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- March 2012 -

JEL CODES : H2 ; H3 ; H7

Working Paper GAEL ; 2012-02

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DOES FISCAL COOPERATION INCREASE LOCAL TAX RATES IN URBAN AREAS?

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Abstract:

The main purpose of this paper is to assess the effects of fiscal cooperation on local taxation in a decentralized country, using the French experience in urban municipalities. We estimate a model of tax setting for local business tax using spatial and dynamic econometric techniques, for the period 1993-2003 and an unbalanced data set. As predicted by the theory, we find that reducing the number of municipalities is likely to limit tax competition and, as a consequence, increase local business tax rates.

Keywords: *fiscal cooperation, tax competition, vertical externalities, local business tax*

Classification JEL: *H2 H3 H7*

1. Introduction

Following seminal work by Zodrow and Mieszkowski (1986), Wilson (1986) and Wildasin (1988) – see Wilson (1999) for a survey – many theoretical studies have emphasized that tax competition can result in inefficiently small levels of local public spending. The reason for this is that when tax bases are mobile, the fiscal action of a benevolent authority will affect the budget constraint of another jurisdiction, through a policy-driven flow of resources between localities. Consequently, taxes can remain inefficiently low. The inefficiency is based on the fact that each jurisdiction sees capital flight as a cost and does not consider the positive fiscal externalities generated for other localities. Local authorities perceive the marginal cost of public funds as being higher than the true cost to the economy as a whole.

Possible policy correctives for the undersupply of local public goods have been discussed extensively in the literature. Several alternatives have been proposed to correct for this inefficiency: a state (or federal) intervention, such as the imposition of minimum tax requirements on local authorities, an increase in revenue sharing or matching grants to lower the cost of local public services, the provision of local public goods by state (or federal) governments or the consolidation of local jurisdictions. In relation to this last, Hoyt (1991) demonstrates that limiting competition by reducing the number of the localities in a metropolis increases tax rates and welfare. A smaller number of jurisdictions reduces the externalities due to capital flow and, therefore, reduces the differences to the social optimum. In this model, therefore, the optimal number of jurisdictions is one. However, for Hoyt, there is a trade-off between erasing horizontal fiscal externality by reducing the number of jurisdictions, and promoting taste stratification *à la* Tiebout based on a large number of jurisdictions.

Consolidation can take different forms - from municipal mergers to fiscal cooperation. Many European countries have implemented waves of inter-municipal cooperation: Austria and Sweden in the 1950s, Germany and Belgium in the 1970s and, more recently, Switzerland, Greece, Denmark and Latvia (Hulst et al., 2009). Although, the need for local authorities to cooperate over the provision of local public goods is on the political agenda of many officials, very few empirical papers investigate the impact of such cooperative agreement on local public policies.[1] The present paper aims to assess the effects of fiscal cooperation on local taxation based on French experience.

The French case offers a favourable setting for research on fiscal cooperation. Local government is structured broadly in three or four tiers: the lowest tier comprises some 36,600 municipalities, the second tier consists of 96 counties and the top tier is the 22 regions of France. Each layer of local government has wide fiscal autonomy: each level sets its own tax rates on a common tax base, for a large range of direct local taxes, which account for 75% of local tax revenues. Furthermore, most French municipalities (about 90% in 2006) are grouped within larger jurisdictions (known as 'Etablissements Publics de Coopération Intercommunale' or EPCI). These jurisdictions, together with the municipalities, have a large degree of autonomy to set local business tax rates. They can set a single business tax rate ("Taxe Professionnelle Unique") or apply an additional business tax rate. In the first case, this single tax rate applies to all jurisdictions that belong to the inter-municipal group, meaning that the municipalities are not free to set their own business tax rates. Thus, this fiscal cooperation regime effectively merges or consolidates the municipalities. In the case of an additional business tax rate, an additional level of local government is introduced, allowing localities and inter-municipal jurisdictions to tax the same business base.

The main contribution of this paper is that it exploits this empirical setting and allows us to test the impact of fiscal cooperation on multi-level government. We estimate a model of tax setting for the local business tax for the period 1993-2003, using spatial and dynamic econometric techniques and an unbalanced data set. As predicted by the theory, we find that fiscal cooperation is likely to limit tax competition and, as a consequence, to increase local business tax rates.

The paper is organized as follows. Section 2 presents a simple model of capital taxation in multi-level government. Sections 3 and 4 discuss the data and the empirical design. Section 5 presents the results for the estimates on the impact of consolidation on tax rate levels. Section 6 provides robustness checks using Generalized Method of Moments (GMM) and Section 7 concludes.

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[1] Ermini (2009) and Ermini and Santolini (2010) investigate the impact of inter-jurisdictional agreements in Italy, focusing on local public spending.

2. Theoretical background

This section presents a simple framework that allows us to capture the effect of consolidation on local business tax rates in a decentralized country. Extending Hoyt (1991), our aim is to investigate the impact of the number of competing localities on local business tax rates in a multi-level government. The model thus combines the simultaneous existence of horizontal and vertical externalities.[2]

We consider a very simple model of capital taxation with two layers of local government (municipality and region) co-occupying the same tax base. We suppose that the common tax base is the capital employed by a single, perfectly competitive, representative firm. This firm produces a homogeneous private good using two inputs: capital and labour. Labour is assumed to be fixed in production, but capital is a variable factor. We can write the production function of the representative firm as $f(k)$ where k denotes the employed capital; f is increasing in k, with decreasing marginal production of capital ($f'' < 0$). The representative firm maximizes its profits with respect to k, yielding

$$f'(k) = p_k \tag{1}$$

Equation (1) implicitly defines the firm's capital demand as $k(p_k)$ with $k' = 1/f''$, where $p_k = \rho + t_1 + t_2$ denotes the pre-tax return on capital, ρ is the exogenous post-tax return, and t_1 and t_2 respectively are the tax rates set by the upper (i.e. the region) and the lower (i.e. the municipality) layers of government.

We suppose that each layer of government plays Nash relative to the other layer. Following Andersson et al. (2004), the utility function can be written such that municipal and regional public goods are not separable. For municipal government, the maximization problem is:

$$\max_{t_2} v(w) + h_2(z_2 \cdot z_1^{\delta}) \text{ subject to } z_2 = t_2 k(p_K) \tag{2}$$

[2] Theoretical tax competition models with horizontal and vertical externalities are developed by Flowers (1988), Keen and Kotsogiannis (2002, 2004), Keen (1995, 1998), Wrede (1996), Flochel and Madies (2002), Bucovetsky (2009).

where $v(\cdot)$ and $h_2(.)$ are strictly concave and $\delta \in [0,1]$ is an exogenous parameter capturing the extent to which municipal and regional public services are complements; complementarity is maximum for $\delta = 1$ and minimum for $\delta = 0$. For the sake of simplicity, complementarity is assumed to be at maximum, i.e. $\delta = 1$. [3]

Since capital owners are supposed to be outside the economy, the gross wage rate $w = f(k(p_K)) - k(p_K)f'(k(p_K))$ is assumed to be the only source of revenue for the representative citizen. z_1 and z_2 respectively are regional and municipal public goods.

