Tax competition among Belgian Municipalities: a multi-dimensional battle?

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Abstract

Local uni-dimensional tax competition between contiguous municipalities has been widely assessed in recent empirical literature. In this paper we assess whether tax competition among Belgian municipalities is played across multiple tax policy dimensions. Moreover, we investigate whether tax competition also exist among municipalities which are socio-economically close to each other rather than geographically close. We do so using data on income and property tax rates of the 589 Belgian municipalities over the period 1990-2004, applying panel data methods allowing for spatially correlated error components (following Kapoor et al. (2002) and Kelejian and Prucha (1998)). We find evidence of cross policy interaction both using physical distance and socio-economic distance weight matrices.

JEL Codes H30, H71, H73

1. Introduction

Strategic interaction among local governments has become of major focus of both theoretical and more recently also of empirical work in public economics. As Brueckner (2003) notes, models of strategic interaction among governments can be classified into two broad types: the resource-flow model and the spillover model. Strategic interaction occurs in both models because a jurisdiction's choice with respect to the level of a decision variable z if affected by the level of z chosen independently by other jurisdictions. Where both models differ is in the way in which this is the case.

In a resource-flow model, the level of z chosen by jurisdiction i (z_i) has an impact on the amount of a particular resource which the jurisdiction cares about. Because the amount of the resource also depends on the levels of z chosen by other jurisdictions, jurisdiction i will take them into account when it determines the level of z_i. In terms of tax competition, the decision variable is a tax such as an income tax or property tax and the particular resource refers to a mobile tax base such as mobile capital, cross-border shoppers or inhabitants in a city. Here, the level of the tax chosen by jurisdiction i affects the amount of the mobile base in other jurisdictions (Wilson (1999)). Hence, in setting its tax rate, jurisdiction i will take into account the level of the tax chosen by other jurisdictions in order to prevent their tax base from relocating to other jurisdictions where the tax is lower. This leads to strategic interaction where each jurisdictions tax levels depend on those chosen by other jurisdictions.

In a spillover model, the level of z_i directly affects the levels of that variable chosen in other jurisdictions. In terms of tax policy, the level of a tax can spill over from jurisdiction i to jurisdiction j in the form of information. Besley and Case (1995) for instance develop a model where voters in i compare the level of taxes in their jurisdiction with the level of the same tax in other jurisdictions. By comparing these levels, voters evaluate the fiscal performance of their jurisdiction's elected officials using the performance in other jurisdictions as a yardstick. As Heyndels and Vuchelen (1998) this creates the possibility that good, non-rent-seeking benevolent officials inflict informational externalities in terms of reduced re-election probabilities on bad, rent-seeking and non-benevolent ones. Hence, as Besley and Case (1995) note, vote-seeking and tax-setting are tied together through the nexus of yardstick competition. Again, this implies that elected officials in jurisdiction i will respond to changes in the level of taxes in other jurisdiction as they will try to stay in line with tax rates used elsewhere.

The empirical literature on strategic interaction among governments has grown rapidly in recent years (see Brueckner (2003)). Although the resource-flow and spillover models are profoundly different in terms of the channels that affect strategic policy interaction, the empirical literature is unable to test the various models separately. As Brueckner (2003) notes, this is due to the fact that the objective functions of both type of models are the same which implies that the reaction functions in both models are the same. Hence, in estimating the reaction function, the empirical literature is not able to differentiate between competing theoretical models. If the estimates of the reaction function suggest that its slope is significantly different from zero, it is conjectured that strategic interaction exists.

This has also been the approach taken in much of the recent literature on strategic tax interaction at the sub-national level (see for instance Ladd (1992), Case (1993), Besley and Case (1995), Heyndels and Vuchelen (1998), Hettich and Winer (1999), Brett and Pinkse (2000), Brueckner and Saavedra (2001), Feld and Kirchgässner (2001), Revelli (2001), Buettner (2001 and 2003), Feld and Reulier (2003), Egger et al. (2005) and Richard et al. (2005).) The evidence presented in those studies finds that strategic interaction among government at the sub-national level is present. Ladd (1992) for instance finds that a $ 1 rise in the average tax burden of a US counties neighbour leads to an increase of the county's own average tax burden of $0.45 to $0.85. Heyndels and Vuchelen (1998) find similar evidence. For Belgian municipalies they find that a 0.67 (0.69) percentage point rise in municipality i local income tax rate (local property tax rate) following a 1 percentage point rise in the average neighbouring level. The analysis in Brueckner and Saavedra (2001) also finds the presence of strategic interaction among 70 cities in the Boston Metropolitain area. Hence, the evidence clearly suggests that there is strategic interaction among jurisdictions at the sub-national level. However, this literature approaches the issue in a uni-dimensional framework where one estimates if and to what extent the level of a tax p in jurisdiction i on the level of the same tax in neighbouring jurisdictions. However, as Fredriksson et al. (2004) note, this framework might be too restrictive. In the resource flow model for instance, jurisdictions have multiple instruments with which they can compete. Fredriksson et al. (2004) analyse if and to what extent there is cross-policy strategic interaction in tax-, environmental and infrastructural policies and find evidence which supports their multi-dimensional framework. They find for instance that the abatement effort of a U.S. state depends also on their measure of tax effort and government expenditures.

