Yardstick Competition among Portuguese Municipalities
The Case of Urban Property Tax (IMI)

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ABSTRACT

In this paper we gather empirical evidence on the existence of strategic interaction among Portuguese municipal executives when they set rates of property tax and in particular if we are in the presence of yardstick competition. For that purpose, we adopted the assumption of geographic interaction among Portuguese municipalities when setting rates of property tax. We have estimated, for evaluated and non-evaluated urban property, spatial lag models with two spatial dependency regimes (municipalities with and without a solid majority) and cross-section fixed effects coefficients. The results provide strong empirical evidence on the existence of strategic interaction among Portuguese municipalities when setting rates of municipal taxes and on the yardstick hypothesis.

Key words: Yardstick Competition; Local Governments; Portugal.

JEL Classification: H71; H73.

1. Introduction

With the studies by Case, Rosen and Hines (1993) and Besley and Case (1995), an increasing interest in studying tax mimicking among local governments emerged among academics and local politicians. This new interest coincides with the possibility to use spatial econometrics techniques well suited to test for spatial interaction among local executives when they set rates of local taxes or decide on local public expenditures. The combination of abundant data available at local level, the possibility to use new econometric techniques, and an increasing interest for fiscal policy at local level, led to the publication of a significant number of empirical papers on the strategic interaction among local governments when setting rates of local taxes. Some of the studies go a step further testing if tax mimicking is determined by
competition for economic resources or by the competition in the political market (yardstick competition). The empirical studies cover a wide range of countries such as USA, UK, France, Netherlands, Italy, Spain, Norway, Finland, Portugal, etc.

For Portugal, strategic interaction among municipalities has been studied only recently with the publication of two papers analysing strategic interaction when municipalities set the rates of local taxes (Coimbra et al, 2011 and Costa et al, 2011) and one paper analysing if there is strategic interaction when local governments decide on their expenditures (Silva et al, 2011). A major reason for such scarcity of academic studies on interaction among Portuguese municipalities is associated with the fact that fiscal competition in the past was not an important subject for municipal executives.

With the reform of the Local Governments Finance Law introduced in 2007 municipal fiscal competences were enlarged. With this law, Portuguese municipalities receive 5% of income tax collected to their residents and they have the capacity to decide return the income tax payers. Before the publication of this law, municipalities already had the possibility to set rates of urban property tax and municipal business tax (DERRAMA) in a pre-defined range of taxes, but this possibility was not sufficient to determine a large interest for tax competition among Portuguese municipalities. This behaviour may be explained by the political agenda at local level.

In the last two decades of the twenty century, the lack of infra-structures and equipments at local level created the conditions for a strong political orientation of local executives towards public expenditure. This orientation was further reinforced by the high electoral visibility of public investment and the low electoral visibility of other components of local executive performance, such as level of debt and other indicators of good public management. Considering these conditions, the first two/three decades of democratic local governments in Portugal can be characterized by the low levels of competition among local executives. If there was some level of competition it occurred on the expenditure side.

The satisfaction of most of the needs concerning infra-structure and equipments, the new perception of local executives and local voters on the importance of sustainability, the tightening of financial conditions accompanied by the increase in fiscal competencies at local level, contributed for a new political agenda at local level. Now, local executives pay more attention to quality of management and attribute substantial importance to transparency and
accountability. So, it is no surprise that, in such a new environment, municipalities pay more attention to competition, not only on the expenditure side, but also on the revenue side, namely when setting rates of municipal taxes. Moreover, it is likely that competition for new resources will be accompanied by “yardstick competition” since voters are more sophisticated and have the capacity to use information of neighbor jurisdictions to evaluate local politicians.

In a previous paper (Costa et al. 2011), we have tested if there is empirical evidence on the existence of strategic interaction among Portuguese municipal executives when they set rates of municipal taxes and in particular if we are in the presence of yardstick competition. The results obtained do not disclaim, in general, the existence of strategic interaction among Portuguese municipalities when setting rates of municipal taxes. Testing for the yardstick hypothesis, we have incorporated in the estimated reaction functions political variables used as proxy for intensity of competition in the political market. In the estimations we have used as explanatory variable the rate of municipal taxes, the average rate of neighbour municipalities, four control variables (per capita income of residents in the municipality, per capita transfers from central government, and two proxies for needs), as well as a set of political variables. Political variables include the variable majority (taking the value one if the mayor has majority in the executive council and zero otherwise), the variable percentage of votes of the party supporting the mayor, the ideology of the party supporting the mayor (taking the value one if it is a left party and zero otherwise) and a political cycle variable (taking the value in pre-electoral years and zero otherwise).

According to the results obtained in the referred study, spatial interactions in municipalities’ decision processes can be explained through the hypothesis of yardstick-competition causality. But, results were not enough to take full extent conclusions on such causality nexus. New developments still need to be done in view of testing how yardstick-competition effects are sensible to certain control factors behaviour. We need to evaluate how results are sensible to the inclusion of other control factors such as economies of agglomeration, the political inertia and power perpetuation phenomena and the consideration of terms limit to consecutive re-election of Mayors. Agglomeration economies decrease the pressure on municipal executives when they compete in the political market (yardstick competition) and when they compete for mobile resources. Political inertia captures the fact that incumbent mayors have an important advantage that will contribute to less pressure to enter into yardstick competition. The recent introduction of a three term limit will prevent mayors to run for re-
election in many municipalities in 2013, putting, therefore, additional pressure on the
competition in the political market and so we should observe an increase in yardstick
competition among municipalities in the last term.