The first order condition (FOC) of the maximization problem is:

$$h_2' = z_1^{-\delta} / (1 + t_2(k'/k)) = MCPF \qquad (3)$$

Assuming that the marginal utility of private consumption is equal to 1, the left side of equation (3) is just the marginal benefit (MB) of the municipal-provided public good, while the right side is usually defined as the marginal cost of public funds (MCPF). In evaluating the MCPF, municipal government recognizes only erosion of its own tax base, induced by a higher tax rate. However, the true MCPF might also include erosion of the regional tax base. Municipal government then underestimates the true MCPF and sets a tax rate that is too high from a social point of view. This is a well-known result from a tax competition model with vertical interactions (see e.g. Flowers, 1988; Keen and Kotsogiannis, 2002, 2004).

From FOC (3), we obtain the municipal tax setting function:

$$t_2 = t(t_1, \rho) \qquad (4)$$

As the tax reaction function cannot be signed unambiguously, it is necessary to conduct an empirical analysis to establish the direction of the vertical tax interaction.

The above analysis focuses only on the vertical interaction resulting from tax base sharing, thus it ignores the possibility of fiscal interdependencies due to tax base mobility among municipalities. Together with vertical interactions, we now include into the model the presence of horizontal tax interactions.

For the sake of simplicity in dealing with horizontal tax competition among municipalities, capital is assumed to be costlessly mobile across N identical municipalities

[3] Charlot and Paty (2010) provide some support for this assumption in the French case.

$(i = 1,..., N)$, and relocates until it earns the same net return on capital in each of them, Thus:

$$f'(k_2^i) - t_1 - t_2^i = f'(k_2^j) - t_1 - t_2^j = \rho \qquad \forall i \neq j \qquad (5)$$

where t_1 is the regional tax rate, t_2^i (t_2^j) is the tax rate in the municipality i (j), and k_2^i (k_2^j) is the capital invested in municipality i (j). From (5), it is easy to show that

$$k_2^i = k(t_1, t_2^i, t_2^{-i}) \qquad (6)$$

where $-i$ represents "the set of competing municipalities". Note that we have $dk_2^i / dt_2^i < 0$ and $dk_2^i / dt_2^{-i} > 0$.

In order to analyse tax competition under the assumption of strategic interactions among identical municipalities, we assume also that the regional economy is closed so that $\rho(\tau_2^1, \tau_2^2, ..., \tau_2^N)$ is implicitly defined by the following market-clearing condition:

$$NS(\rho) = \sum_{i=1}^{N} k_2^i(\rho + \tau_2^i) \qquad (7)$$

where $S(\rho)$ is the supply of savings in each municipality, and $\tau_2^i \equiv t_1 + t_2^i$ is the aggregated tax rate borne by capital in the municipality *i*. We then have:

$$\partial\rho / \partial\tau_2^i = \frac{1}{N}\left[\frac{k_2'(\rho + \tau_2^i)}{S'(\rho) - k_2'(\rho + \tau_2^i)}\right] \in (-1,0) \qquad (8)$$

The FOC of the maximization problem of a given municipality becomes:

$$h_2' = z_1^{-\delta}\left[1 + \frac{t_2^i k_2'}{k_2}\left(1 + \frac{k_2'}{N(S' - k_2')}\right)\right]^{-1} = MCPF \qquad (9)$$

Equation (9) shows that the MCPF increases with the number *N* of competing municipalities. The higher the MCPF, the lower the equilibrium tax rate and public spending is. As shown in the standard literature, competition has a negative impact on the municipal tax rate level. Conversely, when *N* decreases, the government will set a higher tax rate and supply more public services. This outcome is in line with Hoyt (1991) who demonstrates that limiting competition by reducing the number of localities in a metropolis increases tax rates.

Finally, from (9), we obtain the municipal tax setting function:

$$t_2^i = t(t_1, t_2^{-i}, N) \qquad (10)$$

The tax rate chosen by a municipality depends not only on the tax rates set by the upper layer of government, but also on the tax rates and on the number of competing municipalities. As in Hoyt (1991) without vertical interaction, the theoretical prediction of this model combining horizontal and vertical interactions is the following: the lower the number of competing municipalities, the less intense the horizontal tax competition, the higher will be the tax rate. However in our model there also is an impact of tax rate decided by the upper layer of government, although empirical analysis is needed to establish the sign of this impact.

3. Data

3.1. The French institutional context

The French local institutional context is characterized by three or four overlapping tiers of local government. The lowest tier is made up of 36,000 municipalities, the middle-tier of 96 counties, and the highest level of local government is constituted by 22 regions. Most municipalities are grouped (voluntarily) into inter-municipal jurisdictions or EPCI. Since the 'Chevènement' law enacted in 1999, these groups of municipalities are particularly favoured[4] in France, and this structure is being chosen by a growing number of municipalities (almost 30,000 in 2003). The municipalities and EPCI are responsible for local urban services, building maintenance provision of nurseries and primary schools and sports facilities, and maintenance of municipal roads and urban public transport. The counties administer social assistance, and maintain departmental roads and middle schools. Regions are responsible for the provision of vocational training, economic development and building, and maintenance of high schools.

Local revenues come from taxation (54%) and grants (23%). The local business tax (or "Taxe Professionnelle") is the major source of local governments tax revenue, accounting for approximately 45% of the revenue derived from direct local taxes.[5] The tax base consists mainly of capital goods and is based on the rental values of buildings and of equipment (assumed to be 16% of the original equipment cost). The remaining fiscal revenues are collected from households in the form of residential tax ("taxe d'habitation"), property tax ("taxe foncière sur le bâti") and land tax ("taxe foncière sur le non bâti").

[4] An extra state grant is awarded to inter-municipal jurisdictions that opt for the single business tax regime.