A feature which is shared by a lot of the empirical work is the way in which the neighbour's tax levels are calculated. The neighbour's tax levels are often determined as the average tax level in the geographically neighbouring jurisdictions. Hence, contiguity is the criterion to determine if 2 jurisdictions are neighbours. Although some authors use a weighting scheme such as distance, income or population this scheme if often applied to contiguous jurisdictions.

In this paper we focus on the cross-policy strategic interaction and we analyse if and to what extent the multi-dimensional character of strategic tax interaction is present in a sample of 589 Belgian municipalities for 1991-2003. Furthermore, we focus on the way in which one determines 'neighbours' and test if and to what extent socio-economic distances matter in terms of policy competition. The remainder of this paper is organized as follows: the next section introduces our hypothesis with respect to the multi-dimensional character of tax interaction and the socio-economic distances. The 3rd section presents the empirical model and discusses the data. The 4th section contains the results while the last section concludes.

2. Cross-policy strategic interaction with socio-economic neighbours

Cross-policy strategic interaction occurs when a jurisdiction changes the level of its policy-instrument p in response to a change in its neighbour's level of policy-instrument q. For U.S. states, Fredriksson et al. (2004) for instance find that U.S. states appeal to firms by lowering environmental stringency levels as a response to neighboring states improving their provision of public goods and reducing their taxes. Following Fredriksson et al. (2004) we conjecture that it might be possible that cross-policy strategic interaction exists. To our knowledge, this is the fist attempt to capture this type of interaction of tax levels at the sub-national (local) level. Cross-policy strategic interaction is highly likely to be present on the local level. Most municipalities have multiple instruments at their disposal with which they can compete. In terms of taxes for instance sub-national jurisdiction in some countries can introduce a wide variety of taxes on business, residents, property, the environment, etc. Belgian municipalities, which will be the focus of our empirical estimates, have at their disposal a whole range of taxes including taxes on income, property, waste, … . The most important ones are the local income tax (LIT) and local property tax (LPT) and we will use them to test both within policy and across policy strategic interaction.

Secondly, we analyse a number of different weighting schemes. Our hypothesis is that municipalities interact not only with municipalities that are close in a geographic sense but are comparable in a socio-economic sense. Richard et al. (2005) find evidence that this might be the case for Belgian municipalities. In competing with other jurisdictions, we expect that jurisdiction take into account similar jurisdiction's level of a policy variable. In terms of the resource-flow model, large cities might compete with other large cities to attract economic activity which is too big for a small city. Hence, competition takes place between these two large cities and not between the big and small ones. In terms of the spillover model, again it seems to be more likely that citizens compare their cities policies with those in similar cities. Hence, we assume that both tax setters and tax payers look at municipalities with the same socio-economic characteristics. For example, people living in a big city could use other big cities as a yardstick instead of the neighbouring rural area, while people living in rural areas will compare their government's performance with performances of governments in other rural areas. Therefore we will use several (combined) socio-economic and distance matrices in order to asses the nature of tax competition among Belgian municipalities.

3. Data and empirical model

In order to test if and to what extent local competition is multidimensional between municipalities whose distance is short in socio-economic terms, we use data on Belgian municipalities tax rates. As mentioned by Heyndels and Vuechelen (1998) and Richard et al. (2005), Belgium offers some very interesting characteristics for studying local tax competition. First, we have a balanced panel for 589 municipalities for 14 years. Second, the 589 municipalities are institutionally homogenous, meaning that all municipalities have the same responsibilities inside their borderlines. Moreover, the local income tax rate (LIT) and the local property tax rate (LPT) are surcharges on federal and regional tax rates respectively, for which the tax base is uniformly defined at the federal level. This not only makes it easier for us to compare the tax policies of municipalities but also for the tax setters and tax payers. Third, LIT tax revenues and LPT tax revenues accounted for 80% of total tax revenues over the years 1990-2003, total tax revenues constituting 42% of total local revenues over the same period[1].

The local income tax rates (LIT) and the local property tax rates[2] (LPT) were obtained from the Belgian Ministry of Finance. In our analysis we use tax rates for the period 1991-2004, while for the other explanatory variables we use data for the period 1990-2003. The reason being that tax rates which are applied in the year t are decided on at the end of the year t-1, meaning that the tax rate for 1991, was decided at the end of 1990 and thus based on data from 1990.

The local income tax rates and property tax rates are our tools with which we test the hypothesis of cross-policy strategic interaction. If cross-policy interaction is present in the tax setting behaviour of Belgian municipalities, we would expect municipality *i*'s local income tax is affected by its neighbours income tax as well as its neighbours level of property taxes.

In order to test the hypothesis with respect to the socio-economic distance, we propose several weight matrices in order to better asses which municipalities are used by tax setters and tax payers as a yardstick to evaluate a municipality's tax policies. The first weight matrix we will be used as a benchmark. It is a row-stochastic neighbour's weight matrix, neighbours specified using Delaunay contiguity[3]. Our socio-economic distance weight matrices are based on population size, socio-economic clusters and median income. We produced the population weight matrix, based on 10 population classes, represented in table 1. The population classes are based on the average municipality populations over the period 1990-2003. A value of 1 was given to municipalities belonging to the same population class and a value of zero to municipalities of another population class. This weight matrix was then row normalized.

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[1] own calculations based on data from Dexia Bank.