In this paper instead of studying several municipal taxes we concentrate the analysis on urban
property tax. We expand the research done in the referred paper by incorporating in the
reaction functions new explanatory variables to answer to the limitations referred above. The
paper is organized in six sections. In a next section we present a brief overview of the
literature on strategic interaction and yardstick competition among municipalities when they
set rates of taxes. In a third section we analyze the evolution of municipal fiscal competences
in Portugal. In a fourth section we present the model to be estimated. In a fifth section we
analyse the empirical results obtained. Finally, in the last section we derive some conclusions.

2. Overview of the Literature

In one of the most cited papers in Economics (A Pure Theory of Public Expenditures, 1956)
Tiebout represents the voter-consumer as an individual who chooses de jurisdiction which
better satisfies his preferences for local public goods and services. The voter-consumer
reveals his preferences for local public goods and services by moving from one jurisdiction to
another (“voting with the feet” or “exit”). He compares the burden of local taxes with local
public goods and services available in each local jurisdiction. According to this model, the
larger the number of jurisdictions the greater the competition among them, the greater the
satisfaction of voters-consumers. The model proposed by Tiebout relies on strong
assumptions: voters-consumers have no costs to move from one jurisdiction to another and
choose the jurisdiction that offers the best combination of local taxes and local public goods
and services; voters-consumers have complete information on local government revenue and
local government expenditures; there is a large number of local jurisdictions to choose from;
voters-consumers only have income from dividends; local public goods are produced with
constant returns to scale; the combination of local public goods is defined to meet local voters
preferences; the optimum size of each jurisdiction is determined by fixed land resources and
by local households demand; jurisdictions below optimum size desire to growth and
jurisdictions above optimum size to maintain their population. An important implication of
the model developed by Tiebout is that more competition among local governments, both on
the revenue side and on the expenditure side, generates more homogeneous local jurisdictions since there is smaller distance between the preferences of voters and the mix of local public goods and local taxes offered by local governments (sorting process). We find also in Tiebout’s model a rationale for strategic interaction among municipalities and in particular for tax competition.

The assumptions of the Tiebout’s model are quite strong: agglomeration economies in certain locations may compensate for higher local taxes; the choice of place of residence may be determined by availability of jobs; information is incomplete and local voters may have difficulty to evaluate performance of municipal executives; real estate market conditions may influence place of residence choices, etc. So, we expect to observe less tax competition among local jurisdictions protected by a high level of agglomeration economies, with more job opportunities, and with voters with higher asymmetry of information. On the contrary, municipalities with a weak economic base (and therefore with higher dependence on central government transfers) in general are more sensible to tax competition and have more incentives to set low rates of municipal taxes.

As we referred before, the existence of incomplete information is an important feature that we can not overlook when studying strategic interaction among municipalities. Sleifer (1985) introduced the concept of yardstick competition applying it to firms in an oligopoly. Salmon (1987) generalized the concept to local governments when choosing rates of local taxes. According to Salmon, in a context of incomplete information voters evaluate the quality of local politicians’ decisions comparing the level of taxes in neighbor jurisdictions. If the local government where the voter resides increases taxes, the evaluation is more favorable if the others jurisdictions that serve as reference also increased the taxes. Otherwise, they will penalize the local executive in local elections. Therefore, decreases in rates of local taxes puts further political pressure on local executives to do the same otherwise they will be perceived as bad performers. So, the strategic interaction among municipalities is of the type “yardstick competition”.

Hirschman (1970) puts into perspective the “exit mechanism” together with two other mechanisms (“voice” and “loyalty”) to understand the way citizens influence local politicians on their decisions. “Voice” interacts with “exit”. This interaction can be seen in two ways: does “exit” diminish the intensity of voice or is it a last resort action? Who is more active demanding from local governments may explain who gets what. “Loyalty” is higher when
citizens expect their local government will correct their action. “Loyalty” interacts also with “voice” since loyal voters have higher propensity to use “voice” to correct local policies.

Brueckner (2003), analysing the different theoretical explanations for strategic interaction among municipalities, identifies two types of models: the “spill-over model” and the “resource-flow model”. In the “spill-over model” decisions of other municipalities generate spatial externalities influencing political decision in the municipality. In this case, the decisions taken by each municipality depend on their specific conditions, as well as on the decisions of other municipalities, trough a “spill-over” mechanism. We can include in this type of model the competition through public expenditure as well as the “yardstick competition”. As we referred before, in this type of competition among municipalities, political decisions on expenditures or on rates of municipal taxes take directly into consideration the decisions of other municipal executives because voters will use this information when formulating their votes.

In the “resource-flow model” municipalities decide on the strategic variable without directly taking into consideration the decision of other municipalities concerning this variable. More precisely, their decisions are affected by the amount of a certain resource available locally. Because the distribution of such resource is affected by choices of all, decisions of each municipality on the strategic variable are indirectly influenced by decisions of all other municipalities.

In both type of models (“spill-over model” and “resource-flow model”) the reaction function is similar. Therefore, it is difficult to distinguish if we are using as rational a “spill-over model” or a “resource-flow model”. To gather empirical evidence on the existence of “yardstick competition” many authors incorporate political variables as explanatory variables in their models. Some authors also use electoral outcomes as independent variables establishing this way a close relationship between the literature on strategic interaction among local governments and electoral and political business-cycle studies.