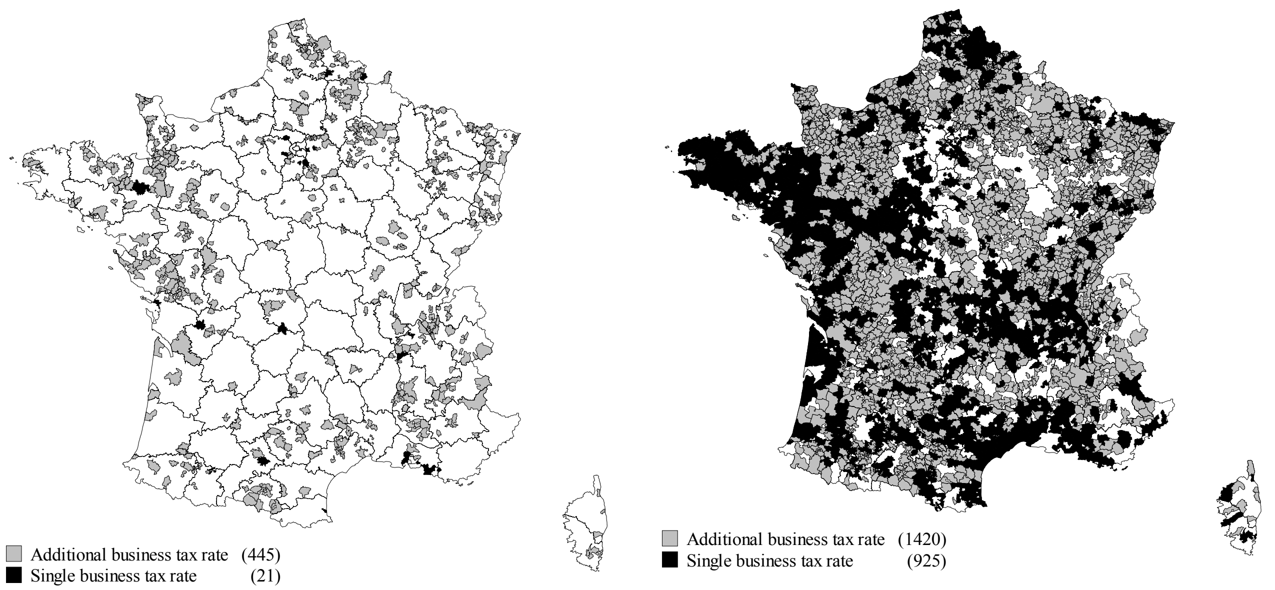
[5] This tax was removed in 2010 and replaced by a territorial economic contribution based on property and value added.

Regions, counties, inter-municipal jurisdictions and municipalities have large autonomy in setting their tax rates on this tax base. The “local tax varying power” is the proportion of local resources represented by tax revenue, over which local authorities have some control; France has the second highest level of tax autonomy (54%) in the European Union, compared with 20% in Germany which is a federal country, Spain (35%) which is close to being a federal country, and the UK at 14%. Furthermore, the degree of tax revenue decentralization, computed as the ratio between sub-national government own tax revenue over consolidated general government total tax revenue, was equal to 18.4% in France in the period 1999-2001, while in the EU-15 it was 14% on average for the same period (see Stegarescu (2005) using OECD categories of tax autonomy).

As already noted French inter-municipal communities can impose an additional business tax rate or apply a single tax rate or “Taxe Professionnelle Unique”. In the latter case, municipalities forfeit their right to set their own business tax rates. Map 1 shows that inter-municipal cooperation increased greatly over the period of study (1993-2003).

Map 1: Distribution of inter-municipal jurisdictions and their tax regimes

in 1993 in 2003



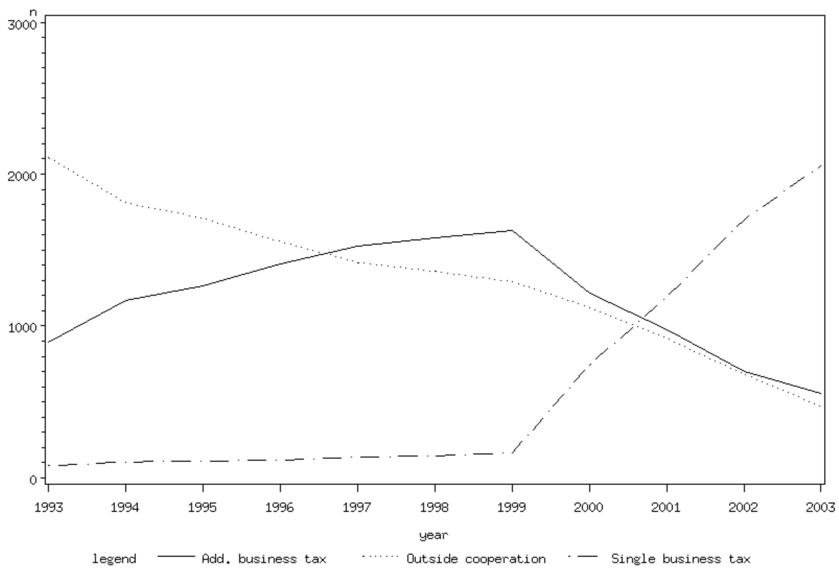
3.2. Urban municipalities and local jurisdictions

Here we are interested in municipalities that belong to urban employment centres, as defined by the French National Statistics Institute (INSEE).[6] In 1999, metropolitan France had 354 urban centres of employment accounting for at least 5,000 jobs. Note that the French definition of an urban employment centre is quite broad and is similar to the US metropolitan area except that the employment threshold is much lower (5,000 jobs compared to 100,000 inhabitants).

Urban employment centres, our sample, include around 3,000 municipalities. However, for all these municipalities we take into account possible interactions with neighbouring municipalities (located within a radius of 50 kilometres) whether or not they are included in our initial sample of municipalities. Fiscal data come from the Direction Générale des Collectivités Locales (DGCL, Ministère de l'Intérieur).

Graph 1 shows the number of municipalities in our sample, for each type of fiscal cooperation regime, over the period 1993 to 2003. At the beginning of the period, most municipalities do not cooperate. At the end of the period, most urban municipalities are part of the cooperation regime, which, since 1999, qualifies them for an extra state grant if they apply a single business tax rate.

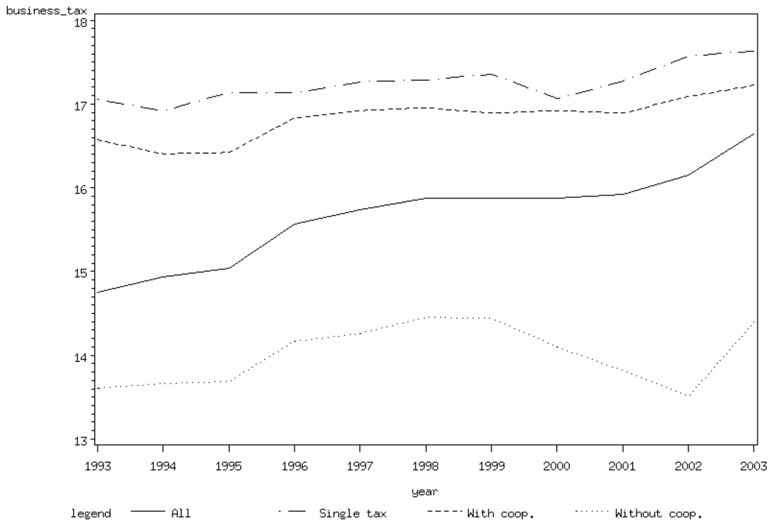
Graph 1: Distribution of municipalities in each fiscal cooperation regime



[6] The choice of urban municipalities introduces a possible selection bias. However, tax rates are not available for all rural municipalities.

Graph 2 shows the evolution of the business tax rate with or without fiscal cooperation. Municipalities that belong to single business tax jurisdictions impose heavier taxes than municipalities that are outside jurisdictions. The average difference between these two fiscal choices is about 3 points.

