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THE FRENCH LOCAL TAX SETTING: DO INTERACTIONS AND AGGLOMERATION FORCES MATTER?*

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Abstract
The main purpose of this paper is to assess the existence of tax interdependencies among the French local tax setting by taking into account the agglomeration forces. We therefore estimate a model of tax setting for the local business tax using the spatial econometrics techniques for 2002. We observe mimic behaviour between localities, which is more intense in the urban area than in the rural area, suggesting that tax competition is harder as agglomeration increases. The relationship between tax rate and capital stock gives presumption of a "taxable agglomeration rent".

Key-words : tax interactions, spatial econometrics, agglomeration, urban area, rural area

Classification JEL : H2 H3 H7 C21

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1. Introduction

Within the vast body of literature on fiscal federalism, a great deal of work concerns tax externalities. Indeed, different kinds of externalities may result from the existence of governments operating in a federal system. On the one hand, a "horizontal externality" may arise when fiscal choices by a local jurisdiction affect fiscal decisions made by other competing local jurisdictions at the same level of government. That is the case for instance if the tax base is mobile across jurisdictions (see Wilson 1999, for a survey) or if local governments are able to export taxes (see, e.g., Bird and Slack 1983). On the other hand, a "vertical externality" may arise from fiscal interactions between different layers of government. That is especially the case when the various layers of government share the same tax base (see the papers by Flowers 1988; Wrede 1996; Keen 1998; Keen and Kotsogiannis 2002 2004).

By introducing agglomeration forces linked to the increasing returns to scale and the trade cost of goods, new economic geography has renewed this issue. Some models show that the level of trade openness and the extent of agglomeration forces have important effects on equilibrium tax rates (See Baldwin, Forslid, Martin, Ottaviano and Robert-Nicoud 2004, Chapters 15 and 16). When regions have the same size, measured by the immobile factors endowment, tax competition becomes harder and Nash tax rates fall as trade gets freer and/or agglomeration forces becomes stronger. In the same time, Baldwin and Krugman (2004) and others before (Ludema and Wooton 2000) insist on the role of the "agglomeration rent" when regions are asymmetric. They show how an agglomerated region can tax more without losing its mobile activities. Firms accept to bear a higher tax rate in order to benefit from agglomeration economies and from local public goods. This leads to a "race to the top" instead of a "race to the bottom". The relationship between agglomeration and the level of local taxation clearly depends on the integration process, i.e. the level of trade cost. This is due to the "humpy" form of the relation between trade cost and the agglomeration rent.

The main purpose of this paper is to assess the existence and the magnitude of tax interdependencies among the French local tax setting by taking into account the agglomeration forces. In order to perform that test, we estimate a tax setting equation using a cross section data set in 2002 and the spatial econometric techniques.

Our paper is in line with this growing empirical literature which generally confirm the positive relationship between competing regions (or states), that is the existence of horizontal externalities, and provide some strong empirical support for the hypothesis of vertical tax interactions between the federal government and lower layers of government but obtain contrasting results with respect to the sign of the vertical reaction functions (see Goodspeed 1999 2000; Hayashi and Boadway 2001; Brett and Pinske 2000; Revelli 2001; Esteller-Moré and Solé-Ollé 2003; Andersson, Aronsson and Wikström 2004).

However our paper is original in the way we introduce the effect of agglomeration on tax interactions by allowing a differentiation in tax setting behaviour according to the degree of urbanization of local government. We observe significant mimic behaviour between the French localities when they choose their rate of local business tax as well as the existence of a vertical interaction between municipalities and departments. Moreover, the interactions are shown to be more intense in the urban area than in the rural area. We then confirm the theoretical prediction according to which tax competition becomes more intense as agglomeration forces increase. Finally, the relationship between the potential tax base and the tax rate is shown to be positive in cities and negative in rural areas, suggesting the existence of a "taxable agglomeration rent" for urban governments.

The structure of the paper is as follows. In the next section we present a brief survey of the main theoretical results found in the literature on the effect of both types of externalities and agglomeration forces on fiscal choices, in order to derive testable hypotheses. In the third section we present the econometric procedure we use in the empirical analysis and the data set based on local business taxation for the year 2002. The fourth section presents our main results. The fifth section concludes.

2. Theoretical considerations

In this part of the paper, our purpose is to present the theoretical background for the empirical analysis of the effect of both types of externalities and agglomeration forces on fiscal choices.

2.1. Horizontal tax externalities and fiscal interactions

In the literature, two main explanations for horizontal tax interactions are offered[2]: tax competition and yardstick competition.

First, tax competition models are based on fiscal base mobility. The numerous models issued from pioneer work of Wildasin (1988 1989) and Hoyt (1991) have the same theoretical foundations (see Wilson 1999 for a survey). Local public decision-makers are supposed to be benevolent in the sense that their objective is to maximise the welfare of their own citizens. Households are assumed to be immobile and to consume both a private good and a local public good. The latter is financed by a tax on capital. Since capital is assumed to be perfectly mobile across local jurisdictions, when a given government raises its tax rate, net return on capital located there falls and then capital chooses to relocate. Marginal productivity of capital within the jurisdiction of departure increases, while marginal productivity of the jurisdiction of arrival decreases. Capital flows carry on until the net return on capital becomes identical everywhere. In the fiscal Nash equilibrium, each local government sets its tax rate in a way that the marginal substitution rate between the public good and the private good is higher than the marginal transformation rate between these two goods: the local public good is under-provided at equilibrium. This inefficiency results from the fact that each jurisdiction sees capital flight as a cost and does not consider the positive fiscal externality generated for other jurisdictions. Consequently, in the presence of this externality, the interaction expected is one where all the local jurisdictions reduce tax rates as an attempt to attract larger tax base.