The interest on testing empirically strategic interaction among municipalities can be traced back to the end of the decade of eighties and beginning of the nineties in the last century. The papers by Case, Rosen and Hines (1993) and Besley and Case (1995) are usually referred as seminal works on the subject. Since then, a significant number of papers studying the strategic interaction among local governments have been published in the specialized literature. A significant number of authors use the rates of municipal taxes as strategic variable estimating
therefore tax competition models. Among them, a significant number test empirically the yardstick hypothesis. Most of the studies analyse the taxes where strategic interaction is more likely to occur (business tax and income tax), but also the urban property tax and user charges, given the central role these taxes play in many local fiscal systems. The papers published cover a wide range of countries: USA (Case et al, 1993 and Besley and Case, 1995); Netherlands and Belgium (Vermeir and Heyndels, 2006; Gerard et al, 2009; Geys and Revelli, 2009); Spain (Sollé-Ollé, 2003; Bosh and Sollé-Ollé, 2007; Delgado and Mayor, 2011); France (Binet, 2003; Elhorst and Fréret, 2009); Germany (Allers and Elhorst, 2005); Norway (Fiva and Ratso, 2007); Italy (Bordignon et al, 2003); United Kingdom (Revelli, 2002), Finland (Kangasharju et al, 2006) etc.

For Portugal, two studies test empirically if there is strategic interaction among municipalities when they set rates of taxes. Coimbra et al. (2011) gathered empirical evidence on the rates of municipal taxes for 278 municipalities of Mainland Portugal and studied separately the rates of three major municipal taxes (rates of property tax (CA and IMI), rates of IRS and rates of municipal business tax (DERRAMA)). The empirical results do not disclaim, in general, the existence of strategic interaction among Portuguese municipalities when choosing rates of local taxes. Although with some differences by type of tax and period of analysis, there is clear evidence on the influence of political business-cycle management when municipal executives set the rates of municipal taxes. Costa et al. (2011), tested if there is empirical evidence of yardstick competition among Portuguese municipalities when they set rates of municipal taxes. Testing for the yardstick hypothesis, political variables were incorporated in the reaction function as independent variables. These variables were used as proxies for intensity of competition in the political market. According to the results obtained in the referred study, spatial interactions in municipalities’ decision processes can be explained through the hypothesis of yardstick-competition causality. But, the results are not strong enough to take full extent conclusions on such causality nexus.

3. Fiscal Competences of Portuguese Municipalities

Portugal (mainland and the islands of Madeira and Azores) is organized into 308 municipalities. Despite being large in geographical terms, many municipalities are very sparsely populated and lack economic activities. About half of the municipalities have fiscal
revenue that represents less than 20% of total revenue, which describes well the redistributive nature of central government transfers to Portuguese municipalities. Portuguese municipalities benefit from revenue of the following municipal taxes: property tax (IMI); tax on transactions of real estate (IMT); tax of circulation (IUC); municipal tax on businesses (DERRAMA). The revenue of these taxes reverts to municipalities with the exception of IMI where the tax collected from rural property reverts 50% to municipalities and 50% to freguesias (lowest level of local governments in Portugal). Since 2007, municipalities receive also 5% of income tax collected by central government from their resident tax payers, an amount that municipalities can decide to return in part or totally to tax payers.

Portuguese municipalities can set rates of urban property tax (IMI) and municipal business tax (DERRAMA) in a pre-defined range and to decide to return to their residents up to 5% of income tax (IRS) collected to their residents by central government. Concerning user charges, municipal fiscal competences are much larger, but are subject to economic demonstration that user charges are in proportion with costs of provision or benefit of users. In table 1 we present the maximum and the minimum rate that municipalities can choose for taxes where municipalities have the competence to set the rate.

<table>
<thead>
<tr>
<th>Tax</th>
<th>Incidence</th>
<th>Minimum rate</th>
<th>Maximum rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Tax (IMI)</td>
<td>From 2003 till 2007</td>
<td>Rural land</td>
<td>0.80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-evaluated urban property</td>
<td>0.40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluated urban property</td>
<td>0.20%</td>
</tr>
<tr>
<td></td>
<td>Since 2008</td>
<td>Rural land</td>
<td>0.80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-evaluated urban property</td>
<td>0.40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluated urban property</td>
<td>0.20%</td>
</tr>
<tr>
<td></td>
<td>Since 2012</td>
<td>Rural land</td>
<td>0.80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-evaluated urban property</td>
<td>0.40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluated urban property</td>
<td>0.30%</td>
</tr>
<tr>
<td>Business Tax (DERRAMA)</td>
<td>From 1998 till 2006</td>
<td>Business tax</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Since 2007</td>
<td>Profit</td>
<td>0%</td>
</tr>
<tr>
<td>Income Tax (IRS)</td>
<td>Since 2007</td>
<td>Income</td>
<td>0%</td>
</tr>
</tbody>
</table>

The perception of fiscal interaction among municipalities is growing and an increasing number of municipalities are decreasing rates of IMI (both on evaluated and non-evaluated urban property). The same happens with the rates of DERRAMA, but with less intensity.
because less developed municipalities already do no collect this tax or collect this tax setting a low rate for a long time.