Graph 2: Distribution of municipalities in and out fiscal cooperation



Our basic data set thus contains three types of jurisdictions: isolated municipalities (outside cooperation); municipalities that belong to an additional tax jurisdiction' and municipalities that belong to a single business tax rate jurisdiction. As we are interested in taxation behaviour and consolidation, isolated municipalities and municipalities belonging to an additional tax rate jurisdiction were treated the same way: they are considered as a single observation. For isolated municipalities, the tax rate corresponds to the municipal rate. For municipalities belonging to an additional tax rate jurisdiction, the tax rate is the sum of the municipal and inter-municipal tax rates.[7] All other variables are also observed at the municipal level. For single business tax jurisdictions, the level of observation is the inter-municipality. The tax rate observed, as well as all other variables, is the inter-municipal tax rate.

[7] The inter-municipal tax rate is the same for all municipalities belonging to that cooperation form and is set by the inter-municipal jurisdiction.

Graph 2 shows that the majority of municipalities have changed their cooperation status over time; some municipalities joined an inter-municipal group, whatever its fiscal status (additional or single business tax), others left one jurisdiction to join another (often), or to return to being autonomous (very rarely). Some jurisdictions have changed fiscal status, often (but always) moving from the additional tax regime to the single business tax.

Our analysis concerns urban municipalities as defined by INSEE. However, one jurisdiction is included in the data set when it contains one of these urban municipalities. Our sample is therefore much more larger than a sample of only these urban municipalities. In order to calculate the time lag variables, one spatial unit (municipality or SBT jurisdiction) should be present in the sample for at least two years. The Paris municipality is excluded because of its very specific fiscal status.[8] Table 1 presents the sample structure.

Table 1: Sample structure

Year	Spatial units (*)	Municipalities outside SBT jurisdiction	SBT jurisdictions	Municipalities inside SBT jurisdiction urban areas	Municipalities inside SBT jurisdictions outside urban areas
1993	2,989	2,975	14	79	64
1994	2,995	2,975	20	103	109
1995	2,997	2,975	22	111	127
1996	2,996	2,973	23	115	130
1997	2,985	2,955	30	136	187
1998	2,981	2,948	33	144	206
1999	2,969	2,929	40	163	252
2000	2,479	2,350	129	739	852
2001	2,108	1,899	209	1,189	1,475
2002	1,594	1,385	209	1,211	1,616
2003	1,234	1,028	206	1,236	1,650

(*) municipality or SBT jurisdiction

Table 1 shows how fiscal cooperation enlarged after 1999. At the beginning of the period, the number of SBT jurisdictions was very small with only 143 municipalities, and 2,975 municipalities outside this form of inter-municipality. Between 1999 and 2001, the number of SBT jurisdictions increased fivefold and remained stable until the end of period. The number of municipalities joining a SBT jurisdiction continued to increase after 2001. In 2003, there were 1,028 municipalities and 206 SBT jurisdictions, including 2,886 municipalities.

[8] Paris is a municipality, but also a county.

Therefore, our sample is definitively an unbalanced panel in which observations and their characteristics change over time. It consists of a total of 2,981 municipalities and 209 SBT jurisdictions. Because of the introduction of a time lag which deletes the first year observed, the estimates refer to 25,137 observations. In this sample, there are 12,941 observations related to municipalities belonging to an additional tax jurisdiction. On average, the share of local taxation due to an additional tax regime is only 21% of the total local tax rate (municipal plus inter-municipal). 71% of municipalities that join a SBT jurisdiction belonged previously to an additional jurisdiction.

4. Empirical design

Since the aim of this paper is to study the effects of fiscal cooperation on local taxation in a multi-level government context, we have to deal with horizontal and vertical tax interactions. To take account of possible horizontal tax interactions, we need to consider spatial dependence in a panel data framework. From theoretical framework, the municipal tax setting function (equation (10)) provides a local policy reaction function that can be written as follows:

$$t_{i,t} = R(t_{j,t}, T_{i,t}, N) \tag{11}$$

where $t_{i,t}$ is the vector of tax rates in a municipality or in a SBT jurisdiction i at time t,[9] $t_{j,t}$ is the vector of tax rates in the set of the other municipalities or SBT jurisdictions j ($j \neq i$) at time t, $T_{i,t}$ is the vector of tax rates applied by other tiers (county, region) in observation i at time t, N is the number of jurisdictions.

This reaction function is in line with the literature on tax interactions (see, e.g., Brueckner and Saavedra, 2001; Brueckner, 2003; Revelli, 2001, 2003; Solé-Ollé, 2003), but it also takes into account the consolidation effect, i.e., the fact that reducing the number N of competing localities increases tax rates.

[9] The SBT rate or the municipal plus additional tax rate if the municipality cooperates, the municipal tax rate if it does not.

4.1. Cooperation effects

In order to deal with the theoretical prediction that limiting competition by reducing the number N of the increases tax rates, we use the French empirical setting where municipalities may or may not belong to an inter-municipality. Instead of introducing N in equation (11), we focus on cooperation process effects and introduce a dummy variable to capture belonging to an inter-municipal community for some observations (with SBT regime).

We investigate whether cooperation affects not only the jurisdiction tax rate, but also the tax interactions with neighbouring municipalities or SBT jurisdictions; thus, we include the interactions among the SBT dummy variable and tax rates in the set of other municipalities or SBT jurisdictions. The aim is to check whether horizontal tax interactions are stronger or not if the observation is an inter-municipal group. Because the number of competing jurisdictions decreases in conditions of fiscal cooperation, the horizontal tax interactions should decrease. Tax competition should be weaker among groups of municipalities than among isolated municipalities. Also, inter-municipal jurisdictions that set a single business tax rate will carry more weight and may be less influenced by the tax decisions of neighbouring localities.

A local feature variables vector is also introduced, to control for other jurisdiction characteristics. Finally, our econometric model, derived from the theoretical model, is as following:

$$t_{i,t} = R(t_{j,t}, \mathrm{SBT}_{\mathrm{i,t}}, \mathrm{SBT}_{\mathrm{i,t}} \times t_{j,t}, T_{i,t}, X_{i,t}) \qquad (12)$$

where $SBT_{i,t}$ is a fiscal cooperation dummy variable that takes the value 1 if the observation i is a SBT jurisdiction. The expected sign of $SBT_{i,t}$ is positive. $X_{i,t}$ is the vector of the economic features of the municipality or SBT jurisdiction i at time t.

4.2. Potential endogeneity of SBT dummy

The SBT jurisdiction dummy could potentially be subject to endogeneity since municipalities that choose to cooperate have common unobservable features that affect their tax rates. In order to address this possibility, we instrument the SBT dummy using two instruments. The first is share of the area represented by the spatial unit (municipality or group) in the total area of all units observed at time t. The larger the share occupied by a spatial unit, the more likely it cooperates. The second instrument is an index that measures the local propensity to cooperate. Map 1 shows that, historically, there has been a greater willingness for municipalities to cooperate in certain regions, such as the western part of France. Our index allows this regional effect to be taken into account. It is calculated as the ratio of number of SBT groups to number of spatial units divided by the ratio of number of municipalities in a SBT group to total number of groups. The index includes all the observations at time t, calculated in a radius of 50 km around the spatial unit observed. Therefore, it controls for variation in the local propensity to cooperate.

