy	-
Term limit	Term limit dummy	+
Elec_tl		
Union	Union dummy	?
DSP	Domestic Stability Pact dummy	-
N_neighbors	Number of neighbors	-
Provcap	Province capital dummy	+
Coast	Coast dummy	+

The OLS regression is the starting point of the analyses of the tax setting equation, although its results are biased and inconsistent because they do not take into account neither the spatial nor the time dimension of the dataset. However, OLS results give some preliminary insights about the characteristics of the data such as the presence of heteroskedasticity and the verification of the assumption of normality of the regression residuals.

5.2 Tax setting equation: results

The spatial correlation among the observed units is inherent in 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 neighboring jurisdictions. The presence of spatial correlation in the data is usually tested by means of the cross-sectional Moran test. This test is computed as a ratio adjusted for the spatial weights used. The numerator of the statistic is the product between the variable of interest and its spatial lag, and the denominator is the cross product of the variable of interest. The Moran I computed on the cross-sectional OLS residuals rejects the null of no spatial error correlation in each year.

As a robustness check, the Italian dataset has been splitted into macroareas and the Moran I has been computed on each macroarea. The smaller dimension of these dataset allow the implementation of a geographic distance matrix and check the robustness of the results on different geographical areas of the country[6]. Specifically, while the contiguity matrix considers all the bordering jurisdiction as neighbors, the distance

[6] The weight matrices have been built using the software *R, version .11*.

weight matrix used here considers only the 5 jurisdictions whose centre of settlement is closer to the considered Municipality[7].

The results from Table 10 suggest that the absence of spatial error correlation cannot be rejected and a spatial regression analyses is more appropriate for this dataset.

[7] The choice of the 5 k-nearest neighbors is motivated by the fact that the average number of neighbors in Italy is between 5 and 6.

Table 10. Spatial correlation tests, contiguity spatial weight matrix

	Contiguity spatial weights matrix										Distance spatial weight matrix							
	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	***
	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,Income,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.*

Table 11 shows the results of the spatial panel estimations. The models presented are different in terms of the distinction between non spatial estimations (Model 1-3) and spatial estimations (Model 4 and 5).

Table 11. Estimation of the tax setting equation

	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*	
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	*		
Income	-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. Model 1: OLS; Model 2: Random effects; Model 3: Fixed effects; Model 4: Spatial Random effects; Model 5: Spatial Fixed effects with time and space fixed effects. 6695 observations per year. Robust estimations. Significance levels: *10%, **5%,***1%.*

Almost all the coefficients of the non spatial estimations show expected sign. As already discussed, however, these estimated are biased and inconsistent. More importantly, post-OLS estimation tests reject both homoskedasticity (Breusch-Pagan studentized test value =4569.438, df = 29, p=0), and the assumption of normality of the OLS residuals (Jarque-Bera X^2 = 12236.44, df = 2, p=0).

Model 2 and Model 3 in Table 5 are the results from static panel estimations. These regressions account for the unobserved heterogeneity present in the cross-sections, they correct for omitted variable bias and they are robust to heteroskedasticity. The results of the two panel models verify most of the initial hypotheses on the tax setting equation and about 40% of the change in the dependent variable is explained by the covariates. When testing for the fit of the two static non spatial panel models we obtain conflicting post-estimation results. The Hausman test rejects the null correlation between the disturbances and all the explanatory variables (X^2=3547.16, Prob>X^2=0) while the Breusch-Pagan test rejects the null that random effects is not appropriate (X^2 (1) = 92509.95, Prob > X^2 = 0). These mixed results are consistent with the suspect presence of a pattern of spatial dependence underlying the data, which leads to unreliable results of the Breusch-Pagan test because of a non linear relationship between the error variances and the covariates.

Since both the random and the fixed effects estimations ignore the spatial dependence across the observed units, at this stage of the analyses no model is accepted with absolute certainty. However, the F test for the significance of the time fixed individual effects rejects the null of zero time fixed effects at the 0.01% significance level.