As we can observe in table 2, the number of municipalities that have decided to diminish rates of IMI on non-evaluated urban property in 2004 (year before elections at local level) is much higher than in the other years, which may indicate the intention of municipal executives to manage the political business cycle. In 2008 (year before the local election of 2009) the number of changes is much lower than in 2004, but we have to account that the decrease in municipal fiscal revenue since 2008 might have induced more caution in decisions concerning rates of municipal taxes (in 2009, 2010 and 2011 we observe a much lower number of municipalities changing rates of IMI). Comparing tables 2 and 3, we can observe that the tendency to manage the political business cycle seem to be less important for urban property evaluated under the new code of IMI.

Table 2 - Number of Municipalities that have changed rates of IMI in the years 2004-2011
(Non-evaluated urban property)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate unchanged</th>
<th>Rates changed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Increased</td>
<td>Diminished</td>
</tr>
<tr>
<td>2004</td>
<td>196</td>
<td>112</td>
<td>5</td>
</tr>
<tr>
<td>2005</td>
<td>241</td>
<td>67</td>
<td>12</td>
</tr>
<tr>
<td>2006</td>
<td>231</td>
<td>77</td>
<td>20</td>
</tr>
<tr>
<td>2007</td>
<td>258</td>
<td>50</td>
<td>27</td>
</tr>
<tr>
<td>2008</td>
<td>267</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>2009</td>
<td>280</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>301</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>293</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 3 - Number of Municipalities that have changed rates of IMI in the years 2004-2011
(Evaluated urban property)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate unchanged</th>
<th>Rates changed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Increased</td>
<td>Diminished</td>
</tr>
<tr>
<td>2005</td>
<td>243</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>2006</td>
<td>212</td>
<td>96</td>
<td>21</td>
</tr>
<tr>
<td>2007</td>
<td>254</td>
<td>54</td>
<td>19</td>
</tr>
<tr>
<td>2008</td>
<td>252</td>
<td>56</td>
<td>7</td>
</tr>
<tr>
<td>2009</td>
<td>255</td>
<td>53</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>301</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>292</td>
<td>16</td>
<td>10</td>
</tr>
</tbody>
</table>
### Table 4 – Portuguese municipalities according to rates of IMI (2011)

<table>
<thead>
<tr>
<th></th>
<th>Evaluated urban property</th>
<th>Non evaluated urban property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Minimum rate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Between the minimum rate and the intermediate rate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intermediate rate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Between the intermediate rate and the maximum rate</td>
<td>119</td>
<td>38.64</td>
</tr>
<tr>
<td>Maximum rate</td>
<td>189</td>
<td>61.36</td>
</tr>
</tbody>
</table>

### 4. The Panel Spatial Lag Model

In this study we adopt an assumption of geographic interaction, which may be represented through a specification denominated by Anselin (1999) as panel spatial autoregressive model (SAR model) or panel spatial lag model. Taking into consideration the panel structure of the data, the regression assumes the form of a panel SAR model or panel lag model. According to Anselin (1999) the spatial lag dependence can be introduced into the cross-sectional dimension of traditional panel data models in a straightforward way:

\[
Y_t = X_t\beta + \rho W Y_t + \varepsilon_t
\]

where \(Y_t\), \(X_t\) and \(\varepsilon_t\) refers to the n-spatial unities at the time period \(t\). \(X_t\beta\), \(\rho W Y_t\) and \(\varepsilon_t\) represent, respectively, the regressive influence of exogenous control factors, the spatial autoregressive factor associated to geographic interaction and uncontrolled disturbances.

Allers (2005) points out that a positive and significant coefficient \(\rho\) in the spatial lag model may be interpreted as evidence of tax mimicking. However, to evaluate if tax mimicking results from a yardstick competition process we need to test the existence of a link between the spatial interaction of tax rates and the political process.

To investigate the yardstick hypothesis, Allers (2005) suggests dividing the data set into two parts based upon political characteristics and then re-estimate the spatial econometric model extended for two different political regimes. Inspired on Rietveld (1998), Bordignon (2003) and Allers (2005) spatial lag models with two regimes, we adjust the following alternative models, represented in the form of t-period specific equations:
\( Y_t = \alpha \mathbf{1}_N + X_t \beta + \rho_1 \mathbf{W}Y_t + \rho_2 \mathbf{M}_t WY_t + \delta + \varepsilon_t \)

\( Y_t \), a vector Nx1 of property tax rates in year \( t \) for the \( N=278 \) municipalities of Portugal continental, represents the endogenous variable under study, which is analyzed in both property tax systems covering evaluated and non-evaluated properties.

\( \alpha \) is an unknown constant term and \( \mathbf{1}_N \) is a \( n \)-element unit vector, representing the influence of relevant factors taken as invariant for all set of \( N=278 \) municipalities and the overall \( T=9 \) years (2003 until 2011) under analysis.

\( X_t \) is a matrix NxK of exogenous factors observed at year \( t \), which include a set of explicative factors named TAX CHANGE, WORKING AGE POPULATION, PURCHASE POWER, DEPENDENCY, UNEMPLOYMENT, ELECTION YEAR and LEFT-WING PARTIES. \( \beta \) is vector Kx1 of impact coefficients of exogenous factors included as control variables.

\( \delta \) is a vector Nx1 of local constant terms containing all \( N \) cross-section fixed effects, \( \delta'=(\delta_1, \delta_2, ..., \delta_N) \). \( \delta_i \) represents the \( i \)-municipal time invariant local specific factors. The panel fixed effects option is considered in order to control that local specificities do not interfere in the evaluation of spatial interaction factor and the yardstick explaining hypothesis. To avoid a problem of perfect multicolinearity related to the presence of an overall constant term, the fixed effects \( \delta_i \) are assumed to be as centered coefficients by considering the restriction \( \sum \delta_i =0 \).