A second explanation for horizontal tax interactions, first expressed by Salmon (1987) and more recently developed by Besley and Case (1995) is that tax mimicking may be attributed to yardstick competition. In this framework fiscal interactions are mainly based on information asymmetries between voters and their representatives. In a world of imperfect and asymmetric information, voters have restricted possibilities to evaluate the performance of the representatives in their policy. Selfish representatives aim at gathering political rents and hence have incentives to withhold information about their opportunistic behaviour from voters. However, voters can draw inferences on politicians' behaviour, by comparing it to the performance of governments and parliaments in neighbouring jurisdictions. Other things being equal, these neighbours serve as yardsticks for the voters' evaluation. A bad performance in their own jurisdiction compared to other jurisdictions will penalise representatives; these will not be re-elected. Then fiscal choices would be driven by mimicking behaviour. Indeed, interesting theoretical results are obtained from this current of studies: Due to yardstick

[2] There is a third explanation, based on expenditure spill-overs which will not be developed here. Basically, expenditure levels are related across jurisdictions, which is then reflected in spatially correlated tax rates. Spatial expenditure patterns can result from spill-overs as expenditures on local public services can have some effects on neighbouring jurisdictions (see e.g. Kelejian and Robinson 1993, who show that police expenditure are higher when police expenditures in neighbouring countries are higher).

competition, changes in tax rate in one jurisdiction are influenced by changes in tax rate in the neighbouring jurisdictions.

Both competing theories lead to a common prediction that we will empirically test in the third section: local tax choices are interrelated. Fiscal interactions between jurisdictions belonging to the same level of government are not the only way to generate externalities. They may also result from interactions between two different local government tiers.

2.2. Vertical tax externalities and fiscal interactions

This type of externality arises from the co-occupancy of tax bases between different layers of government. Co-occupancy of tax bases (also called 'concurrent taxation') means that the tax choices of each layer of government are interdependent.

A vertical externality is supposed to arise whenever the tax policy of a given layer of government has an impact on the budget of another layer (Boadway and Vigneault 1996). This is especially the case when the taxes accruing to one level of government give rise to a tax credit or an abatement against taxes collected by an other level of government; or when one or several layers of government grant tax holidays, or finally when several levels of government set their tax rates on a common tax base.

Almost all the recent literature drawing on the seminal paper by Flowers (1988) has focused on this particular vertical externality that arises from co-occupancy of tax bases (also called 'concurrent taxation'). The usual theoretical analysis assumes that each layer of government acts either as a Leviathan (see papers by Flowers 1988; Keen 1995; Wrede 1996, Flochel and Madiès 2002; Keen and Kotsogiannis 2004) or as benevolent (Keen 1998; Keen and Kotsogiannis 2002). They generally show that the combined (aggregated) equilibrium tax rate of two overlapping revenue-maximising governments, which share a common tax base, is higher than a single revenue-maximising government tax rate (see for instance Flowers 1988). The resulting vertical distortion is enhanced if the federal government acts as a Stackelberg leader but is weaker when "horizontal tax competition" operates at the sub-national level. More precisely, interjurisdictional tax competition at the local level will reduce the combined tax rate set by the two overlapping governments and hence result in rising (and not in reducing) aggregated tax revenues since the combined tax rate lies initially on the backward-bending section of the Laffer curve (see for instance Keen 1998 ; Flochel and Madiès 2002).

More generally, when vertical and horizontal externalities are at work in a federation, they generally distort levels of taxation in opposite directions (Keen 1998). On the one hand, horizontal tax competition leads to tax rates being too low since each local government ignores that it harms others when it cuts its tax rate in order to attract a mobile base (which is very often capital). On the other hand, co-occupation of a common tax base results in taxes being too high. Indeed, when a policy-maker raises its tax rate unilaterally, it ignores the loss in revenues due to the induced contraction of the common tax base that the other level of government will suffer from (Keen and Kotsogiannis 2002). Consequently theoretical analysis can not conclude unambiguously on whether the aggregated (federal plus state) tax rate is too low or too high. In short, the tax reaction function cannot be unambiguously signed and then it is necessary to perform an empirical analysis to identify the direction of the vertical interaction (Esteller-Moré and Sollé-Ollé 2003).

2.3. Agglomeration forces and fiscal interactions

As economic activities tend to concentrate in a small number of places (typically in urban area), some literature considers the effect of agglomeration forces on fiscal competition between jurisdictions. More specifically, the new economic geography literature uses the monopolistic competition framework, with internal increasing returns, to study agglomeration in general equilibrium models (Krugman 1991). The increasing returns to scale mean that industrial producers want to be close to consumers (or firms when there is vertical linkage) to satisfy a large demand, while consumers want to be close to producers to benefit from more varieties of goods without sustaining transport cost. Thus, there is a cumulative process of agglomeration whose intensity depends on the values of transport cost, on the magnitude of the preference for diversified goods and on the share of the monopolistic competition sector.

Following this large literature (see Baldwin, Forslid, Martin, Ottaviano and Robert-Nicoud 2004, for a complete survey) recent papers have started to focus on the taxation of factors and their income when firms are in monopolistic competition and when trade costs on goods are present. They show that capital mobility is not the only factor affecting the impact of tax competition on tax rates. The level of trade openness and the extent of agglomeration forces not only have effects on location but also on tax rates in equilibrium, when localities or countries engage in tax competition.

