The taxable agglomeration rent: Evidence from a French panel data

Sylvie Charlot, Sonia Paty, . Spatial Econometric Association

TAXABLE AGGLOMERATION RENT: EVIDENCE FROM A PANEL DATA

by

Sylvie Charlot* and Sonia Paty*

Abstract

The main purpose of this paper is to test the existence of a taxable agglomeration rent in the French local tax setting by taking account the tax interactions among the urban jurisdictions. After presenting a simple economic geography model with fiscal interactions, we estimate a model of tax setting for the local business tax using the econometrics techniques on panel data for 1993 to 2002. We observe that the relationship between tax rate and fiscal base gives presumption of the existence of a " taxable agglomeration rent".

Key words: spatial autocorelation panel, economic geography, fiscal agglomeration rent.

JEL classification: H2 H3 H7 C21

1 Introduction

Fiscal federalism is mainly concerned by explaining tax setting by taking into account 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 on tax competition) 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).

*CESAER, 26 Bld Petitjean, BP 87999, 21069 Dijon. Tel: 33 (3) 80 77 26 91. Fax: 33 (3) 80 77 25 71. charlot@enesad.inra.fr.

*CESAER and MEDEE (University of Lille 1). paty@enesad.inra.fr.

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 tax 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, 2003, 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.

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 stabilises (resp. destabilises) 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. When regions are asymmetric, in terms of immobile factors endowment, Ludema and Wooton (2000), Andersson and Forslid (2003) and 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. 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", as described by the vast body of literature on tax competition.

The main purpose of this paper is to assess the existence and the magnitude of the taxable agglomeration rent, by taking into account the tax interdependencies among the French local tax setting. In order to perform that test, we estimate a tax setting equation using a panel data set from 1993 to 2002 and spatial panel econometric techniques.

We essentially confirm a positive relationship between the potential tax base and the tax rate, suggesting the existence of a "taxable agglomeration rent" for urban governments. We also 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 counties. Our paper is in line with the 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, 2000, 2002; Hayashi and Boadway, 2001; Brett and Pinske, 2000; Revelli, 2001; Esteller-Moré and Solé-Ollé, 2003; Andersson, Aronsson and Wikström, 2004).

The structure of the paper is as follows. In the next section we present a simple model of new economic geography with tax interactions in order to derive testable hypotheses. The third section presents the econometric procedure we use in the empirical analysis and the data set based on local business taxation for the period 1993 to 2002. Main results arise in section 4. The fifth section concludes.

2 Theoretical considerations: An economic geography model with fiscal interactions

In order to understand how agglomeration forces influence the local tax setting, we develop an economic geography model with a mobile capital model without income effect. Local governments tax local capital and produce a local public good which benefit to all residents of the municipalities.

2.1 Assumptions

Our model is a very simple two regions model, with a quasi-linear quadratic utility function . Following Ottaviano and van Ypersele (2005), we use a linear foot-loose capital (FC) model, initially developed by Ottaviano (2001). A very clear description of this model is given by Baldwin et al. (2003), more precisely in chapter 5, section 2. In this kind of model, capital is mobile and its spatial distribution gives the spatial equilibrium. As owners of capital, who are also labourers, are immobile, capital can be invested in one region and owned by someone living in the other region.

There are two regions, two factors of production, and two private sectors. We also consider two local governments. The traditional sector, A, is perfectly competitive, under constant returns to scale, and employs only labour. The good produced by this sector is freely tradable and, after normalisation of the marginal cost of production and considering this good as numéraire, price and wage are equal to unity.

The manufacturing sector, M, employs labour and capital, and is in monopolistic competition and under increasing returns to scale: there is a fixed cost, in terms of capital, in production function. Since wage is unity, the total cost of producing x units of a variety of the M good is $\pi J + a_m x$. Where J is the number of unities of capital employed to produce one variety (a fixed cost), and a_m the variable cost in labour. J determines the number of firms and therefore the number of varieties produced, N.π is the net remuneration of capital.

Transport of a manufacturing good from one region to the other costs τ units of the A good.