TAX CHANGE is a dummy variable representing the structural changes introduced in 2008 in the rates of property tax. TAX CHANGE is equal to one for 2008 and following years and it is equal to zero in the years before. Attending to the fact that the structural changes introduced in 2008 led to an overall decrease on the maximum tax rates, it is expected a negative sign for the estimated coefficient of this variable.

The variable WORKING AGE POPULATION refers to resident population aged from 15 to 64 years old subjected to a logarithm transformation in order to mitigate the scale effect. This variable captures the influence of agglomeration economies on municipal decisions concerning the rates of IMI. Agglomeration economies diminish the pressure of yardstick competition. Municipalities benefiting from agglomeration economies will have a higher
degree of freedom on the decision to follow the decrease of tax rate by other jurisdictions. Thus, this variable is expected to have a negative estimated coefficient.

The variable PURCHASE POWER is an index of municipal per capita purchase power defined on a per capita base. The per capita purchase power index reflects the relative tax basis capacity. For the same number of taxpayers, when the per capita purchase power increases the tax base increases, and therefore, the tendency to lower tax rates is higher. Consequently, we expect a negative sign for the estimated coefficient of the purchase power variable.

The variable DEPENDENCY refers to the resident population younger of 15 years old added with the resident population older than 64 years as a proportion of the working age population. Because residents of municipalities with high dependency rates are socially more vulnerable and have less ability to pay we expect lower tax rates in municipalities with higher dependency.

The variable UNEMPLOYMENT is defined as the total number of unemployed people registered in local employment centers in proportion of the working age population. Similar to the previous variable, the unemployment rate as a social vulnerability factor affects the ability of residents to pay taxes. Consequently, we expect a negative estimated coefficient for this variable.

The variable ELECTION YEAR is a dummy variable representing years influenced by local government elections. The variable is equal to one in years of municipal elections and it is equal to zero in the remaining years. As we know from the political business cycle literature, the management of the political cycle is expected to be reflected in lower tax rates in electoral periods and therefore the estimated coefficient for this variable is expected to be negative.

The variable LEFT-WING PARTIES is a dummy variable representing local governments led by left-wing parties. The variable is equal to one in municipalities led by a left-wing party and it is equal to zero in those led by a right-wing party. Traditionally, left-wing parties tend to favor higher property tax rates compared with municipalities dominated by right-wing parties. So, the estimate coefficient for this variable is expected to have a positive sign.

The presence of spatial autoregressive terms in the right-end of the model represent an assumption of spatial interaction in the moment of fixing the properties tax rates. The existence of two regimes in the spatial interaction factors correspond to the hypothesis under
study that spatial dependency in the political decision process is explained by an yardstick competition effect.

Spatial interaction is represented by $WY_t$, $M_tWY_t$ and $M_tWMY_t$ factors, where $W$ is a matrix $N \times N$ of spatial contiguity weights and $M_t = \text{diag}(m_{it})$, is a diagonal matrix $n \times n$ whose diagonal elements $m_{it}$ are equal to one in municipalities governed by a solid majority in year $t$ and otherwise are equal to 0. Two spatial contiguity matrix are used, a row-stochastic spatial weight matrix ($W1$) and a symmetric spatial weight matrix ($W2$).

The yardstick effect occurs if spatial interaction effects are different in municipalities with different political regimes. The hypothesis is that in municipalities governed by a solid majority, the interaction effects are distinguished from those of municipalities without such majority.

$\rho_1$ is the impact coefficient of spatial interdependency in municipalities not having a majority. $\rho_2$ and $\rho_3$ are differential impact coefficients of spatial interaction in municipalities governed by a majority. $\rho_1$ is expected to have a positive estimate, meaning that property tax rates are fixed according to municipal neighborhood tendencies. In the hypothesis of yardstick competition $\rho_2$ and $\rho_3$ are expected to be positive. This assumption is related with the fact that municipalities with a solid majority have more capacity to take decisions by taking into consideration the practices of the closest municipalities. In reality, the rationale behind such hypothesis is related with the tendency of citizens to be more exigent with local political processes when local executives have full capacity to decide on the subjects.

To evaluate the yardstick effect two alternative ways to consider differential regimes in the spatial interaction processes are followed. The factor $M_tWY_t$ means that, in this differentiation, solid majorities follows more intensively the decision processes of all neighborhood municipalities (governed by majorities as well as by non-majorities). The factor $M_tWMY_t$ means that such differential is related to the comparison of political processes involving only neighborhood majorities.

$\varepsilon_t$ is a vector $N \times 1$ of $n$-municipal cross-section white noise disturbances in period $t$, which means that is assumed that residuals between different cross-sections and different periods are not correlated and their variances are assumed to be homoscedastic. There is, for all $i$, $j$, $s$ and $t$ with $i \neq j$, it will be $E(\varepsilon_i \varepsilon_j) = 0$ and $E(\varepsilon_{it} \varepsilon_{it}) = \sigma^2$. 