Because of their consequences on location equilibrium, in this literature, the key assumptions are those relating to the factors which are taxed, especially assumptions made on their (im)mobility and on the place where their incomes are owned and spent. If just a perfectly mobile factor is taxed in a world with identical regions, tax competition becomes harder and Nash tax rates fall as trade gets freer, becoming inefficient, as in traditional tax competition literature. In Ottaviano and Van Ypersele (forthcoming), we find a classical mechanism in the literature with tax base exportation, i.e. taxation is beard by owners of capital who do not benefit from its counterpart, the public good. They actually use a “footloose capital model”, where the perfectly mobile capital is taxed on a source base, and the profit is spent where its owner is localised. They study the impact of the trade cost decline on the welfare, in tax competition and market outcomes. They show that when trade cost is high the welfare is higher in tax competition equilibrium than without public sector, and when trade cost becomes very low, the opposite result occurs.

Nevertheless, in a pioneer paper, Andersson and Forslid (2003) build a model where taxation on factors is used by local government to produce a local public good. They show that taxation on immobile (resp. mobile) workers leads to stabilise (resp. destabilise) the dispersed equilibrium. One of the major explanations is the production’s technology of the public good which constitutes a new agglomeration force; regions with more mobile factors own resources to produce more public goods, attracting more mobile factors. This effect is reinforced when mobile factors are not too much taxed comparatively to the immobile ones. Introducing a public sector often makes agglomeration forces stronger. When regions are asymmetric, in terms of immobile factors endowment, Andersson and Forslid (2003), but also Baldwin and Krugman (2004) show that agglomeration creates rents for the mobile factor that can be taxed, increasing the equilibrium tax rates. In this setup, the result, according to which the mobile factor may not respond to marginal changes in tax rates, differs from the standard tax competition theoretical predictions. Ludema and Wooton (2000) had also highlighted this mechanism, since in their model the remuneration of the factor is owned and spent in the region where it is taxed.

This overview of literature leads to two main predictions that we will test in the following section. First of all, when jurisdictions are identical, tax competition is harder with agglomeration forces. The horizontal tax interactions between agglomerations are therefore stronger. Secondly, the relationship between tax rate and tax base is different in agglomeration and in dispersed areas. In the first case, because of the agglomeration rent, the relationship

should be positive; the larger the tax base, the higher the tax rate can be. In the second case, we should observe a negative relationship, since the smaller localities want to attract the tax base by reducing their tax rate.

3. Empirical framework, econometric procedure and data

3.1. The French institutional and urbanisation context

The French local institutional context is characterized by three tiers of overlapping local governments. The lowest tier is made up of 36,000 local jurisdictions or localities. The middle-tier consists of 96 departments. Finally, 22 regions are at the highest level of local government. Municipalities are responsible for local urban services, building, and maintaining nursery and primary schools and sport facilities, municipal roads and urban public transport. Departments are in charge of administering social assistance, departmental roads and maintaining middle schools. Regions are responsible for vocational training, economic development and building and maintaining high schools. Local revenues mainly come from taxation (54%) and grants (23%). The local business tax or 'taxe professionnelle' accounts for approximately 45% of revenues from local taxation. Its base is the same for the three layers of local governments and is mainly made up of capital goods. Furthermore, regions, departments and municipalities have a large autonomy to set their tax rate on that tax base. Even though the local business tax reaches a maximum and a lot of firms are exempted for this taxation[3]. Besides, most municipalities are grouped in larger jurisdictions which are called in French 'Etablissements Publics de Coopération Intercommunale' or EPCI. Since the 'Chevènement' law in 1999, this type of cooperation between municipalities is particularly favoured in France and has been chosen by a growing set of municipalities (more than 13.000 in 2004). These jurisdictions can also set their own tax rate which is called "Taxe Professionnelle Unique" (Single Business Tax).

Local jurisdictions (EPCI) are distributed among rural and urban employment centers, defined by the French National Statistics Institution (INSEE). In 1999, metropolitan France contained 354 urban employment centers where employment is at least 5,000. Note that the French definition of urban areas in this typology is rather broad and matches rather closely that of metropolitan areas in the US except that the threshold is much below (5,000 jobs instead of 100,000 inhabitants).

The rest of the country is classified into different levels of 'peri-urban' (i.e., remote suburban) and rural areas. "Rural employment centers" are all rural municipalities or urban units where employment is 2,000 to 4,999 and where the number of jobs available is greater than or equal to the number of residents. In 1999, there were about 330 rural employment centers.[4] We focus on, in one hand, urban centers and part of their periphery, and on the other hand, on rural areas, in order to have relatively homogenous samples, in their urbanization characteristics. It allows us to test the impact of agglomeration economies on horizontal and vertical fiscal interactions by comparing coefficients in each case[5]. In these samples we have only kept jurisdictions in which the local business tax is the same for all municipalities. Finally our samples contain 354 urban jurisdictions (that is 5117 municipalities) and 129 rural jurisdictions (that is 1855 municipalities) with "Single Business Tax". Most of rural jurisdictions contain at least one rural employment center.

[3] Frequent changes in legislation concerning local tax business represent the main difficulties to analyze the variations of the effects of local taxation. Especially the institutional definition of tax base always changes and the redistribution system, from federal state to the regions, to the "departments" and to the municipalities (or local jurisdictions), is also very complex.

[4] For a more detailed description of this spatial typology see INRA-INSEE (1998).

[5] Calculating distance matrix for a very large sample like all jurisdictions with "Single tax business" is difficult to implement.

3.2. Empirical framework and econometric procedure

Our main empirical purpose is to assess the existence and the magnitude of tax interdependencies among the French local tax setting by taking into account the agglomeration forces.