Consumers localised in region j maximise the quasi-linear quadratic utility function:

$$U_j = \alpha \int_{i=0}^{n_1+n_2} c_i d_i - \frac{\beta - \delta}{2} \int_{i=0}^{n_1+n_2} c_i^2 d_i - \frac{\delta}{2} \left(\int_{i=0}^{n_1+n_2} c_i d_i \right)^2 + C_A + H\left(G_j\right)$$

where c_i is consumption of variety i of the M good, C_A is the consumption of the A good and n_1 and n_2 are the number of varieties produced in region 1 and 2. α expresses the preference for the M goods, $\beta (> \delta)$ the preference for variety, and the δ substitutability between different varieties.

H is a function, concave in G_j, the local public spending in region j.

Capital is mobile and is owned by workers who are immobile. As capital is mobile, it can be employed in one region while its owner is located in the other. The location of capital depends on the net return on capital in each region and determines the spatial equilibrium. $s_L \equiv L_1/L$ is the share of total labour which is localised and employed in region 1. $s_K \equiv K_1/K$ is the share of total capital owned by workers localised in region 1 and s_1 is the share of capital employed in region 1. We suppose that each layer of local government plays Nash relative to the two other layers of government. This means that each layer of government will set its own tax rate in order to maximise the indirect utility function of consumers subject to its budget constraint. Local governments produce G_j public goods.

2.2 Short-run location equilibrium

Short run equilibrium on private sectors, A and M, are the same as without governments, since public goods do not interact with private choices. In equilibrium, the prices of manufactured goods produced in region 1 and consumed respectively in region 1 and in region 2 are equal to

$$p_{11} = \frac{1}{2}\frac{2\left[a + a_m\left(b + cN\right)\right] + \tau c n_2}{2b + cN}, \qquad p_{12} = p_{11} + \frac{2\left(b + cn_1\right)}{2b + cN}$$

Prices of manufactured goods produced in region2 are: $p_{22} = p_{11} + \frac{(n_1 - n_2)\tau c}{2(2b+cN)}$, $p_{21} = p_{11} + \frac{\tau}{2}$. Where $N = n_1 - n_2$ are the total number of firms and the firms localised in region 1 and 2, and $a \equiv \frac{\alpha}{\beta + \delta(N-1)}$, $b \equiv \frac{a}{\alpha}$, $c \equiv \frac{\delta b}{\beta - \delta}$. c measures the substitutability of goods and is therefore an inverse index of preference for diversity. The net return rate on capital in region 1 is equal to

$$\pi_1 = (b + CN)\frac{(p_{11} - a_m)^2 M_1 + (p_{12} - a_m)^2 M_2}{j} - t_1$$

where $M_1 = s_L L + s_K K$ and $M_2 = (1 - s_L)L + (1 - s_K)K$ are the numbers of consumers in each region and t_1 is the local government tax rate. The clearing condition on capital market requires: $n_1 = s_1 \frac{K}{L}$, where s_1 is the share of manufacturing goods produced in region 1. We normalize $K = J$ and then $N = 1, n_1 = s_1$ and $n_2 = 1 - s_1$. For having trade between regions, we have to assume that $\tau < \tau_{trade} \equiv \frac{2(a - ba_m)}{2b+c}$ [see Baldwin et al. (2003) for details].

2.3 Long-run location equilibrium

Long-run location equilibrium is characterized by no incitation for capital to move from one region to the other, i.e. when the net return on capital localised in one region is greater than the net remuneration in the other: $\pi_1 = \pi_2$, $0 < n_1 < 1$, $\pi_1 > \pi_2$, $n_1 = 1$, and $\pi_2 > \pi_1$, $n_2 = 1$.

Spatial distribution of capital given the non-agglomerated equilibrium is equal to

$$n_1^* = \frac{1}{2} + \frac{2(2a - 2ba_m - b\tau)}{c\tau}\left(s_E - \frac{1}{2}\right) - \underbrace{\frac{2K(2b + c)(t_1 - t_2)}{\tau^2 c(b + c)M}}_{A} \tag{2}$$

with $s_E \equiv \frac{M_1}{M}$ and $M = M_1 + M_2 = K + L$.

This equilibrium spatial distribution is the same as without taxation except the term A. The tax rate differential obviously decreases the attraction of the region. The more the share of capital in M is, the less important this impact is. Conversely, the more important are the trade cost the less the local tax rate differential influences the equilibrium location. Otherwise the agglomerations forces and mechanisms are the same as those present in the linear FC model.