Model 4 and Model 5 estimate spatial panel regressions including random effects (Model 4) and fixed effects (Model 5).

The empirical literature on spatial panel prefers the use of fixed-effect model when the observations belong to a precise set of individuals, also in the spatial framework (see Arbia et al., 2005). The Italian Municipalities belonging to the 15 Ordinary Regions match this requisite and the non spatial post-estimation results support this hypotheses. For the sake of completeness, the random effect estimation has been presented in Model 4.

The results of the random effects verifies some of the theoretical predictions and suggest positive spatial correlation, as shown the positive sign of both the lag and the error coefficients. In terms of interpretation, high (low) tax rates are observed close to high (low) tax rates; furthermore an unobserved spatially correlated factor hidden in the error term stimulates spatial clusters of tax rates similar among the jurisdictions.

Model 5 relaxes the assumption of random effects and includes unobserved heterogeneity time fixed and space fixed (as the region-based dummies: macro-areas, province capital, coast, and so on). The results of Model 5 show a slight improvement in the coefficients with respect to the previous specifications. In addition to the hypotheses verified also in Model 4, income per capita is now associated with the expected positive sign. The socio-demographic variables are not significant, probably because their limited variance in time. The coefficient for right wing government is significantly negative and also all 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 incumbents before elections, one of the main predictions of yardstick competition.

Although the spatial coefficients from Model 5 show opposite signs, the interpretation does not contradict the yardstick competition hypotheses. The residuals include variables as the true competence level of the incumbent and the realized cost shock, which cannot be observed but determine the tax rate. The negative error coefficient is consistent with a separating equilibrium driven by the true values of the unobserved variables. As an example, an increase in the competence level in *–i* causes a reduction of the tax rate in *–i* that decreases the spatial lag of the tax rate ($W*tax_{-i}$); the negative spatial error coefficients (-0.16) indicates that in such a situation an increase in the tax rate in *i* is observed. This evidence suggests that if the incumbent takes fiscal decision according to non strategic determinants of the tax rate, dissimilar tax levels among neighbors would be observed. The spatial lag coefficient, on the contrary, shows the presence of similar tax rates among nearby jurisdictions (spatial lag=0.28). The domestic tax rate is close to the average tax rate level in the neighborhood, although unobserved determinants would not suggest it to occur.

These results support the presence of mimicking behavior of the incumbents, confirming the yardstick competition hypotheses in the analyzed dataset.

A set of spatial panel regressions have been estimated on the macroareas subsamples of the dataset to control for the dynamics of the spatial coefficients in different geographical areas, using alternatively the contiguity and the distance weight matrix. Table 12 reports the results, which roughly confirm the pattern of interaction found at the national level. The spatial error coefficient is positive in the central subsample when using the same contiguity matrix as in Model 5, and in north-eastern and central subsamples using the distance matrix.

Table 12. Tax setting equation, spatial estimation, robustness check

	Northwest				Northeast				center				south			
	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	**
Income	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	
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%. Model 1: OLS; Model 2: Random effects; Model 3: Fixed effects; Model 4: Spatial Random effects; Model 5: Spatial Fixed effects with time and space fixed effects.*

5.3 Strategic interaction in local tax setting: dynamics in time

The longitudinal dimension of the dataset used allows us to investigate the dynamics of strategic interaction in time. The pattern of interaction, in fact, may vary in time. 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. The empirical works kept this assumption also when using long time series of data.

In this paper, on the contrary, we aim at investigating the dynamics of strategic interaction in the ten years considered, looking for a pattern in the data.

For this purpose the spatial panel regression of Model 5 has been estimated on subsequent time subsamples of the dataset to analyze the variation of the estimated spatial coefficients. The intuition for this approach lies in the fact that variation of the strategic interaction year after year depends, *ceteris paribus*, on the efficiency of the political market. When it becomes more efficient, interaction decreases.