The existence of such externalities may imply that the tax rates set by any given local government depend upon the other-tier authorities' tax rates as well as upon the tax rates set by other horizontally related governments. However, the sign of the tax reaction functions is theoretically ambiguous (Esteller-Moré and Sollé-Ollé 2002). In the empirical literature, most of the papers have focused on the horizontal tax interdependencies (Ladd 1993; Case 1993; Besley and Case 1995b; Feld et al. 2002; Heyndels and Vuchelen 1998; Buettner 2001; Brueckner and Saavedra 2001; Richard et al. 2002; Leprince et al. 2005). All of them have found evidence of positive interactions among tax rates of competing jurisdictions. More recent papers try to assess the existence and the magnitude of tax interdependencies among different levels of government taking into account both types of externalities, horizontal and vertical (see Goodspeed 1999 2000; Hayashi and Boadway 2001; Brett and Pinske 2000; Revelli 2001; Esteller-Moré and Solé-Ollé 2003; Andersson, Aronsson and Wikström 2004). These papers generally confirm the positive relationship between competing jurisdictions and provide some strong empirical support for the hypothesis of vertical tax interactions between the federal government and lower layers of government but obtain contrasting results with respect to the sign of the vertical reaction functions.

Our paper is in line with this literature and concentrates on tax interactions in the French local institutional context. To assess the right magnitude of horizontal tax interaction, one has to control for possible vertical tax interdependencies. Therefore, we will use the appropriate econometric specification and estimation procedure based on spatial statistics developed by Anselin (1988). Indeed, the horizontal tax interaction between localities may be controlled in a spatial autoregressive or "spatial lag" model, that is with the inclusion of a weighted average of the tax rates of competing jurisdictions in the tax setting function.

The empirical study of local tax setting is also conducted by controlling for specific socio-economic factors which might affect the local tax choices. We therefore include several socio-economic characteristics of jurisdictions such as expenditure "needs" variables which will be discussed below. We also introduce an economic resource variable which is the local capital stock is also introduced in order to evaluate the impact of the tax base on the determination of the tax rate[6].

Finally we will explain the role of agglomeration forces on local tax choices by estimating the same tax setting equation for two data sets which differ by the urbanization level of the jurisdictions. The tax setting equation below allows for horizontal or spatial tax interactions:

$$t_i = \rho \sum_{j \neq i} w_{ij} t_j + \delta T_d + \alpha T_r + \beta X_i + \varepsilon_i \qquad (1)$$

In equation (1), the index i refers to the jurisdiction (i=1,…, 354 urban jurisdictions or i=1,…,129 rural jurisdictions), the index d refers to the department (d=1, …, 93) and r refers to the region (r =1, …, 20). t_i represents the business tax rate set by the jurisdiction i.

Because of the French fiscal system, we have to take into account the fact that there can be vertical externalities and therefore introduce the impact of the higher levels' government in our econometrics specification. T_d represents the tax rate of the department to which jurisdiction i belongs and T_r is the regional tax rate.

[6] We used the local capital stock instead of the tax base to avoid well-known problem of endogeneity.

Thus, parameters ρ, δ and α respectively measure the magnitude of horizontal tax interactions between neighbouring jurisdictions, vertical tax interactions between municipalities and departments and vertical interactions between municipalities and regions. X_i is a vector of explanatory variables including the local capital stock and socio-economic control variables.

The estimation of the magnitude of horizontal interactions requires specifying which jurisdictions the jurisdiction *i* compete with. This is done by choosing the nature of the spatial weight matrix *W* included in (1), where w_i denotes its i^{th} row. We choose the specification based on the geographical distance between jurisdictions. This scheme is given by W^d and imposes a smooth distance decay, with weights given by $1/d_{ij}$ where d_{ij} is the distance between jurisdictions *i* and *j* for $j \neq i$. Matrix W is then standardized so that elements of each row sum to one. It is important to note that these weights are arbitrary (Brueckner and Saavedra 2001).

As is well known from the literature on spatial econometrics (Anselin 1988), several econometric issues must be confronted in estimating equation (1). These are the endogeneity of the tax rates voted by competing jurisdictions and the possible spatial error dependence (Brueckner 2001), as well as the possible endogeneity of two explanatory variables.

First, equation (1) cannot be consistently estimated by standard ordinary least squares (OLS) because there is an endogeneity problem which is well known in the spatial econometrics literature (Cliff and Ord 1973). On the one hand, a given jurisdiction's tax setting behaviour is influenced by tax rates voted by neighbouring jurisdictions. On the other hand (and at the same time) the tax setting behaviour of neighbouring jurisdictions is also influenced by the tax setting behaviour of its neighbours, one of whom being the given jurisdiction. The coefficient ρ is then correlated with the error term (ε) (Anselin 1988) and using OLS would lead to a biased estimation of this parameter. Different approaches to tackle spatial simultaneity have been suggested such as maximum likelihood (ML) and instrumental variables (IV) estimation techniques. We implement the ML approach basically following Case and al. (1993), Besley and Case (1995b), Brueckner (1996), Saavedra (1999) and Brueckner and Saavedra (2001). Under this method, the parameter ρ enters nonlinearly in equation (1) and a nonlinear optimisation routine must be used to estimate it[7].

Second, the error term in (1) may exhibit spatial dependence, that is it may be correlated across jurisdictions. When spatial error dependence is present, the error vector ε satisfies the following the relationship:

$$\varepsilon = \lambda W\varepsilon + \mu \qquad (2)$$

where λ is an unknown parameter, *W* is a weight matrix which is often assumed to be the same as in (1) and μ is a well-behaved error vector. Spatial error dependence is likely to arise when ε includes omitted variables that are themselves spatially dependent. Case et al. (1993) point out that when this spatial error dependence is ignored ($\lambda = 0$), estimation of (1) might provide false evidence of strategic interaction. Several approaches exist for dealing with this problem (see Brueckner and Saavedra 2001). One is to estimate (1) taking account of the error structure given by (2) as is done by Case et al. (1993). However, as Anselin (1988) claims that reliable estimation of the two separate parameters may be difficult, we turn to another method. This method is to separately test the hypotheses $\rho = 0$ and $\lambda = 0$ using the Lagrange multiplier tests developed by Anselin et al. (1996).