[2] The municipal property tax rates are supplements to regional property tax rates of 1,25% in Wallonia and Brussels and 2,5% in Flanders. Therefore, in order to make the centimes comparable across the regions we multiplied the property tax centimes charged by Flemish municipalities by 2.

[3] This weight matrix was produced by the matlab xy2cont function (Lesage and Pace 2004, p 29).

Table 1 : population classes

POPULATION CLASSES	NUM. OF OBS. PER CLASS
pop > 60.000	24
35.000 < pop < 60.000	23
25.000 < pop < 35.000	39
20.000 < pop < 25.000	43
15.000 < pop < 20.000	70
12.500 < pop < 15.000	56
10.000 < pop < 12.500	70
7.500 < pop < 10.000	87
5.000 < pop < 7.500	78
pop < 5.000	99

The second socio-economic weight matrix is derived from the socio-economic typology of Belgian municipalities by Dessoy (1998). Dessoy constitutes 12 Flemish, 13 Walloon and 5 Brussels socio-economic clusters, applying a factor analysis and a cluster analysis. The following socio-economic dimensions are included in the analysis: the allocation of territory and buildings, the level of income, economic activity and population structure, demographic structure and level of attractiveness. A description of the 12 Flemish and 13 Walloon socio-economic clusters can be found in appendix A. We opted to replace the 5 Brussels clusters by analogous[4] Flemish clusters in order not to isolate the Brussels municipalities to much in our analysis. In the socio-economic weight matrix, again municipalities of the same cluster get a value one, others a value zero. This weight matrix is then standardized. Note that because there are separated clusters for Flemish and Walloon municipalities, we assume in this matrix that Flemish municipalities do not compete with Walloon municipalities and vice versa.

A third socio-economic weight matrix is constructed in a similar way as the population weight matrix now using 10 income classes instead of population classes. The income classes consist of 10 percentile classes based on the average median income over the period 1990-2003, each class containing 59 municipalities[5].

[4] Dessoy (1998 p35) shows the analogy between the clusters in the Flemish and Brussels regions, see also appendix A.

[5] except the poorest class containing 58 municipalities.

The fourth, fifth and sixth weight matrices combine socio-economic weights matrices with the distance weight matrix. For example in the combined distance-population class matrix, the elements with value one are multiplied by the inverse of the Euclidian distance between the respective two municipalities.

We propose the following empirical model to test if and to what extent cross-policy strategic interaction has occurred among Belgian municipalities:

$$\tau_{it} = \rho_\tau W\tau_{it} + \delta_\kappa W\kappa_{it} + X_{it}\beta_\tau + \lambda_t + u_{\tau it} \quad [1]$$
$$\kappa_{it} = \delta_\tau W\tau_{it} + \rho_\kappa W\kappa_{it} + X_{it}\beta_\kappa + \lambda_t + u_{\kappa it} \quad [2]$$

with τ_{it} municipality i's local income tax rate in year t, κ_{it} its local property tax for year t, X_{it} municipality i's characteristics determining the level of the taxes, λ_t a set of time dummies that capture time dependent influences on tax setting behaviour independent of the municipality such as the business cycle or elections and $u_{\tau it}$ and $u_{\kappa it}$ are two error terms. The weight matrices W here are already defined. The estimate of ρ_τ and ρ_κ capture within policy strategic interaction while the cross-policy interaction is caught by δ_κ and δ_τ. If cross-policy strategic interaction is present among Belgian municipalities we would expect δ_κ and δ_τ to be statistically significant. β_τ and β_κ are vectors to be estimated associated with the exogenous characteristics of the municipalities.

The error terms $u_{\tau it}$ and $u_{\kappa it}$ allow for spatial dependence and are specified as follows:

$$\begin{aligned} u_{\tau it} &= \psi_\tau W u_{\tau it} + \varepsilon_{\tau it} \\ \varepsilon_{\tau it} &= \mu_{\tau i} + \upsilon_{\tau it} \end{aligned} \quad [3]$$

and

$$\begin{aligned} u_{\kappa it} &= \psi_\kappa W u_{\kappa it} + \varepsilon_{\kappa it} \\ \varepsilon_{\kappa it} &= \mu_{\kappa i} + \upsilon_{\kappa it} \end{aligned} \quad [4]$$

with $\upsilon_{\tau it} \sim IID\left(0, \sigma^2_{\upsilon\tau}\right)$, $\upsilon_{\kappa it} \sim IID\left(0, \sigma^2_{\upsilon\kappa}\right)$ and $\mathsf{E}[\upsilon_{\tau it}\upsilon_{\kappa it}] = 0$ uncorrelated idiosyncratic shocks, $\mu_{\tau i}$ and $\mu_{\kappa i}$ two municipality specific effects and ψ_τ and ψ_κ the spatial dependence parameters. With respect to $\mu_{\tau i}$ and $\mu_{\kappa i}$, we will allow them to be both fixed effects as well as random effects. In the latter case, we have $\mu_{\tau i} \sim IID\left(0, \sigma^2_{\mu\tau}\right)$, $\mu_{\kappa i} \sim IID\left(0, \sigma^2_{\mu\kappa}\right)$, $\mathsf{E}[X_{it}\mu_{\kappa i}] = 0$, $\mathsf{E}[X_{it}\mu_{\tau i}] = 0$ and $\mathsf{E}[X_{it}\mu_{\kappa i}] = 0$.