The abovementioned hypotheses comprise the absence of period and cross-section correlation as well as the absence of period and cross-section heteroscedasticity. Despite the spatial autoregressive assumption of the model, their disturbances may stay influenced by the presence of spatial autocorrelation or by spatial heteroscedasticity. Thus, the white-noise disturbances hypothesis is confronted with the assumption of a general conditional error covariance matrix given by:

$$E(e_t e'_t) = \Omega_N = \begin{bmatrix}
\sigma_{11} & \sigma_{12} & \cdots & \sigma_{1n} \\
\sigma_{21} & \sigma_{22} & \cdots & \sigma_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{n1} & \sigma_{n2} & \cdots & \sigma_{nn}
\end{bmatrix}$$

As pointed out by Anselin (1999) this class of covariance structures allows for conditional correlation between the contemporaneous residuals for distinct space unities $i$ and $j$, but restricts residuals in different periods to be uncorrelated:

$$E(e_t e_{jt}) = \sigma_{ij}$$

$$E(e_t e_{jt}) = 0$$

Assuming the spatial fixed-effects hypothesis, in which the constants varying across municipalities are fixed unknown parameters, both models are represented by

$$Y = \alpha I_{NT} + \bar{X}B + I_N \otimes I_T\delta + \varepsilon$$

Where $Y = [Y_1 | Y_2 | \cdots | Y_T]'$ is a column vector of stacked observed values over space and time for the dependent variable, $I_{NT}$ is NT-element unit vector, $\bar{X} = [\bar{X}_1 | \bar{X}_2 | \cdots | \bar{X}_T]'$ is a matrix of stacked observed values on regressors $\bar{X}_t = [X_t | WY_t | M_t W Y_t]$ or $\bar{X}_t = [X_t | WY_t | M_t Y_t | M_t W M_t Y_t]$, respectively for model (A) or (B), $B = [\beta | \rho_1 | \rho_2]'$ is a column vector of $k+2$ coefficients of impact, $I_N \otimes I_T$ is the Kronecker product between the n-element identity matrix and the n-element unit vector and $\varepsilon = [\varepsilon_1 | \varepsilon_2 | \cdots | \varepsilon_T]'$ is a column vector of stacked disturbances.

In order to ensure the identification of local-specific constant terms the model is instead represented by the expression

$$Y = \bar{X}B + I_N \otimes I_TY + \varepsilon$$

where $Y = \alpha I_{NT} + \delta$
Under the assumptions that the regressors are exogenous and the errors are Gaussian, the most efficient estimator is a least squares called by Baltagi (2005) as least squares dummy variables (LSDV) and by Hsiao (2004) as within estimator (WE), although the most frequent designation is fixed effects estimator (FE).

The presence of endogenous regressors on \( \bar{X} \) related to spatial lag terms compromises the validity of the LSDV estimator. As demonstrated by Anselin (1999), the spatial lag term must be treated as an endogenous variable and the proper estimation methods must account for this endogeneity (OLS will be biased and inconsistent due to the simultaneity bias). Nevertheless, in our paper we retain the LSDV estimation as referential for the analysis of other more robust estimation results.

As pointed out by Anselin (1999), the endogeneity of the spatially lagged dependent variable can be addressed by approaches like those based on two stage least squares (2SLS) or on the principles underlying the generalized method of moments (GMM). Both methods imply the use of instrumental variables.

We follow Kelejian and Robinson (1993) to choose instrumental variables. From the conditional expectation of \( Y_t \) in the reduced form:

\[
\begin{align*}
(A) \quad & \mathbb{E}(Y_t) = \alpha l_N + X_t \beta + \sum_{j=1}^{+\infty} \left( p_1^j W + p_2^j M_t W \right) \left( \alpha l_N + X_t \beta + \delta \right) \\
(B) \quad & \mathbb{E}(Y_t) = \alpha l_N + X_t \beta + \sum_{j=1}^{+\infty} \left( p_1^j W + p_2^j M_t W M_t \right) \left( \alpha l_N + X_t \beta + \delta \right)
\end{align*}
\]

Stopping in lag \( j=1 \) we have chosen as instrumental variables, the exogenous part of the models as well their first spatial lags: \( l_N, X_t, Wl_N, WX_t, M_t Wl_N \) and \( M_t WX_t \) for model (A) and \( l_N, X_t, Wl_N, WX_t, M_t WM_t l_N \) and \( M_t WM_t X_t \) for model (B).

The model under study can be represented algebraically as follows:

\[
Y_{it} = \bar{X}_{it} B + \gamma_i + \epsilon_{it} ,
\]

Where \( \bar{X}_{it} \) includes both exogenous and endogenous regressors and \( \gamma_i \) represents non centered fixed effects.

In situations where the errors are influenced by spatial autocorrelation or spatial heteroscedasticity the classic assumptions of \( \mathbb{E}(\epsilon_{is} \epsilon_{jt}) = 0 \) for \( i \neq j \) and \( \mathbb{E}(\epsilon_{it} \epsilon_{jt}) = \sigma^2 \) are no
longer valid. As mentioned before, we have to substitute such assumptions by a more general one of $E(\varepsilon_i\varepsilon_t') = \Omega_N$. The errors are spatial heteroscedastics if the elements of the main diagonal $\sigma_{ii}$ are not constant and they are spatial auto-correlated if there are nonzero elements $\sigma_{ij}$ ($i \neq j$). Consequently we adopted the methodology proposed by Beck and Katz (1995) called Panel Corrected Standard Error (PCSE), which is robust to unrestricted unconditional covariance matrices $\Omega_N$.

5. Empirical results

The following tables present the estimation results for non-evaluated and evaluated urban properties tax rates spatial lag models with two spatial dependency regimes (municipalities with and without a solid majority) and cross-section fixed effects coefficients. The models were structured throughout two spatial contiguity matrix options: a row-stochastic spatial weight matrix (W1) and a symmetric spatial weight matrix (W2).