[7] The second method developed in the literature (the IV approach) has been chosen by Ladd (1992), Heyndels and Vuchelen (1998), Figlio et al. (1999) and Buettner (2001). This method uses the fitted values $W\hat{t}$ as instruments for *Wt*.

Finally, one additional problem might arise: the possible endogeneity of the departmental and the regional tax rates. To evaluate the existence of this problem, we use a Hausman exogeneity test (Hausman 1978), using various instruments of the departmental and the regional, that is variables that are correlated with business tax rates but are uncorrelated with the regression error.

3.3. Data set

In order to test the tax interdependence hypothesis, we use data corresponding to the business tax rates set by the French localities, departments and regions for the year 2002.

As noted above, local tax policies also reflect the impact of differences in economic and demographic factors grouped in the vector *X*. Following the empirical literature, we include two sets of variables:

- The first one is an economic resource variable: the local capital stock, which is the main element of the local business tax base. [8] The expected sign is positive in urban areas, due to the existence of a taxable rent, and negative in rural areas.

- The second data set is composed of "expenditure needs" variables, such as the density, the shares of young and old people, the unemployment rate and the personal income per capita. The density also measured the agglomeration effects. The expected signs are positive. Indeed, one finds that the higher this expenditure needs variables, the heavier the fiscal burden, the higher the tax rates. Finally, the personal income per capita is included to capture its positive effect on the demand in local public services, hence on business tax rates.

Finally, to take into account the complexity of local tax setting in France, we have included the residential tax rate as an explanatory variable. More precisely, as each municipality chooses its residential tax rate, we used a weighted mean[9] of these tax rates set into the localities belonging to each jurisdiction.

To test the possible endogeneity of the departmental and the regional tax rates, we also use some lagged business tax rates for the departmental (resp. regional) level of government to explain the 2002 cross-sectional variation in the departmental (resp. regional) tax rates.

Table 1 below provides some descriptive statistics for each variable used. These data come from the *Direction Générale des Collectivités Locales* (DGCL, Ministère de l'Intérieur) and from the French census made in 1999. Jurisdictions belonging to both Corsican departments as well as the Paris department (Paris being at the same time a municipality and a department) were excluded from the sample because the allocation of responsibilities in these departments differs significantly from what is observed in common departments, and because they do not vote any business tax rates since 1995. We therefore use the two samples of jurisdictions.

[8] See Appendix for details on the construction of this variable.
[9] It is weighted by the residential tax base.

Table 1. Summary statistics measured at the local level in France

Variable	Mean	Maximum	Minimum	Standard dev.	Obs.	Year
Urban jurisdictions						
Local business tax rates (%)	16,40	27,76	5,65	4,37	354	2002
Regional business tax rates (%)	2,27	3,43	1,02	0,60	354	2002
Departmental business tax rates (%)	7,99	13,62	4,02	2,01	354	2002
Residential tax rates (%)	14,84	30,99	4	4,30	354	2002
Income per capita	14901,32	25552	9710,81	2501,83	354	2002
Density	886,29	12876,58	25,32	1444,42	354	1999
Unemployment rate (%)	13,49	27,4	4,22	4,55	354	1999
Capital stock	11,758,680	693,903,440	11,404	81,845,745	354	1999
Rural jurisdictions						
Local business tax rates (%)	13,33	24,62	6,15	3,73	129	2002
Regional business tax rates (%)	2,43	3,43	1,69	0,40	129	2002
Departmental business tax rates (%)	8,23	13,62	5,30	2,03	129	2002
Residential tax rates (%)	12,53	20,11	3,61	3,19	129	2002
Median income per capita	13305,31	16891,38	9960,99	1181,06	129	2002
Density	288,69	7945,91	55,37	696,24	129	1999
Unemployment rate (%)	13,08	25,49	5,57	4,03	129	1999
Capital stock	936,770	40,336,557	12,339	4,979,012	129	1999

The table allows us to verify some well-known stylised facts: people are richer and younger in urban areas and the rural unemployment rate is slightly smaller than the urban one. The local capital stock is obviously larger in cities, but its variability is larger in rural areas (the determination coefficient is equal to 0,14 in the first and to 0,19 in the second). More interesting for our topic, notice that the average local business tax rate is larger in urban jurisdictions than in rural jurisdictions.

4. Results

The estimation results are presented in table 2.