As exogenous explanatory variables included in X_{it}, we use the number of labourers (LAB), the size of the population (POP), the percentage of population younger than 20 (%YOUNG), the percentage of population older than 64 (%OLD) and the median income (MEDINC). Heyndels and Vuchelen (1998) and Richard et al. (2005) use similar variables. Tables 2 summarizes the sources of our variables and the units of measurement. The number of labourers measures a municipality's economic activity. The population variable captures the size of a municipality. The median income measures the tax base for the local income tax. As the decisions with respect to the tax are set at the end of the year prior to the year within which they are applied, all the exogenous variables are measures in t-1.

Table 2: description of variables

VARIABLE	SOURCE	UNIT	MEAN	STAND DEV
LIT	Min. of Finance	%	6,9383	1,0387
LPT	Min. of Finance	Centimes	2231	533
LAB	RSZ[1]	1	5 574	16 879
POP	NIS[2]	1	17 134	27 757
%YOUNG	NIS	%	24,83	2,3181
%OLD	NIS	%	15,5856	2,5994
MEDINC	NIS	€ per year	27 517	4 765

[1] Social Security Administration

[2] National Statistics Institute

In spatial econometrics literature, it is well known that equations [1] and [2] can not be consistently estimated by OLS. In order to derive consistent estimators of the parameters in [1] and [2] we use the feasible generalized spatial 2 stage least squares procedure (FGS2SLS) based on Kelejian and Prucha (1998) and Kapoor et al. (2002) and used in for instance, Egger et al. (2004). The procedure proceeds in various steps. To get a consistent estimate of ρ_τ, ρ_κ, δ_κ, δ_τ β_τ and β_κ in [1] and [2] we use a consistent 2SLS within estimator using all exogenous variables in X and the spatial lag WX as instruments. The residuals from the first step are the basis the Generalized Methods of Moments (GMM) estimator derived in Kapoor et al. (2002) of ψ_τ and ψ_κ as well as the variance components $\sigma^2_{\upsilon\tau}$, $\sigma^2_{\upsilon\kappa}$, $\sigma^2_{\mu\tau}$ and $\sigma^2_{\mu\kappa}$.

In the third step, we first apply a Cochrane-Orcutt-type transformation using the estimates of ψ_τ and ψ_κ which we will denote with $\hat{\psi}_\tau$ and $\hat{\psi}_\kappa$. For a variable z this transformation gives the transformed variable z_{it}^* defined as $\left(I - \hat{\psi}_\tau W\right) z_{it}$ (for the local income tax) or $\left(I - \hat{\psi}_\kappa W\right) z_{it}$ (for the local property tax) with I the (appropriately sized) identity matrix. From [3] and [4] it can be seen that this transformation removes the spatial lag in the error process of [1] and [2] as (using the local income tax) $u_{\tau it} = \psi_\tau W u_{\tau it} + \mu_{\tau i} + \upsilon_{\tau it} \Rightarrow u_{\tau it} = \left(I - \hat{\psi}_\tau W\right)^{-1} (\mu_{\tau i} + \upsilon_{\tau it})$. Hence, using [1] $\tau_{it} = \rho_\tau W \tau_{it} + \delta_\kappa W \kappa_{it} + X_{it}\beta_\tau + \lambda_t + \left(I - \hat{\psi}_\tau W\right)^{-1} (\mu_{\tau i} + \upsilon_{\tau it})$, the error process of the equation with transformed variables does no longer include spatial dependence. The second transformation uses the estimates of $\sigma_{\upsilon\tau}^2$, $\sigma_{\upsilon\kappa}^2$, $\sigma_{\mu\tau}^2$ and $\sigma_{\mu\kappa}^2$, i.e. $\hat{\sigma}_{\upsilon\tau}^2$, $\hat{\sigma}_{\upsilon\kappa}^2$, $\hat{\sigma}_{\mu\tau}^2$ and $\hat{\sigma}_{\mu\kappa}^2$, to apply a GLS transformation on z_{it}^* defined as, for the local income tax, $z_{it}^{**} = z_{it}^* - \left(1 - \frac{\sigma_{\tau\upsilon}}{\sigma_{\tau 1}}\right)\overline{z}_{i.}^*$ with $\sigma_{\tau 1}^2 = \sigma_{\tau\upsilon}^2 + T\sigma_{\tau\mu}^2$ and $\overline{z}_{i.}^*$, the sample mean for municipality i for the variable z_{it}^* or, for the local property tax, $z_{it}^{**} = z_{it}^* - \left(1 - \frac{\sigma_{\kappa\upsilon}}{\sigma_{\kappa 1}}\right)\overline{z}_{i.}^*$ with $\sigma_{\kappa 1}^2 = \sigma_{\kappa\upsilon}^2 + T\sigma_{\kappa\mu}^2$. The last step applies 2SLS on the transformed model with instruments variables X^{**} and WX^{**} transformed using $x_{it}^{**} = x_{it}^* - \left(1 - \frac{\sigma_{\tau\upsilon}}{\sigma_{\tau 1}}\right)\overline{x}_{i.}^*$ for the local income tax and $x_{it}^{**} = x_{it}^* - \left(1 - \frac{\sigma_{\kappa\upsilon}}{\sigma_{\kappa 1}}\right)\overline{x}_{i.}^*$ for the local property tax equation. Note that with fixed effects, $z_{it}^{**} = z_{it}^* - \overline{z}_{i.}^*$ and $x_{it}^{**} = x_{it}^* - \overline{x}_{i.}^*$. This procedure yields consistent and asymptotically normal estimates.