4.3. Spatial dependence

As suggested by Anselin (1988), an a priori set of interactions needs to be defined and tested. While a variety of weighting schemes could be applied, allowing different patterns of spatial interaction, a scheme commonly used in the relevant empirical literature assigns weights based on Euclidean distance or contiguity (Brueckner, 2003).

In line with this literature, we chose a precise geographical definition of neighbourhood based on the Euclidean distance between jurisdictions. This scheme imposes smooth distance decay, with weights w_{ij} given by $1/d_{ij}$ where d_{ij} is the Euclidian distance between jurisdictions i and j for $j \neq i$. ($w_{ij} = 1/d_{ij}$ if $d_{ij} \leq 25$ kms, otherwise $w_{ij} = 0$). The weight matrix (W^{d25}) is standardized so that the elements in each row sum to 1.[10] We replace the vector $t_{j,t}$ with a weighted average, such as $\sum_j w_{ij} * t_{j,t}$, which implies that every municipality responds in the same way to the weighted average tax rates.

We also test an alternative and commonly used weight matrix, the contiguity matrix (W^{contig}). The contiguity matrix considers that two geographic units i and j are neighbours if they have a common border (w_{ij}=1, otherwise w_{ij}=0).

These spatial weight matrices obviously change over the period since the number of observations changes over the period. Table 2 gives the number of spatial units used in the spatial lags, for W^{d25} and W^{contig}. The average number of neighbours is 3 for the contiguity

[10] Standardization may be justified for technical reasons. Parameter value is comprised between -1 and 1, which greatly facilitates its interpretation. However, the interpretation must be in terms of relative, not absolute, distance between units of observation. See Anselin (1988) for more detail.

matrix (W^{contig}) and 11 for the inverse distance matrix (W^{d25}). In both cases, we chose a broad definition of neighbourhood in order to avoid border effects. Neighbouring municipalities may belong to rural areas and may not be part of our initial sample of urban local jurisdictions.

Table 2: Weight matrices

Year	Number of observations	Number of neighbours W^{contig}	Number of neighbours W^{d25}
1993	2,989	7,647	30,830
1994	2,995	7,687	30,762
1995	2,997	7,701	30,701
1996	2,996	7,703	30,646
1997	2,985	7,716	30,485
1998	2,981	7,705	30,394
1999	2,969	7,699	30,202
2000	2,479	7,405	28,126
2001	2,108	7,067	25,924
2002	1,594	5,801	22,511
2003	1,234	4,824	19,353

The presence of the dependent variable on the right-hand side of equation (12) raises two main econometric issues.

First, if municipalities react to other's tax rate choices, then competing municipalities' taxation decisions are endogenous and correlated with the error term (ε). OLS (ordinary least squares) yields a biased estimate of parameter ρ (Anselin, 1988). There are two possible approaches that provide consistent estimates of the spatial parameter: the first is based on instrumental variables (IV) and the second is based on maximum likelihood. In this paper, we compute IV/GMM estimators for two main reasons. First, our main variable of interest (single business tax jurisdiction dummy) might be endogenous. Fingleton and Le Gallo (2007, 2008) show that IV/GMM estimators are useful in those cases where spatial dependence models contain one or more endogenous explanatory variables (apart from the spatially lagged dependent variable).[11] Second, as already argued, since neighbouring municipalities may belong to rural areas and not be part of our sample of urban local jurisdictions, the usual maximum likelihood (ML) routines cannot be used here. We need variables that are correlated with competing municipality tax choices, but are uncorrelated with the error term. We use the

[11] See also Elhorst (2010, p.15) on this issue.

weighted average of some of the neighbour control variables as instruments.[12].

Second, if neighbours' localities are subject to correlated shocks, we may find a correlation between jurisdictions' spending choices. Omitting the spatially dependent explanatory variables may generate spatial dependence in the error term, which is given by the following equation:

$$\varepsilon_{i,t} = \lambda W \varepsilon_{j,t} + \nu_{i,t} \tag{13}$$

If spatial error dependence is ignored, estimation of (12) may provide false evidence of strategic interaction. However, the IV method yields consistent estimations of (12) even with spatial error dependence.

4.4. Serial correlation

Serial correlation may arise because French municipal tax decisions can be persistent over time. To allow for possible serial correlation we include a time-lagged dependent variable (Devereux et al., 2007). This introduces correlation with the municipal fixed effect. To deal with this, we instrument the lagged dependent variable by including the municipal property tax rate and the municipal residential tax rate. The legislation restrains the evolution of these different local taxes; one municipality cannot modify its business tax rate independently for property or the residential tax rate. Any increases in the different local tax rates must be made jointly. This legislation ensures that local government cannot increase the business tax rate too hugely without the approval of the voters who pay residential and property taxes.

Therefore, our final specification is:

$$\begin{aligned} t_{i,t} = {} & \alpha_i + \beta t_{i,t-1} + \gamma SBT_{i,t} + \rho_1 Wt_{j,t} + \rho_2 Wt_{j,t} \times SBT_{i,t} + \delta T^C_{i,t} + \chi T^R_{i,t} \\ & + \phi Dens_{i,t} + \varphi Inc_{i,t} + \eta Young_{i,t} + \kappa Old_{i,t} + Time_t + \varepsilon_{i,t} \end{aligned} \tag{14}$$

where α_i is the municipal fixed effect, $SBT_{i,t}$ is the fiscal cooperation dummy, $Wt_{j,t}$ is the weighted tax rate of neighbouring municipalities, $Wt_{j,t}*SBT_{i,t}$ is the interaction variable between the weighted tax rate and the fiscal cooperation dummy, $T^C_{i,t}$ is the county tax rate, $T^R_{i,t}$ is the regional tax rate, $Dens_{i,t}$ is the municipal or jurisdictional density, $Inc_{i,t}$ is the average municipal or jurisdictional income, $Young_{i,t}$ is the share of residents aged under 14

[12] The list of instruments is detailed for each estimate in the relevant results tables.

years, and $Old_{i,t}$ is the share of people in the municipality or jurisdiction *i* aged over 60 years. $Time_t$ are year dummies included to capture common shocks.

In addition, county and regional business tax rates ($T_{i,t}$) might be endogenous. We instrument them with the county property tax rate and the regional property tax rate respectively. Once again, at these tiers, the different tax rates change in a coordinated way.[13]

We test the validity of the instrument sets using a standard over-identifying restrictions (Sargan/Hansen) test. A large value of the partial R^2 in the first step confirms that these instruments are sufficient to explain the endogenous variables. We treat the remaining control variables as exogenous.[14]

All variables are log-transformed. Summary statistics are presented in Appendix Table A1.