Table 2: Estimates of the spatial model

	Urban area		Rural area	
	(1)	(2)	(3)	(4)
Estimation technique	OLS	ML	OLS	ML
Local business tax rate (ρ)	-	0.901*** (102) [0.000]	-	0.648** (11.2) [0.012]
Departmental tax rates (δ)	0.431*** (8.22) [0.000]	0.326*** (42) [0.000]	0.405*** (4.44) [0.000]	0.308*** (11.2) [0.000]
Regional tax rates (α)	0.023 (0.497) [0.619]	0.036 (0.691) [0.406]	0.053 (0.406) [0.686]	0.001 (0.001) [0.995]
Residential tax rates	0.382*** (8.04) [0.000]	0.378*** (71.7) [0.000]	0.401*** (5.44) [0.000]	0.411*** (35) [0.000]
Income per capita	0.126 (0.985) [0.325]	0.035 (0.087) [0.767]	0.859*** (3.27) [0.001]	0.763*** (9.36) [0.002]
Unemployment rate	0.11* (1.78) [0.075]	0.058 (1.01) [0.316]	0.193** (2.44) [0.016]	0.164** (4.8) [0.028]
Density	0.065*** (3.61) [0.000]	0.071*** (17.3) [0.000]	0.049* (1.69) [0.093]	0.052* (3.63) [0.056]
Capital stock	0.019** (2.24) [0.025]	0.022*** (7.29) [0.006]	-0.045** (-2.04) [0.043]	-0.046** (4.92) [0.026]
Constant	-1.32 (-0.991) [0.323]	-2.67** (4.47) [0.034]	-7.68** (-2.96) [0.003]	-8.24*** (11.3) [0.001]
R^2	0.48	-	0.42	-
Log-likelihood	56.98	71.89	18.17	20.83
LM test of spatial lag dependence	[0.000]	-	[0.017]	-
Observations	354	354	129	129

Notes: Dependent variable is the local business tax rate set by each group of localities. All variables are log-transformed. Student values (resp. Wald statistics) are reported in parentheses OLS (resp. ML) estimation techniques. Probability values are given in brackets. *: significant at 10% ; **: significant at 5%. Year: 2002.

Columns 1 and 2 show the estimation results for the 354 urban jurisdictions while columns 3 and 4 give the results for the rural jurisdictions. More precisely, columns 1 and 3 present OLS estimates without controlling horizontal tax effects, that is setting the tax coefficient ρ equal to zero in the specification (1). Columns 2 and 4 reveal ML estimates of equation (1) with horizontal tax effects. The specification used in columns 2 and 4 has been chosen after having performed various tests on the nature of spatial interdependencies. The results showed that the slope parameter ρ is significantly different from zero at the 5 percent level while the Lagrange multiplier test of the spatial error dependence shows that λ is never significantly different from zero (see columns 1 and 3). We can conclude that the error term in (1) does not exhibit spatial dependence.

Before having a detailed look at the estimates of the three tax parameters ρ (the horizontal tax interaction parameter), δ (the vertical tax interaction parameter between departments and municipalities) and α (the vertical tax interaction parameter between municipalities and regions), we have verified with a Hausman test that none of tax rate variables – the departmental tax rate and the regional tax rate - were endogenous.

First, concerning spatial dependence, the results show that horizontal fiscal interactions between jurisdictions are quite strong irrespectively of the level of urbanization. The estimate of the spatial coefficient ρ is large and statistically significant under any estimation technique. In the specification of columns 2 and 4, the ML estimates of ρ range from 0,648 to 0,901. This implies that an average business tax increase of 10% in the neighbouring jurisdictions induces an increase of 6,48 to 9,01% in the jurisdictional business tax rate.

Result 1 – The business tax rate of a given jurisdiction is the lower (the higher), the lower (the higher) are the tax rates of their neighbours, which confirms the existence of a mimic behaviour in the French jurisdictions.

There is evidence of strategic interactions in the choice of local business tax rates which may be explained by a standard tax competition argument. Jurisdictions might thus want to remain attractive with respect to their competing neighbours and engage themselves in a strategy of 'copy cat' in the business tax rates. Unfortunately, such empirical evidence might be consistent with different competing theories of local government behaviour. More precisely, the fact that local tax rates tend to be correlated across neighbouring jurisdictions has been also interpreted as arising from yardstick competition[10]. Some recent papers try to discriminate between tax competition and yardstick competition by introducing political explanatory variables into the tax setting (see e.g. Solé-Ollé 2003), that provides evidence of yardstick competition between Spanish municipalities by showing that the reaction to neighbours' tax rates is lower when left-wing parties control government.

However, one can note that this result of horizontal tax interactions in the French local case is close to those obtained in previous tests in different countries. In the USA, Ladd (1992) obtains estimates of the spatial correlation coefficient between counties' tax burdens that range form 0,45 to 0,8 while in Europe Heyndels and Vuchelen (1998) using a cross-section of 589 Belgian municipalities conclude to a mimicking behaviour amongst these local jurisdictions, the estimates of the spatial correlation coefficient ranging form 0,5 to 0,7. In the French case, our result at the local level of local government is also consistent with those obtained by Feld et al. (2002) at the regional level and by Leprince et al. (2005) at the departmental level. Nevertheless the coefficients of spatial interactions are lower in their case than in ours, suggesting tax competition is harder at the local level.

Our results also show that the horizontal tax interactions are stronger in the urban area than in the rural area. Indeed, in the specification of columns 2 and 4, the ML estimates of ρ range from 0,648 in the rural area to 0,901 in the urban area. We then confirm the theoretical prediction according to which tax competition becomes more intense as the degree of agglomeration increases.

[10] In yardstick competition models, as voters use other jurisdictions as a yardstick against which to evaluate the fiscal performance of their own government (Salmon, 1987; Besley and Case, 1995a; Besley and Smart, 2001), local incumbents tend to mimic each other in order to be reelected.

Result 2 – Tax competition becomes more intense as the degree of agglomeration increases.

Furthermore, the coefficient δ associated to the departmental tax rate is statistically significant and the estimate of its parameter has a positive sign irrespectively of the level of urbanization. This result suggests that the business tax departmental tax rates and jurisdictional tax rates are strategic complements. Its estimates range from 0,308 to 0,326. This means that a tax increase of 10% in the departmental tax rates induces an increase of around 3% in the single business tax rate.

Result 3 – Departmental and jurisdictional business tax rates are strategic complements: an increase in the departmental tax rate increases the jurisdictional tax rate.