4. Results

Table 3 to table 6 present the results. Table 3 contains the benchmark results based on the contiguity weight matrix while the tables 4 to 6 give the results using six socio-economic matrices. The R^2 vary between 12% and 21% for the estimates with LIT as a dependent variable and between 36% and 54% for the estimates with LPT as a dependent variable. Overall, estimating [1] and [2] using the combined distance and socio-economic clusters matrix explains most of the variance in LIT and LPT. Tax competition between both neighbouring municipalities and socio-economically similar municipalities turns out to be multidimensional in several cases.

Staring with the benchmark contiguity results, let us first confirm the literature (e.g. Heyndels and Vuechelen(1998)) that within or intra policy tax competition exists for both income tax and property tax policy. Estimates using both fixed and random effects, reveal highly significant (P<0,01) positive coefficients ρ_τ (0,59 and 1,10) and ρ_κ (1,02 and 0,84), indicating strong competition within income taxes and property taxes respectively. In addition to the existing literature, we now also find evidence of multidimensional tax competition across income and property tax policies. Therefore we need to look at the significance of the coefficients δ_{κ} (captures the effect of W*LPT on LIT) and δ_{τ} (captures the effect of W*LIT on LPT). Using fixed effects, we find that that neighbour's property tax level (W*LPT) has a highly significantly positive impact on the personal income tax rate of a municipality. More precisely, when the neighbouring municipalities lower their property tax by 1000 centimes, a municipality will react by lowering its personal income tax rate by 0,7 percentage points. Using random effects we observe a highly significantly positive relationship between the personal income tax rate in the neighbouring municipalities and the property tax rate of a municipality. More specifically, a 1 percentage point increase of LIT by the neighbours brings about a rise of 92 centimes in LPT.

[Insert table 3]

We now turn to tax policy competition between municipalities belonging to the same population class, the same socio-economic cluster or the same income class. Concerning within tax policy interaction, we find evidence of competition for both income and property taxes for almost all socio-economic weight matrices and estimation methods (FE and RE) in tables 4 to 6. The only exceptions where coefficient ρ was not significant were in the RE estimation for LPT comparing municipalities of the same population class, and in the RE estimation for LIT and the FE estimation for LPT comparing municipalities of the same income classes. Besides, ρ was highly positively significant with values around 1 in most of the LIT cases and a bit lower in the LPT cases. These results tell us that not only contiguous municipalities act on each others income tax rates and each others property tax rates, but that also distant communities belonging to the same socio-economic class (using several definitions of socio-economic class) use each other's policy as a yardstick for their own tax policy.

[Insert tables 4, 5, 6]

With respect to cross policy tax competition, we are looking for significant values of parameter δ. We begin our analysis by examining the cross policy effect of the neighbours' W*LITs on LPT, captured by the parameter δ_{τ}. This effect is the clearest and most uniform. In all but two estimations[6], we find a significantly positive impact of the socio-economic neighbours' income tax rates on a municipality's property tax. This means that when local governments, belonging to the same socio-economic class, lower their income tax rate, a municipality will follow by lowering its property tax rate. Weighting municipalities by population class (table 4) we find δ_{τ} s between 154 and 705, the latter meaning that a 1 percentage point decrease of the socio-economic neighbour's income tax rate would entail a 705 centimes drop in the property tax. Weighting municipalities by Dessoy's (1998) socio-economic cluster (table 5), gives us δ_{τ} s between 102 and 278, while weighting by income class (table 6) delivers a cross policy tax coefficients of 654 at the highest but a non-significant coefficient at the lowest as mentioned above.

Proceeding to cross policy competition between socio-economic neighbours' property tax W*LPT and a municipality's income tax LIT, we come across a different picture. The evidence on this interaction, captured by δ_{κ} , is less clear. In none of the cases using socio-economic weights we find a highly significant value of δ_{κ} for the FE and the RE estimation at the same time. In one case (FE, combined distance and population classes) we find a highly significantly positive δ_{κ} , while in two other cases (RE population classes and FE income classes) we find highly significantly negative δ_{κ} s. In most of the cases, however, the coefficients are hardly significant or not significant at all. Because of the low or non significance and lack of consistency in these results, we might conclude that the cross policy interaction between W*LPT and LIT is a lot less expressive than between W*LIT and LPT.

From the above analysis on within policy and between or cross policy interaction we can conclude that when income taxes in socio-economically similar municipalities go down, a municipality lowers both its income tax (within interaction) and its property tax rate (cross interaction). If on the other hand the socio-economically similar municipalities decrease their property tax rates, a municipality is very likely to also lower its property tax rate, but unlikely to also adopt its income tax rate. We thus point out that the cross policy interaction is asymmetric.

A possible explanation of this could be that the income tax rates are more visible or better known by taxpayers than the property tax rates or that tax setters attribute more importance to income tax rates than to property tax rates. As a result local governments will rather react on changes in neighbouring income tax rates than on changes in neighbouring property tax rates. Note in this respect that the within ρ s were also higher in case of LIT than LPT.

[6] The two exceptions are the RE estimation with income classes and the RE estimation with combined distance and income classes.