5. Results

Appendix Table A2 shows the results of the IV estimations using the within transformed model considering the SBT dummy as an exogenous variable. Since the fiscal cooperation dummy is time-invariant for each individual (with a value of 0 for 2,981 municipalities and a value of 1 for 209 cooperating localities), this variable is dropped in the within transformation (deviation from the individual mean). However, there are other ways of estimating the within model: we can introduce a dummy for each individual (3,190=2,981+209) and no constant term, or introduce a dummy for each individual and a constant term and restrict the sum of the individual dummies to be equal to zero. Using this second formulation, for the constant parameter we obtain the mean fixed effect, and the individual deviation from this mean in the dummies. This change in parameterization has no impact on the other estimated parameters. We followed the same reasoning to obtain our estimate of the SBT dummy and we restricted the sum of the 209 SBT jurisdictions dummies to be equal to zero.

Table 3 shows the results using the IV method when SBT is endogenous. The estimation results are very similar.

[13] As Reulier and Rocaboy (2009) argue, regions are not completely free to set their own tax rates. Limiting rules generate some relationships between business, housing and property tax rates.

[14] We performed standard exogeneity tests for the control variables; there was no evidence of endogeneity.

Table 3: Estimation results (endogenous SBT dummy)

Methodology	IV Within (1)	IV Within W^{contig} (2)	IV Within W^{contig} (3)	IV Within W^{d25} (4)	IV Within W^{d25} (5)
Intercept	0.351***	-0.129	-0.196*	-0.386***	-0.439***
Lagged endogenous variable, $t_{i,t-1}$	0.739***	0.695***	0.691***	0.714***	0.709***
Single Business Tax (SBT) jurisdiction dummy	0.014**	0.035***	0.684**	0.019***	1.110***
Neighbour's tax rates, $Wt_{j,t}$		0.245***	0.251***	0.333***	0.341***
Neighbour's tax rates*SBT jurisdiction			-0.256**		-0.438***
County tax rate, t^C	0.058***	0.044***	0.041***	0.031**	0.028**
Regional tax rate, t^R	-0.005	-0.004	-0.004	0.007	0.007
Density	0.033**	0.027*	0.039***	0.029*	0.038***
Average income	-0.004	-0.003	-0.004	-0.003	-0.003
Share of under 14s	0.014	0.024	0.021	0.027*	0.026*
Share of over 60s	-0.007	-0.005	-0.004	-0.001	-0.000
Time fixed effects	yes	yes	yes	yes	yes
Number of observations	25,137	25,137	25,137	25,137	25,137
Number of individuals	3,190	3,190	3,190	3,190	3,190
Weakness of instruments: *Partial adj. R^2*					
Lagged endogenous variable, $t_{i,t-1}$	0.528	0.530	0.531	0.531	0.532
Single Business Tax jurisdiction dummy	0.631	0.633	0.742	0.632	0.706
Neighbour's tax rates, $Wt_{j,t}$		0.485	0.498	0.535	0.591
Neighbour's tax rates*SBT jurisdiction			0.744		0.704
County tax rate, t^C	0.700	0.700	0.710	0.702	0.709
Regional tax rate, t^R	0.997	0.997	0.997	0.997	0.997
Validity of instruments: *Sargan test*	3.81 $\chi^2(2)$	1.50 $\chi^2(4)$	10.62 $\chi^2(15)$	3.90 $\chi^2(3)$	11.24 $\chi^2(7)$
Exogeneity test: *Fisher test*	135.98***	113.23***	94.58***	116.23***	97.31***

(1) Instruments: time lag of local property tax rate, time lag of local residential tax rate, county property tax rate, regional property tax rate, propensity to cooperate, share of area that the observation represent in the total area in the sample at time t. The propensity to cooperate is the ratio among the number of SBT groups and the number of spatial units divided by the ratio among the number of municipalities in a SBT group and the total number of groups (all variables are included at time t and calculated in a circle of 50 km around the spatial unit observed).
(2) Instruments: as (1) plus spatial lag of local property tax rate, spatial lag of the share of under 14s, spatial lag of the share of over 60s
(3) Instruments: as (2), plus spatial lag of local property tax rate multiplied by propensity to cooperate, spatial lag of local residential tax rate multiplied by propensity to cooperate, spatial lag of density multiplied by propensity to cooperate, spatial lag of average income multiplied by propensity to cooperate, spatial lag of the share of under 14s multiplied by propensity to cooperate, spatial lag of the share of over 60s multiplied by propensity to cooperate, spatial lag of local property tax rate multiplied by share of area, spatial lag of local residential tax rate multiplied by share of area, spatial lag of density multiplied by share of area, spatial lag of average income multiplied by share of area, spatial lag of the share of under 14s multiplied by share of area, spatial lag of the share of over 60s multiplied by share of area.
(4) Instruments: as (1), plus spatial lag of local property tax rate, spatial lag of the share of under 14s
(5) Instruments: as (4), plus spatial lag of local residential tax rate, spatial lag of local property tax rate multiplied by propensity to cooperate, spatial lag of local residential tax rate multiplied by propensity to cooperate, spatial lag of local property tax rate multiplied by share of area, spatial lag of local residential tax rate multiplied by share of area.

Below, we present the main results of our estimations. Table 3 shows that the time-lagged endogenous variable ($t_{i,t-1}$) is always significant and takes a positive sign in all the specifications (columns 1 to 5). This result confirms the consistency of the autoregressive specification. Since the coefficients of the lagged business tax rates provide an estimate of about 0.7, we can assume relatively high levels of persistence in the tax rates. As expected, local business tax rates are likely to change very slowly over time.

The estimation results also confirm the existence of tax interactions among and between jurisdictions. First, the coefficients associated with a neighbour's tax rate ($Wt_{j,t}$) is always significantly positive, implying the existence of horizontal tax interactions between French jurisdictions. The estimate takes a value of about 0.3. This implies that an average tax increase of 10% in neighbouring jurisdictions induces an increase of around 3% in the business tax rate. Note that this result is close to those obtained in studies of other countries (see e.g. Heyndels and Vuchelen, 1998; Brueckner and Saavedra, 2001; Revelli, 2001; Richard et al., 2002; Solé-Ollé, 2003).

Second, the tax parameter associated with the county tax rate (T^C) is significantly positive, while the regional tax rate (T^R) is not significant. The estimation of our spatial tax model with several levels of local government, leads us to reject the hypothesis of vertical tax interactions between French local jurisdictions and the regional government level. However, county and local business tax rates seem to interact (as in Charlot and Paty, 2010). It seems that county and municipal/inter-municipal business tax rates are likely to be strategic complements because counties and localities supply many complementary local public services.

We turn next to the main estimation results associated with the fiscal cooperation parameter, which here represents implementation of the single business tax rate by the inter-municipal community. We find a positive and significant sign for the parameter associated with this fiscal regime ($SBT_{i,t}$) in all specifications. We can confirm our theoretical predictions that reducing the number of competing localities increases tax rates.

Result 1: Fiscal cooperation is likely to increase local business tax rates.