Furthermore, two distinct assumptions were considered for the spatial dependency diffusion process, both stating that local powers governed by a solid majority are more closely influenced by the decision processes of other neighborhood municipalities. A distinction is considered in terms of neighborhood referential, since we admit that comparisons are made in relation to all other neighborhood municipalities (MWY) or only to those neighborhood municipalities governed also by majorities (MWMY).

As a consequence of the endogeneity of spatial lags repressors, LSDV estimators are biased and inconsistent and related statistics are invalid. Despite that, LSDV results are presented in parallel with TSLS/GMM results as a term of reference. A first conclusion we can derive is on the robustness of our estimates. In all estimated models, from LSDV or TSLS/GMM, taking W1 or W2 spatial weight matrix and considering MWY or MWMY spatial dependency differentiation regimes, the estimated coefficients have identical signs and identical levels.

In both estimation approaches, all estimates have the expected sign and almost all have significant t-statistics. LSDV results point to the significance of all repressors, with the exception of the variable UNEMPLOYMENT for evaluated urban property and LEFT-WING PARTY for non-evaluated urban property. The Cross-section chi-square statistics reveal significant cross-section fixed effects factors. Nevertheless, LSDV results are inconclusive attending to the biasness and inconsistency of LSDV estimators.
In the TSLS/GMM results, the variables \textit{UNEMPLOYMENT} and \textit{ELECTION YEAR} is not significant for evaluated urban property, while \textit{LEFT-WING PARTY} left-wing party still being non-significant for non-evaluated properties models. All other control regressors, cross-section fixed effects coefficients and spatial interaction factors proved to be significant.

Tax change, representing the structural changes introduced in 2008 in national property tax systems, is significant in all hypotheses under evaluation and their impact estimates reveal a general decrease on properties tax rates explained by an overall decrease introduced in legal boundaries.

Table 5- LSDV Estimation Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Evaluated properties</th>
<th>Non-evaluated properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1</td>
<td>W1</td>
</tr>
<tr>
<td>Constant</td>
<td>2.0164</td>
<td>(5.3523)</td>
</tr>
<tr>
<td>Tax change</td>
<td>0.0431</td>
<td>(-14.1397)</td>
</tr>
<tr>
<td>Working age population</td>
<td>-0.1694</td>
<td>(-4.2462)</td>
</tr>
<tr>
<td>Purchase power</td>
<td>-0.0969</td>
<td>(-4.7171)</td>
</tr>
<tr>
<td>Dependency</td>
<td>-0.1178</td>
<td>(-1.9948)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-0.1703</td>
<td>(-1.9627)</td>
</tr>
<tr>
<td>Election year</td>
<td>-0.0053</td>
<td>(-2.6597)</td>
</tr>
<tr>
<td>Left-wing party</td>
<td>0.0167</td>
<td>(4.3492)</td>
</tr>
<tr>
<td>WY</td>
<td>0.2827</td>
<td>(6.0381)</td>
</tr>
<tr>
<td>MWY</td>
<td>0.031</td>
<td>(2.7681)</td>
</tr>
<tr>
<td>MWMY</td>
<td>0.0428</td>
<td>(3.6497)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.7644</td>
<td>0.7649</td>
</tr>
<tr>
<td>Cross-section chi-square</td>
<td>2692.3</td>
<td>2714.6</td>
</tr>
</tbody>
</table>

The working age population, as an agglomeration economy proxy factor, has significant negative impact coefficients. All other factor constants, as higher is the number of residents in working age as lower is properties tax rates. This tendency is explained as an agglomeration economy phenomenon related to the fact that the higher tax bases of most populated municipalities give higher degree of freedom to decide decreasing tax rates.
Similarly to the working age population, the purchase power is a factor having significant negative impact coefficients. Municipalities with similar control characteristics, those with higher per capita purchase power tend to set lower property tax rates. This tendency is also explained as an agglomeration economy phenomenon. Being an index of municipal per capita purchase power defined on a unitary basis, this factor reflects the relative tax base capacity. Municipalities with similar number of taxpayers, as the per capita purchase power increases, the tax base increases and for the reasons explained above it increase tendencies to reduce property tax rates.

Table 6 - TSLS/GMM Estimation Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Evaluated proprieties</th>
<th>Non-evaluated proprieties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1</td>
<td>W1</td>
</tr>
<tr>
<td>Constant</td>
<td>1.7364 (4.5136)</td>
<td>1.6452 (4.1137)</td>
</tr>
<tr>
<td>Tax change</td>
<td>-0.0303 (-4.5412)</td>
<td>-0.0274 (-4.3348)</td>
</tr>
<tr>
<td>Working age population</td>
<td>-0.1515 (-3.6865)</td>
<td>-0.1447 (-3.5246)</td>
</tr>
<tr>
<td>Purchase power</td>
<td>-0.0739 (-3.1545)</td>
<td>-0.0689 (-2.9756)</td>
</tr>
<tr>
<td>Dependency</td>
<td>-0.1072 (-1.7895)</td>
<td>-0.1059 (-1.7620)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-0.1391 (-1.5676)</td>
<td>-0.1160 (-1.3032)</td>
</tr>
<tr>
<td>Election year</td>
<td>-0.0036 (-1.7104)</td>
<td>-0.0032 (-1.4905)</td>
</tr>
<tr>
<td>Left-wing party</td>
<td>0.0170 (4.3892)</td>
<td>0.0172 (4.4259)</td>
</tr>
<tr>
<td>WY</td>
<td>0.4977 (4.421)</td>
<td>0.5443 (5.1067)</td>
</tr>
<tr>
<td>MWY</td>
<td>0.0291 (2.5836)</td>
<td>-0.0291 (2.4894)</td>
</tr>
<tr>
<td>MWMY</td>
<td>-0.0371 (3.1282)</td>
<td>-0.0359 (2.9493)</td>
</tr>
<tr>
<td>R²</td>
<td>0.7617</td>
<td>0.7608</td>
</tr>
</tbody>
</table>