To finish this section, we give an overview of the impact of the control variables on the tax rates. First, the coefficient on the number of labourers (LAB) is highly significantly negative in all of the LIT cases. Municipalities with a high level of economic activity (and thus more workers) use a broad range of instruments to tax the economic activity[7]. Because of these tax revenues they are less constrained to tax their citizens. On the other hand, LAB is only two times significantly negative concerning property taxes LPT. This confirms the reasoning that municipalities are rather inclined to lower the income tax rate than the property tax rates. Second, population size (POP) seems to have a positive impact on both income and property tax rates, a result also found by Heyndels and Vuechelen (1998). The main reason might be that larger municipalities need to foresee a broader range of services. Third, the coefficient on percentage of young people (%YOUNG), with respect to LIT, turns out to be not significant in most cases (except for a positively significant value in the benchmark contiguity case). Regarding LPT we observe six times a significantly negative impact of the share of young people. This could point to the fact that young people are more mobile than old people and that municipalities lower their property taxes in order to attract young people. The opposite effect is true for the fifth variable, percentage of old people (%OLD). Not only on LIT (five times) but certainly on LPT (thirteen times) the share of old people emerges to have a positive effect. Contrary to younger people older people are considered to be more settled and less mobile than younger people. Consequently municipalities are less concerned about levying a high tax rate on the income and property of these people. Finally, we take a look at the median income variable (INC). Depending on the estimation method and the weight matrix used the effect of INC on the LIT is eight times significantly negative but also two times significantly positive. With respect to LPT, the picture is different with nine times a positive coefficient and three times a negative coefficient. It is hard to make conclusion from this.

5. Conclusion

The first aim of this paper was to find out whether tax competition at the local level is played across several tax instruments rather than only within one tax instrument. Using the income tax rates and property tax rates of 589 Belgian municipalities, we find evidence that cross policy tax competition exists and that it is asymmetric. On

[7] A lot of municipalities have a power tax, a tax on number of people employed in a company, a tax on industrial surface of a company, a tax on the number of computer screens,…

the one hand, income tax rates of neighbouring municipalities have a positive impact on a municipality's property tax rate. On the other hand, variable (and often non-significant) results on the impact of neighbours' property tax rates on a municipality's income tax rate, make us conclude that this interaction is less important.
The second aim of this paper was to reveal whether tax competition is not only played between adjacent or contiguous regions but also between (possibly distant) regions belonging to the same socio-economic class. Using weight matrices based on the division of municipalities into population classes, socio-economic clusters and income classes, we point out that both within and cross policy interaction exists between municipalities with similar socio-economic characteristics. This means that tax payers and tax setters compare their municipality's tax policy performance with the performance of municipalities the are socio-economically similar.

Some issues deserve more attention in the future. First, it would be interesting to see how the multidimensional tax game evolves when we incorporate LIT as an explanatory variable in the reaction function for LPT and vice versa. Doing so we would need to estimate both expressions (with LPT and LIT as dependent variables) simultaneously by means of three stages least squares. Second, a three dimensional game including not only tax rates on personal income and property but also municipality investments would give us an even broader image of policy competition. Finally, more socio-economic weight matrices could be used in order to better establish which municipalities competes with whom.

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Appendix A

Flemish clusters:

Caractère dominant	Spécificité complémentaire	Clusters
Communes agricoles	Moyennement agricole	V1
	Fortement agricole	V5
Communes résidentielles	***Revenus < moyenne régionale***	
(«niveau de vie»)	Expansion démographique (composante naturelle)	V2
	Revenus > moyenne régionale	
	Rurales	V8
	Revenus moyens	V6
	Revenus élevés	V4
	Revenus élevés + activité économique	V12
Communes urbaines	Petites villes	V3
(«attractivité -externalités»)	Villes régionales	V9
	Grandes Villes	V10
Communes industrielles	Urbanisées / villes	V7
Communes touristiques	Expansion démographique (composante migratoire)	V11

Source: Dessoy (1998), typologie socio-économique des communes, p 9.

Walloon Clusters:

Caractère dominant	Spécificité complémentaire	Clusters
Communes agricoles	Moyennement agricole	W3
	Fortement agricole	W9 /
	W10	
Communes résidentielles	***Revenus < moyenne régionale***	
(«niveau de vie»)	Déclin démographique	W 1
	Revenus > moyenne régionale	
	Rurales	W5
	Revenus moyens	W7
	Revenus élevés (avec/sans activité économique)	W13
Communes urbaines	Petites villes et pôles urbains secondaires	W8
(«attractivité - externalités»)	Villes moyennes	W12 / W6
	Grandes villes et	
	villes régionales	W11
Communes industrielles	Urbanisées / villes	W2
	Caractère rural	W4
Communes touristiques	Activités agricoles	

Source: Dessoy (1998), typologie socio-économique des communes, p15.

Analogy Flemish and Brussels clusters:

Tableau comparatif des résultats de l'analyse des clusters

Caractère dominant	Spécificité complémentaire	Flandre	Wallonie	Bruxelles
Communes agricoles	Moyennement agricole	V1	W3	
	Fortement agricole	V5	W9 / W10	
Communes résidentielles («niveau de vie»)	***Revenus < moyenne régionale***			
	Expansion démographique	V2		B4
	Déclin démographiqhe		W 1	B4
	Revenus > moyenne régionale	V8	W5	
	Rurales	V6	W7	B2
	Revenus moyens	V4	W13	B I
	Revenus élevés	V12	W13	B1
Communes urbaines («attractivité -externalités»)	Petites villes;	V3	W8	
	Villes régionales	V9	W12	
	Grandes Villes	V10	W11	B5

Source: Dessoy (1998), typologie socio-économique des communes, p35.