We investigate the extent of tax competition in more depth by interacting neighbour's tax rates with the single business tax rate (columns 3 and 5). [15] We find a significant and negative sign for the parameter associated with this interaction variable, and a positive and significant sign for neighbour's tax rates, which suggests that applying a single business tax rate is likely to decrease very much the intensity of the horizontal tax interactions. Horizontal tax interactions are thus strongly weaker if the observation is an inter-municipal group. Since the number of competing jurisdictions decreases in conditions of fiscal cooperation, the horizontal tax interactions decrease. Since both parameters have a very similar value (columns 3 and 5), this might suggest that there are no longer any tax interactions between a SBT group of municipalities and its neighbours. This outcome, in turn, would suggest that inter-municipal jurisdictions that set a single business tax rate carry more weight and are less (or not) influenced by the tax decisions of neighbouring localities.

Result 2: Fiscal cooperation is likely to reduce (cancel) horizontal tax interactions among neighbouring municipalities.

Finally, in terms of the estimation results associated with the remaining explanatory variables, the coefficient associated with population density has the expected positive sign: the larger the municipality's population, the greater will be local public needs. Average income - included to measure demand for public services at the municipal level, share of young (under 14s) and the share of elderly (over 60s), is never significant.

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[15] Note that. in columns 3 and 5 where we include interacted variables, the parameters associated with SBT dummy and neighbour's tax rates cannot be interpreted as capturing an unconditional effect of these variables (see Brambor *et al.*, 2006, p.72). In such a multiplicative interaction models, the coefficient of SBT only captures the effect of cooperation on business tax rate when there is no horizontal tax interaction among municipalities.

6. Robustness checks

To check the robustness of our results, we provide estimation results using GMM (Tables 4a, 4b and 4c). Wooldridge (2002) recommends providing efficient GMM estimates in the presence of arbitrary intra-cluster correlation. With this methodology, the intra-cluster correlation can be any form, from serial correlation to random effects or some other, therefore

we have no estimates for the time-lagged dependent variable. Estimates should also be efficient in the presence of spatial error dependence if spatially linked individuals are included in the same cluster.

Clusters are defined as follows. First, municipalities and the groups they belong to are included in the same cluster. Then groups are included in the same cluster when they comprise municipalities that are not in our sample, but have a common border with the observed groups. Finally, the 3,190 spatial units observed are distributed across 286 clusters. This methodology is aimed at controlling for spatial autocorrelation into each cluster.

The different sets of instruments are described in Table 4a. They are similar to those chosen in the previous section; propensity to cooperate, spatial lag of exogenous covariates, etc. We also introduce number of years the observation has been present in the sample to control for potential attrition. We follow the procedure described in Baum et al. (2003).

Since this procedure, which is applied to the within transformation, does not give a direct estimation of the parameter associated with our binary variable SBT, we run GMM to get a consistent estimate using the residuals obtained in the first stage (Table 4b). In Table 4c, we also provide a ML estimator using the same two-step method, which takes account of the binary nature of SBT using a probit (see Cameron and Trivedi, 2010, p. 193).

Table 4a : Estimation results first equation (GMM)

Methodology: GMM	(1)	(2) W^{contig}	(3) W^{contig}	(4) W^{d25}	(5) W^{d25}
Neighbour's tax rates, $Wt_{j,t}$		0.620***	0.596***	0.783***	0.817***
Neighbour's tax rates*SBT jurisdiction			-0.606***		-0.802***
County tax rate, t^C	0.118***	0.072**	0.079***	0.126***	0.088***
Regional tax rate, t^R	-0.032	-0.015	-0.022**	-0.014	-0.011
Density	0.080***	0.070***	0.053***	0.095***	0.058***
Average income	-0.032***	-0.020**	-0.019*	-0.023**	-0.020**
Share of under 14s	-0.005	0.010	-0.009	-0.013	-0.016
Share of over 60s	-0.039	-0.013	-0.020	-0.004	-0.023
Time fixed effects	yes	yes	yes	yes	yes
Number of observations	28,327	28,327	28,327	28,327	28,327
Number of individuals	3,190	3,190	3,190	3,190	3,190
Number of clusters	286	286	286	286	286
Underidentification test: *Kleibergen-Paap rk LM statistic*	46.04 $\chi^2(6)$***	55.42 $\chi^2(13)$***	76.32 $\chi^2(26)$***	46.00 $\chi^2(14)$***	73.32 $\chi^2(25)$***
Validity of instruments: *Hansen J statistic*	9.03 $\chi^2(5)$	18.23 $\chi^2(12)$	29.41 $\chi^2(25)$	19.68 $\chi^2(13)$	28.54 $\chi^2(24)$

(1) Instruments: county density, county average income, county share of over 60s, county property tax rate, county residential tax rate, regional share of over 60s, regional property tax rate

(2) Instruments: county density, county average income, county share of under 14s, county property tax rate, county residential tax rate, regional density, regional average income, regional share of under 14s, regional share of over 60s, regional property tax rate, spatial lag of density, spatial lag of average income, spatial lag of the share of over 60s, spatial lag of local property tax rate, spatial lag of local residential tax rate

(3) Instruments: as (2), plus county share of over 60s, spatial lag of the share of under 14s, spatial lag of density multiplied by observation area spatial lag of average income multiplied by observation area, spatial lag of the share of under 14s multiplied by observation area, spatial lag of the share of over 60s multiplied by observation area, spatial lag of local property tax rate multiplied by observation area, spatial lag of local residential tax rate multiplied by observation area, spatial lag of density multiplied by number of years that the observation is present in the sample, spatial lag of average income multiplied by number of years that the observation is present in the sample, spatial lag of the share of under 14s multiplied by by number of years that the observation is present in the sample, spatial lag of the share of over 60s multiplied by number of years that the observation is present in the sample, spatial lag of local property tax rate multiplied by number of years that the observation is present in the sample, spatial lag of local residential tax rate multiplied by number of years that the observation is present in the sample

(4) Instruments: as (1), plus county share of under 14s, regional average income, regional share of under 14s, spatial lag of density, spatial lag of average income, spatial lag of the share of under 14s, spatial lag of the share of over 60s, spatial lag of local property tax rate, spatial lag of local residential tax rate

(5) Instruments: as (4), plus spatial lag of density multiplied by observation area, spatial lag of average income multiplied by observation area, spatial lag of the share of under 14s multiplied by observation area, spatial lag of the share of over 60s multiplied by observation area, spatial lag of local property tax rate multiplied by observation area, spatial lag of local residential tax rate multiplied by observation area, spatial lag of density multiplied by number of years that the observation is present in the sample, spatial lag of average income multiplied by number of years that the observation is present in the sample, spatial lag of the share of under 14s multiplied by number of years that the observation is present in the sample, spatial lag of the share of over 60s multiplied by number of years that the observation is present in the sample, spatial lag of local property tax rate multiplied by number of years that the observation is present in the sample, spatial lag of local residential tax rate multiplied by number of years that the observation is present in the sample.