The variables DEPENDENCY and UNEMPLOYMENT have, as expected, negative estimated coefficients. All other factor constants, as dependency or unemployment increases municipalities tend to decrease the property tax rates. Nevertheless, such evidence is not conclusive concerning unemployment, since the estimated coefficient is not statistically significant. Anyway, both variables are included in the model as social vulnerability factors, reflecting less ability to pay and social pressure to lower property tax rates.
The variables ELECTION YEAR and LEFT-WING PARTY are both political context variables included in the analysis. The results reveal a general tendency of municipalities to reduce properties tax rates in electoral periods. Such result is clearly significant only for non-evaluated property models adopting a row-stochastic spatial weight matrix (W1). The other political context variable (LEFT-WING PARTY) is significant for evaluated property models, but it is not significant for non-evaluated property models. Our results bring empirical evidence that municipalities governed by left-wing parties set higher rates of property tax than those municipalities governed by right-wing parties.

Spatial interaction factors are significant in all models. There is strong empirical evidence that municipal decisions concerning properties tax rates take into consideration rates of property tax in neighborhood municipalities. This conclusion is solid because in our models we consider a set of fixed effects to avoid interference of local specificities in the evaluation of the spatial interaction factor and the corresponding yardstick explicative hypothesis.

The yardstick effect hypothesis was evaluated by testing if spatial interaction dependency patterns are different in municipalities with different political regimes (municipalities governed by a solid majority or otherwise). All models are significantly conclusive about the presence of a yardstick effect. In municipalities governed by a solid majority, interaction effects are likely more intense than those observed in municipalities having not such kind of majority.

6. Conclusions

In recent years Portuguese municipalities have paid more attention to competition on the revenue side when setting rates of municipal taxes. Two major reasons contribute to this change. On one hand, competition on the expenditure side is less important because most of the needs on infrastructure are satisfied. On the other hand, voters are more sophisticated and look not only to the expenditure side, but also to the revenue side, and in special to the burden of municipal taxes. Furthermore, they have more information on neighbor jurisdictions rates of taxes and consequently they use such information to evaluate local politicians (yardstick hypothesis).

In this paper we gather empirical evidence on the existence of strategic interaction among Portuguese municipal executives when they set rates of property tax and in particular if we
are in the presence of yardstick competition. For that purpose, we adopted the assumption of geographic interaction among Portuguese municipalities when setting rates of property tax. We have estimated, for evaluated and non-evaluated urban property, spatial lag models with two spatial dependency regimes (municipalities with and without a solid majority) and cross-section fixed effects coefficients. The models were structured throughout two spatial contiguity matrix options: a row-stochastic spatial weight matrix (W1) and a symmetric spatial weight matrix (W2).

The estimates provide empirical evidence on the existence of strategic interaction among Portuguese municipalities when setting rates of municipal taxes and on the yardstick hypothesis. Spatial interaction factors are significant in all models estimated. This conclusion is solid because in our models we consider a set of fixed effects to avoid interference of local specificities in the evaluation of the spatial interaction factor and the corresponding yardstick explicative hypothesis. In this paper we provide also empirical evidence of the influence of economic context factors and political variables on municipal decisions concerning rates of property tax. The results obtained confirm our theoretical expectations but they are less robust than the empirical evidence on the yardstick hypothesis. In general, we conclude that left-wing parties set higher rates of property tax and that municipalities manage the political business cycle setting lower property tax rates in election years. Municipalities with larger fiscal base, all other factors constant, set lower rates of property tax. Municipalities with higher dependency rate, all other factors constant, set lower rates of property tax.

Empirical data confirms the hypothesis of yardstick-competition causality in the way as municipalities mutually interacts when fixing property tax rates. This conclusion means that, having in consideration a priori assumptions resumed in the model adopted for analysis, available data complies with such hypothesis. The analytical approach consisted in trying to conclude about tendencies of micro decision processes from a macro panel data view. By adopting an analytical model assumption, we tried to extract conclusions from regularities and tendencies evidenced in a set of longitudinal macro-information available at municipal level. Obviously, all conclusions are conditioned by the information available and the model assumptions themselves.
The validation of the robustness of our conclusions depends on new analytical steps, closed to the micro-processes underlying to the way as municipal governments set their decisions on fixing local taxes. Further developments depend on collecting information from municipalities about their specific framework for fixing budgets and local taxes. A Mayor’s Budget Survey should be implemented to collect desirable information. A Structural Equation Model approach will be helpful for this new development.

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**Legislation:**

Lei nº 1/1979 de 2 de Janeiro – Lei das Finanças Locais.
Lei nº 1/1987 de 6 de Janeiro – Lei das Finanças Locais.
Lei nº 42/1998, de 6 de Agosto – Lei das Finanças Locais.
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