Table 3: interaction using the contiguity weight matrix, benchmark case

WEIGHT MATRIX	CONTIGUITY			
Dependent variable	LIT		LPT	
Estimation method	FE	RE	FE	RE
W*LIT	0,589789***	1,101584***	-24,483993	92,700128***
	(8,608922)	(13,137385)	(-0,728042)	(2,641477)
W*LPT	0,000722***	-0,000068	1,029191***	0,843637***
	(5,141695)	(-0,472952)	(14,934525)	(12,383584)
LAB	-0,000047***	-0,000007***	-0,01264***	0,000551
	(-7,540621)	(-4,36159)	(-4,154521)	(0,443821)
POP	0,000014*	0,000009***	0,014295***	0,002797***
	(1,757621)	(9,008744)	(3,597029)	(4,024245)
%YOUNG	0,021856***	0,014496**	0,201525	1,425158
	(2,759398)	(2,144753)	(0,051831)	(0,421483)
%OLD	-0,03634***	-0,000538	1,347151	15,348948***
	(-3,460516)	(-0,06633)	(0,261334)	(3,485745)
MEDINC	-0,000008*	-0,000014***	0,004164*	-0,002644
	(-1,725775)	(-4,98921)	(1,73556)	(-1,522665)
R^2	0.1758	0.1206	0.5038	0.5075
σ_v	0.4031	0.1310	9.7126e+004	3.7159e+004
σ_i		0.6127		6.7267e+005
ψ	-0.6161	-0.7353	-4.2788	-4.1689

Significant at the 1% level (***), the 5% level (**) and the 10% level (*); t-statistic in parentheses.

Table 4: interaction using population classes and combined distance and population classes weight matrices.

WEIGHT MATRIX	POPULATION CLASSES				COMBINED DISTANCE POP CLASSES			
Dependent variable	LIT		LPT		LPT		LPT	
Estimation method	FE	RE	FE	RE	RE	RE	FE	RE
W*LIT	1,198541***	1,533837***	523,664282***	705,882525***	0,630376***	1,076688***	216,936074***	154,185039***
	(11,071429)	(13,561677)	(9,567188)	(13,597364)	(5,585123)	(12,832996)	(3,857645)	(4,588694)
W*LPT	-0,000302*	-0,000794***	0,149505*	-0,114273	0,000631***	0,00001	0,627194***	0,800007***
	(-1,684557)	(-3,868592)	(1,648383)	(-1,149706)	(3,307033)	(0,05848)	(6,59481)	(11,16106)
LAB	-0,000031***	-0,000014***	0,002692	-0,000419	-0,00003***	-0,000012***	0,002876	0,000552
	(-5,236084)	(-8,005047)	(0,889435)	(-0,540892)	(-5,037339)	(-6,949256)	(0,973738)	(0,704611)
POP	0,000011	0,000009***	0,014444***	0,000818*	0,000018	0,000007***	0,012319***	--0,000626
	(1,386524)	(7,791794)	(3,526737)	(1,682204)	(0,983469)	(6,572183)	(3,02548)	(-1,416731)
%YOUNG	-0,018326**	0,007983	-19,979121***	-0,248526	-0,005504	0,003216	-12,797629***	-5,865866**
	(-2,277098)	(1,160011)	(-4,909905)	(-0,078909)	(-0,690913)	(0,481248)	(-3,224553)	(-2,008995)
%OLD	0,014198*	0,010714	56,949915***	49,1511***	-0,00909	-0,002267	42,434174***	29,897273***
	(1,734623)	(1,637399)	(13,760824)	(16,318658)	(-1,044736)	(-0,329878)	(9,788826)	(10,019652)
MEDINC	-0,000023***	-0,000063***	0,006177***	-0,040044***	-0,000019***	-0,000049***	0,007179***	-0,031847***
	(-5,2074)	(-18,062848)	(2,77632)	(-24,822392)	(-4,333254)	(-14,659945)	(3,30992)	(-21,944483)
R^2	0.1859	0.1206	0.4788	0.3607	0.2025	0.1553	0.5054	0.4396
σ_v	2.3956	0.1433	6.1241e+005	3.9025e+004	0.4225	0.1454	1.0488e+005	3.7025e+004
σ_i		0.7597		1.5247e+005		0.7820		1.3584e+005
ψ	-2.9596	-2.3438	0.0488	0.1660	-0.6801	-0.1587	-0.2160	-0.0387

Significant at the 1% level (***), the 5% level (**) and the 10% level (*); t-statistic in parentheses.

Table 5: interaction using socio-economic classes and combined distance and socio-economic classes weight matrices.