Table 4b: Estimation results second equation (GMM)

Methodology: GMM	(1)	(2) W^{contig}	(3) W^{contig} W^{contig}*SBT	(4) W^{d25}	(5) W^{d25} W^{d25}*SBT
Intercept	1.974***	0.450***	0.678***	-0.101***	0.164***
Single Business Tax (SBT) jurisdiction dummy	0.340***	0.331***	1.821***	0.279***	2.237***
Number of observations	3,190	3,190	3,190	3,190	3,190
Number of clusters	286	286	286	286	286
Underidentification test: *Kleibergen-Paap rk LM statistic*	69.35 $\chi^2(2)$***	69.35 $\chi^2(2)$***	69.35 $\chi^2(2)$***	69.35 $\chi^2(2)$***	69.35 $\chi^2(2)$***
Validity of instruments: *Hansen J statistic*	2.56 $\chi^2(1)$	0.08 $\chi^2(1)$	0.02 $\chi^2(1)$	0.12 $\chi^2(1)$	0.40 $\chi^2(1)$

(1)-(5) Instruments: observation area, number of years that the observation is present in the sample

Table 4c: Estimation results MLE

Methodology: MLE	(1)	(2) W^{contig}	(3) W^{contig} W^{contig}*SBT	(4) W^{d25}	(5) W^{d25} W^{d25}*SBT
Intercept	2.002***	0.459***	0.686***	-0.096***	0.168
Single Business Tax (SBT) jurisdiction dummy	0.172***	0.201***	1.698***	0.172***	2.133
Number of observations	3,190	3,190	3,190	3,190	3,190

(1)-(5) Instruments: observation area, number of years that the observation is present in the sample

The estimates are broadly the same as in the previous tables, which confirms the robustness of the previous results. The spatial lag parameter associated with neighbours' tax rates exhibits a higher value, around 0.7, and is positive and highly significant. When this variable is interacted with the SBT dummy, then again the value of the associated parameter offsets the previous value, suggesting that tax interactions between an inter-municipal jurisdiction and its neighbours are very weak. The parameter associated with the SBT dummy also remains significant and positive, although with a higher value than in the previous section, confirming that cooperation increases the level of business tax rates.

7. Conclusion

The theoretical literature frequently emphasizes that cooperation between local governments could resolve inefficiencies, but there are very few empirical studies analyzing effect of cooperation on the tax rate set by local governments. The objective of the present paper was to assess the effects of consolidation on local taxation, based on the French experience. Since 1999, local cooperation has been widely promoted by the French government with the provision of financial incentives to solve the problem of "municipal fragmentation". Municipalities and inter-municipalities have large autonomy to set their tax rates to finance their supply of public services. We exploited this empirical setting, which allowed us to test the impact of fiscal cooperation in a multi-level government structure. We estimated a model of tax setting for the local business tax using spatial and dynamic econometric techniques, based on an unbalanced panel for the period 1993-2003. Our results confirm that consolidation limits tax competition and increases the level of local business tax rates.

However, further research should be conducted to increase our understanding of the effect of fiscal cooperation on local public policies. For example, on the public spending side, the inter-municipal community might have been supplied new local services or better quality public services by. The supply of these new public goods may explain the observed increase in the local tax pressure.

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APPENDIX

Table A1: Summary statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Municipal tax rate	13.709	5.084	0.279	30.510
Neighbour's tax rates (W^{d25})	11.878	2.934	3.820	25.229
Neighbour's tax rates (W^{contig})	12.926	3.838	1.598	27.078
County tax rate	6.865	1.573	3.650	13.300
Regional tax rate	2.049	0.537	0.907	3.330
Density	1063.63	2055.301	17.138	24581.743
Average income	16.000	5.079	5.784	81.746
Share of under 14s	19.247	2.687	9.429	31.284
Share of over 60s	19.340	5.207	3.210	46.460

Note: All tax rates are in percentages. Number of observations: 25137.

Table A2: Estimation results (with exogenous SBT dummy)

Methodology	IV Within (1)	IV Within W^{contig} (2)	IV Within W^{contig} (3)	IV Within W^{d25} (4)	IV Within W^{d25} (5)
Intercept	0.346***	-0.157	-0.174*	-0.449***	-0.433***
Lagged endogenous variable, $t_{i,t-1}$	0.738***	0.694***	0.692***	0.712***	0.711***
Single Business Tax (SBT) jurisdiction dummy	0.014***	0.038***	0.696***	0.025***	0.653***
Neighbour's tax rates, $Wt_{j,t}$		0.246***	0.252***	0.335***	0.342***
Neighbour's tax rates*SBT jurisdiction			-0.262***		-0.254***
County tax rate, t^C	0.057***	0.044***	0.044***	0.029**	0.028**
Regional tax rate, t^R	-0.005	-0.004	-0.004	0.007	0.007
Density	0.034***	0.033***	0.034***	0.040***	0.036***
Average income	-0.004	-0.003	-0.004	-0.003	-0.003
Share of under 14s	0.013	0.023	0.022	0.026*	0.026*
Share of over 60s	-0.007	-0.005	-0.004	0.000	-0.000
Time fixed effects	yes	yes	yes	yes	yes
Number of observations	25,137	25,137	25,137	25,137	25,137
Number of individuals	3,190	3,190	3,190	3,190	3,190
Adj. R^2	0.495	0.510	0.511	0.506	0.507
Weakness of instruments: *Partial adj. R^2*					
Lagged endogenous variable, $t_{i,t-1}$	0.523	0.524	0.525	0.525	0.526
Neighbour's tax rates, $Wt_{j,t}$		0.483	0.485	0.536	0.536
Neighbour's tax rates*SBT jurisdiction			0.474		0.557
County tax rate, t^C	0.698	0.698	0.698	0.700	0.700
Regional tax rate, t^R	0.997	0.997	0.997	0.997	0.997
Validity of instruments: *Sargan test*	0.14 $\chi^2(1)$	1.44 $\chi^2(3)$	2.85 $\chi^2(5)$	3.46 $\chi^2(2)$	4.96 $\chi^2(3)$
Exogeneity test: *Fisher test*	180.82***	141.30***	112.81***	144.74***	113.92***

(1) Instruments: time lag of local property tax rate, time lag of local residential tax rate, county property tax rate, regional property tax rate
(2) Instruments: as (1) plus spatial lag of local property tax rate, spatial lag of the share of under 14s, spatial lag of the share of over 60s
(3) Instruments: as (2), plus spatial lag of local property tax rate multiplied by the SBT jurisdiction dummy, spatial lag of the share of under 14s multiplied by the SBT jurisdiction dummy, spatial lag of the share of over 60s multiplied by the SBT jurisdiction dummy
(4) Instruments: as (1), plus spatial lag of local property tax rate, spatial lag of the share of under 14s
(5) Instruments: as (4), plus spatial lag of local property tax rate multiplied by the SBT jurisdiction dummy, spatial lag of the share of under 14s multiplied by the SBT jurisdiction dummy