Studies in the existing literature often conclude to a significant positive interdependence between different layers of governments in a federal system. Goodspeed (2000) confirms the existence of vertical income tax externalities in the OECD countries. Esteller-Moré and Solé-Ollé (2001) show a positive response of state tax rates to changes in the federal income tax rate in the USA. They also provide evidence of a significant and positive response of provincial tax rates to changes in the federal income tax rate in Canada (Estelle-Moré and Solé-Ollé, 2002). Brett and Pinske (2000) demonstrate some evidence that municipal tax rates are sensitive to taxes set on the same base by super-municipal bodies in the province of British Columbia. However, Revelli (2001) shows the absence of correlation in property tax rates between lower tier (district) authorities and upper tier (county) authorities in UK. In The French case, our results are in line with those obtained by Leprince et al. (2005).

In order to explain these results in the French case, we provide the following explanation. This result can be explained by the complementarity of public services provided by municipalities and departments. Major public infrastructures and capital spending in primary schools provided by municipalities might indeed increase the marginal utility of social services and capital spending in secondary schools provided by departments. In other words, where municipal public services are high, household preferences would lead to a high level of departmental public services**.**

We also observe that the tax parameter α is indeed never significant in any specification.

Result 4 – Estimation of the spatial tax model with three overlapping levels of local government leads to reject the hypothesis of business tax interactions between local jurisdictions and regions.

This result might be explained by the vertical structure of the aggregate tax rates paid by French business taxpayers. Indeed, regional tax rates account for a small part (around 10%) of the sum of the municipal, departmental and regional rates, whereas the first two rates respectively account for 60% and 30% of the sum. Regional tax rates might thus have no effect on municipal tax behaviour.

When we turn to the potential tax base, i.e. the local capital stock, we can observe that the sign of its estimated coefficient changes between urban and rural jurisdictions.

Result 5 – The relationship between the tax rate and the tax base is significantly positive in urban jurisdictions and significantly negative in the rural ones, suggesting the presence of an "agglomeration rent".

Rural areas seem to have to reduce their tax rate to attract more activities while the larger the cities' tax base is, the heavier they are able to tax. Firms seem to prefer to stay in cities where agglomeration economies are stronger, even if they have to pay an important taxation.

Finally, concerning the socio-economic features, the results in table 2 show that unemployment rate exhibits the expected positive sign while the shares of old and young people are never significant. The positive sign of the residential tax rate suggests that there is no substitutability between both local tax rates. Finally we observe some specificity in the impact of socio-economic features on local tax choices due to the agglomeration forces. Indeed, the income per capita takes a significant and positive sign only in the rural area while the density takes a positive sign only in the urban area.

5. Conclusions

This paper allows for horizontal and vertical tax interdependencies between the three tiers of local jurisdictions in France to determine the possible effect of agglomeration forces on local tax setting. The business tax is by far the main local tax in France and its base is shared by the three local levels of government. We show the existence of significant horizontal tax interactions among jurisdictions which tend to mimic each other when they choose the level of their business tax rate. Moreover, the interactions are shown to be more intense in the urban area than in the rural area suggesting that tax competition becomes more intense as agglomeration increases. We also verify the existence of an agglomeration rent: the cities tax more when their base increases, since in rural areas the tax rates are negatively linked to their tax base.
Finally, our estimation results provide strong evidence of the existence of business tax interactions between local jurisdictions and departments, the two main levels of local government in France but lead us to reject the hypothesis of tax interactions between regions and jurisdictions.

References

Andersson L, Aronssson T, Wikström M (2004) Testing for vertical fiscal externalities, *International Tax and Public Finance*, 11(3), 243-263.

Andersson F, Forslid R (forthcoming) Tax competition and economic geography, *Journal of Public Economic Theory.*

Anselin L (1988) *Spatial econometrics: Methods and models*, Kluwer Academic Publishers, Dordrecht et al. (eds).

Anselin L, Bera AK, Florax RJ, Yoon MJ (1996) Simple diagnostic tests for spatial dependence, *Regional Science and Urban Economics*, 26(1), 77-104.

Baldwin R, Forslid R, Martin P, Ottaviano G, Robert-Nicoud F (2003) *Public Policies and Economic Geography*, Princeton University Press.

Baldwin RE, Krugman P (2004) Agglomeration, integration and tax harmonisation, *European Economic Review*, 48. 1-23.

Besley T, Case A (1995a) Incumbent behavior: Vote seeking, tax setting and yardstick competition, *American Economic Review*, 85, 25-45.

Besley T, Case A (1995b) Does electoral accountability affect economic policy choices? Evidence from gubernatorial term limits, *Quarterly Journal of Economics*, 150, 769-798.

Besley T, Rosen H (1998) Vertical externalities in tax setting: Evidence from gasoline and cigarettes, *Journal of Public Economics*, 70, 383-398.

Bird RM, Slack NE (1983) *Urban Public Finance in Canada*, Toronto: Butterworths, 1983.

Bordignon M, Cerniglia F, Revelli F (2003) In search for yardstick competition: A spatial analysis of Italian municipality property tax setting, *Journal of Urban Economics*, 54, 199-217.

Brett C, Pinske J (2000) The determinants of municipal tax rates in British Columbia, *Canadian Journal of Economics*, 33, 695-714.

Brueckner JK (1996) Testing for strategic interaction among local governments: The case of growth controls, *Journal of Urban Economics*, 44, 438-467.

Brueckner JK, Saavedra L (2001) Do local governments engage in strategic property-tax competition ?, *National Tax Journal*, 54, 203-229.

Brueckner JK (2001) Strategic interaction among governments: an overview of empirical studies, mimeo.