Table 13 shows the results of these set of estimates.

Table 13. Estimation results of the spatial correlations coefficients in time

	spatial lag		spatial error
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

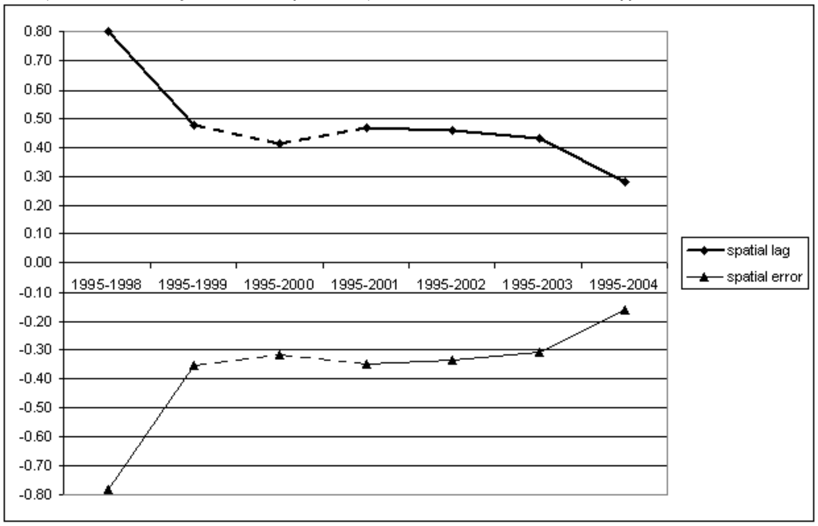
*Notes: Spatial Fixed effects with time and space fixed effects. Dependent variable natural log of ICI house tax rate, continuous variables in log. 6695 observations per year. Years before 1997 have been dropped to build instruments for the regression. Significance levels: *10%, **5%,***1%. Model 1: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

The coefficients show the opposite sign in all the regression. The spatial lag coefficient is not significant when using the sample 1995-2000, motivated by the influence of the low strategic interaction during the year 2000, a post-electoral year in which the incentive of the incumbent to mimic is the lowest than in other years.

The main results is the dramatic decrease in the magnitude of the coefficients when moving from the sample 1995-1998 to the sample 1995-1999, repeated when moving from the sample 1995-2003 to the sample 1995-2004. It is interesting to note that 1999 and 2004 are first order electoral year, therefore the large reduction is driven by the electoral Municipalities in those years. These result suggest a progressive reduction of interaction due to a reduction of the incentives of the incumbents to play mimicking.

Graph 4 depicts the spatial coefficients. The resulting pattern is evidence of convergence towards less and less interaction.

Graph 4. The dynamics of the spatial correlations coefficients in time



6. Concluding remarks

This work analyzed strategic interactions in tax competition on a comprehensive dataset of Italian Municipalities during the period 1995-2004, searching for evidence of yardstick competition.

The economic voting hypotheses is verified by means of a 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 distance*, has been proposed to perform a more precise test. The results confirm a strong link between the popularity of the mayor and the fiscal decisions when the focus is not on the relative performance but on the comparative performance in the neighborhood.

Beside this results, the spatial panel tax setting equation found evidence of strategic interaction. Although the spatial correlation of the residuals is negative, tax rates of nearby jurisdictions are positively correlated among each other. This result is interpreted as evidence of mimicking, which stimulates neighborhood clusters of the tax rates levels also in presence of unobserved factors stimulating tax competition.

Finally, the estimation results show a decreasing pattern of interaction in time. The extent to which the incentive of the bad incumbent to behave strategically changed over time, it is an issue left for future research.

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APPENDIX

Table A.1. 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.2. 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.3. 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
Income	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.4. Correlation among the explanatory variables, tax setting equation

	BICI lag	grants	area	pop	depratio	Tur	Income	Left wing	Right wing	Local list	Elec_ year	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											
Income	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_year	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