WEIGHT MATRIX	SOCIO-ECONOMIC CLASSES				COMBINED DISTANCE AND SOC-ECO CLASSES			
Dependent variable	LIT		LIT		LPT		LPT	
Estimation method	FE	FE	RE	FE	RE	RE	FE	RE
W*LIT	1,036567***	1,164295***	184,078027***	278,804218***	0,920578***	1,00167***	102,087583***	121,296674***
	(21,68139)	(31,065867)	(7,900584)	(15,774434)	(14,620322)	(19,494837)	(3,383393)	(5,349285)
W*LPT	-0,000012	-0,000105	0,659706***	0,683141***	0,000191	0,000172*	0,815545***	0,899155***
	(-0,111027)	(-1,14803)	(12,053995)	(16,192397)	(1,406149)	(1,684001)	(12,557172)	(20,191956)
LAB	-0,000032***	-0,000011***	-0,002548	-0,000454	-0,000029***	-0,000011***	-0,00048	-0,000168
	(-5,240652)	(-6,098856)	(-0,867766)	(-0,562353)	(-4,980938)	(-6,202984)	(-0,169647)	(-0,230114)
POP	-0,000007	0,000007***	0,004553	0,00087*	-0,000003	0,000007***	0,006403*	0,000385
	(-0,862636)	(6,582042)	(1,155379)	(1,770019)	(-0,403943)	(6,482564)	(1,692369)	(0,872585)
%YOUNG	0,010669	0,002435	-1,952998	4,434169	0,017827	0,019193	-2,645749	5,291825*
	(1,335389)	(0,358547)	(-0,501615)	(1,403122)	(0,990232)	(1,408512)	(-0,698481)	(1,853446)
%OLD	0,0213**	0,023016***	36,75566***	42,559433***	0,001953	0,01743	21,586245***	23,501633***
	(2,366428)	(3,423593)	(8,379248)	(13,72274)	(0,199148)	(1,042149)	(4,593531)	(7,574023)
MEDINC	-0,000002	-0,000011***	0,007463***	-0,00764***	-0,000006	-0,000011***	0,003215	-0,008238***
	(-0,459063)	(-3,599364)	(3,269128)	(-5,503247)	(-1,174845)	(-3,666842)	(1,372242)	(-6,592736)
R^2	0.1811	0.1715	0.5141	0.4201	0.2065	0.2059	0.5448	0.5120
σ_v	4.6274	0.1101	1.0990e+006	3.4886e+004	0.7602	0.1287	1.7456e+005	3.1784e+004
σ_i		0.7082		1.8253e+005		0.7098		1.5697e+005
ψ	-4.4871	-0.1756	-0.9480	-0.2970	-1.2593	0.0319	-0.8271	-0.4675

Significant at the 1% level (***), the 5% level (**) and the 10% level (*); t-statistic in parentheses.

Table 6: interaction using income classes and combined distance and income classes weight matrices.

WEIGHT MATRIX	INCOME CLASSES				COMBINED DISTANCE AND INCOME CLASSES			
Dependent variable	LIT		LIT		LPT		LPT	
Estimation method	FE	FE	RE	FE	RE	RE	FE	RE
W*LIT	1,316731***	1,036343	654,565764***	98,266841	1,177741***	1,018413***	262,914328***	-10,661917
	(11,650984)	(0)	(11,54525)	(0)	(9,741729)	(26,999555)	(4,433162)	(-0,730353)
W*LPT	-0,000512***	0,000023	-0,06627	0,777408***	-0,000417*	-0,00001	0,459147***	0,957631***
	(-2,760098)	(0,179008)	(-0,712434)	(13,517993)	(-1,885095)	(-0,081252)	(4,235937)	(18,785875)
LAB	-0,00005***	-0,000014***	-0,008544***	-0,000628	-0,000045***	-0,000012***	-0,008584***	-0,000916
	(-8,170645)	(-7,991556)	(-2,786962)	(-0,846254)	(-7,277246)	(-6,868325)	(-2,838041)	(-1,338672)
POP	0,000023***	0,00001***	0,022604***	0,001988***	0,000025***	0,000009***	0,018784***	0,001912***
	(2,87416)	(8,916101)	(5,513222)	(4,366319)	(3,072737)	(8,307289)	(4,619344)	(4,577191)
%YOUNG	-0,006355	0,007516	-14,740074***	-5,034166*	-0,00253	0,010212	-12,590192***	-3,392237
	(-0,789847)	(1,099905)	(-3,65203)	(-1,646683)	(-0,314723)	(1,520279)	(-3,19269)	(-1,2011)
%OLD	0,016782**	-0,004887	60,080119***	31,248711***	0,017525*	-0,006397	43,563028***	19,298123***
	(2,036305)	(-0,728025)	(14,531273)	(10,458794)	(1,760774)	(-0,918465)	(8,922231)	(6,698326)
MEDINC	0,00002***	-0,000001	0,026721***	0,001953*	0,000019***	0	0,014596***	0,002286***
	(3,521869)	(-0,227013)	(9,44488)	(1,927036)	(2,98816)	(0,054545)	(4,650412)	(2,74903)
R^2	0.1733	0.1328	0.4802	0.4028	0.1734	0.1631	0.5031	0.4704
σ_v	1.6526	0.1456	4.1591e+005	3.8950e+004	0.8649	0.1374	2.0814e+005	3.7220e+004
σ_i		0.7657		1.4629e+005		0.7719		1.2615e+005
ψ	-2.2636	-1.9803	0.1638	0.1610	-1.3612	0.0734	-0.1690	-0.0929

Significant at the 1% level (***), the 5% level (**) and the 10% level (*); t-statistic in parentheses.