Buettner T (2001) Local capital income taxation and competition for capital: The choice of the tax rate, *Regional Science and Urban Economics*, 31, 215-245.

Case AC (1993) Interstate tax competition after TRA86, *Journal of Policy Analysis and Management*, 12, 136-48.

Case AC, Rosen NE, Hines JR (1993) Budget spillovers and fiscal policy interdependence: Evidence from the states, *Journal of Public Economics*, 52, 285-307.

Cavlovic A, Jackson J (2003) Bother thy neighbour ? Intergovernmental tax interactions in the Canadian federation , Working Paper 2003/09, Department of finance, Canada.

Cliff A., Ord J (1973) *Spatial autocorrelation*, London: Pion.

Esteller-More A, Sole Olle A (2001) Vertical income tax externalities and fiscal interdependence: evidence from the US, *Regional Science and Urban Economics*, 31, 247-272.

Esteller-More A, Sole Olle A (2002) Tax setting in a federal system: The case of personal income taxation in Canada, *International Tax and Public Finance*, 9, 235-257.

Feld L, Josselin JM, Rocaboy Y (2002) Le mimétisme fiscal: une application aux régions françaises, *Economie et Prévision*, vol. 156(5), 43-49.

Feld L, Reulier E. (2002) *Strategic tax competition in Switzerland: Evidence from a panel of the Swiss Cantons*, mimeo.

Figlio DN, Kolpin VW, Reid WE (1999), Do states play welfare games?, *Journal of Urban Economics*, 46, 437-454.

Flochel L, Madiès T (2002) Interjuridictional tax competition in a model of overlapping revenue-maximizing governments , *International Tax and Public Finance*, vol. 9, 121-141.

Flowers MR (1988) Shared tax sources in Leviathan model of federalism, *Public Finance Quaterly*, 16, 67-77.

Goodspeed TJ (1999) Tax competition and tax structure in open federal economies: Evidence from OECD countries with implications for the European Union, mimeo.

Goodspeed TJ (2000) Tax structure in federation, *Journal of Public Economics*, 75, 493-506.

Hausman J (1978) Specification tests in econometrics, *Econometrica*.

Hayashi M, Boadway R (2001) An empirical analysis of intergovernmental tax interaction: The case of business income taxes in Canada, *Canadian Journal of Economics*, 34, 481-503.

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

INRA-INSEE (1998) Les campagnes et leurs villes, série *Contours et Caractères*, INSEE, Paris.

Keen M (1998) Vertical tax externalities in the theory of fiscal federalism, *International Monetary Fund Staff Papers*, 45, 454-485.

Keen M, Kotsogiannis C (2002) Does Federalism Leads to Excessive High Taxes?, *American Economic Review*, 92 , 363-370.

Keen M, Kotsogiannis C (2004) Tax competition in federations and the welfare consequences of decentralization ?, *Journal of Urban Economics*, 56, 397-407.

Krugman P (1991) Increasing returns and economic geography, *Journal of Political Economy*, 99 (3), 483-499.

Ladd HF (1992) Mimicking of local tax burdens among neighboring countries, *Public Finance Quaterly*, 20, 450-67.

Leprince M, Madies T, Paty S (2005) Business tax interactions among levels of local governments: An empirical analysis of the French case , mimeo.

Ludema R, Wooton I (2000) Economic geography and the fiscal effects of regional integration, *Journal of International Economics*, 52(2). 331-357.

Ottaviano G, van Ypersele T (forthcoming) Market size and tax competition, *Journal of International Economics*.

Roos MWM (2004) Agglomeration and the public sector, *Regional Science and Urban Economics*, 34, 411-427.

Revelli F (2001) Spatial patterns in local taxation: tax mimicking or error mimicking?, *Applied Economics*, 33, 1101-1107.

Richard JF, Tulkens H, Verdonck M (2002) Dynamiques des interactions fiscales entre les communes belges 1984-1997, *Economie et Prévision*, 156 (5), 1-14.

Saavedra LA (1999) A model of welfare competition with evidence from AFDC, *Journal of Urban Economics*, 47, 248-279.

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

Wildasin DE (1988) Nash equilibria in models of fiscal competition, *Journal of Public Economics*, 35, 229-240.

Wilson, J (1999) Theories of tax competition, *National Tax Journal*, 52, 269-304.

Wrede M (1996) Vertical and horizontal tax competition : will uncoordinated Leviathans en up on the wrong side of the Laffer curve ?, *Finanzarchiv*, 3, 461-479.

Appendix: Calculation of the local capital stock

Data on the exact local capital stock are not available, we therefore construct it by using national industrial capitalistic intensity (Alisse, INSEE) and data on local employment by sector (General Census, INSEE). We multiplied the number of employees in each locality by the average national capitalistic intensity, for each sector selected and finally sum up all sector's local capital stock.

This methodology assumes that, inside a sector, the spatial distribution is homogenous among urban and rural areas whereas functions of different plants are not the same: production plants are more concentrated in cities and headquarters, administrative and research plants in urban areas.

Because of the French legislation, we excluded some sectors which do not bread the local business tax: agriculture – education, health and social action - public sector. Sectors for which the national capitalistic intensity is available are more or less detailed. The following table presents these sectors and their capitalistic intensity we used.

Sectors	***Capitalistic intensity (euros)***
Food manufacturing	*90*
Consumption goods manufacturing	*51*
Automobile manufacturing	*163*
Equipment goods manufacturing	*46*
Intermediate goods manufacturing	*100*
Energy	*928*
Building	*18*
Transport	*162*
House activities	*976*
Firms services	*62*
Estate services	*51*
Automobile sale and repair	*28*
Wholesale	*43*
Detailed sale and repair	*162*