2.4 Local governments' behaviour and tax competition

The maximisation problem for the local level is: $\underset{t_j}{Max} H(G_j)$ subject to $G_j = t_j n_j K_j$. H is concave in G_j. To illustrate our purpose, we choose the simplest concave function: $H = G_j - 2G_j^2$. In spatial equilibrium, local taxes rate that maximise the public objective functions are equals to:

$$
\begin{aligned}
t_1^* &= \frac{\tau(b+c)}{3K(2b+c)} + \left[\frac{3}{4}c\tau M + (2ba_m + b\tau - 2a)\left(\frac{1}{2}M - M_1\right)\right] \\
t_2^* &= t_1^* - \frac{\tau(b+c)(2ba_m + b\tau - 2a)\,(M - 2M_1)}{3K(2b+c)}
\end{aligned}
\tag{3}
$$

When regions have the same size ($M_1 = M_2 = \frac{1}{2}M$), the local tax rates in Nash equilibrium are the same and they increase with the size of total demand (M), with the transport cost and with goods' substitutability, c. As in Baldwin et al. (2003), when regions are identical, agglomeration forces, assessed by preference for diversity and integration process, make tax competition harder: equilibrium tax rates decrease with agglomeration forces.

Since $2ba_m + b\tau - 2a < 0$ under the trade condition, when regions are different, the relative size of the local demand (M_i/M) increases this optimal tax rate and the higher the trade cost, the larger this effect is. It is also worth noting that the government in a larger region can tax more than the smaller region. At this stage, we therefore find the same results as Ottaviano and van Ypersele (forthcoming) and others before: there is an agglomeration rent for large regions and horizontal interactions between local governments depends on the size of each locality.

This results of a simple economic geography model lead 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 strong. Secondly, because of the agglomeration rent, the relationship between tax rate and tax base should be positive in cities; the larger the tax base, the higher the tax rate.

3 Empirical framework, econometric procedure and data

Our main empirical purpose is to assess the existence of the taxable agglomeration rent in the French local tax setting by also taking into account the possible existence of tax interdependencies, horizontal tax interactions among municipalities but also vertical tax externalities between first jurisdictions and counties and second between jurisdictions and regions. We therefore have to use an appropriate econometric model taking into account spatial interactions.

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 counties. 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. Counties are in charge of administering social assistance, county 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, counties 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 .

Municipalities are distributed among rural and urban employment centers, defined by the French National Statistics Institution (INSEE). In 1999, metropolitan France contained 360 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).

We focus on the most populated municipalities in each urban center. Thus, our sample contains 342 urban municipalities.

3.2 Econometric procedure and empirical framework

3.2.1 Econometric procedure

The presence of fiscal 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

1995ab; 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, 2000, 2002; 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 tax choices 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.

Here we aim at testing the existence of a taxable rent in the local tax setting by using a panel of 342 municipalities whose fiscal choices are observed between 1993 and 2002. As we also take into account the existence of tax interactions, we estimate a model with spatial interactions using panel data. In spatial research, two problems may arise when panel data have a locational component (Elhorst, 2003). The first problem is spatial heterogeneity, which can be defined as parameters that are not homogeneous throughout the data set but vary with location. The second problem is that spatial dependence may exist between the observations at each point in time. The main reason that one observation associated with a location may depend on observations at other locations is that distance affects economic behaviour. Each agent may change its economic decisions depending on the market conditions in the region of location compared to other regions and on the distance to these regions. This paper is related to this second issue as our model relies on spatial interaction between governments tax decisions.

To model spatial dependence between observations, the model may take the form of a spatial autoregressive process in the error term (spatial error case) or in the variable to explain (spatial lag case). The spatial econometric literature has shown that OLS estimation in models with spatial effects is inappropriate. In the case of spatial error autocorrelation, the OLS estimator of the response parameters, while unbiased, loses its property of efficiency. In the case of a spatially lagged dependent variable, the OLS estimator of the parameters not only loses its property of unbiasedness but also its consistency. A suggested method to overcome these problems is to estimate the model by the maximum likelihood (ML) method (see Anselin, 1988; Anselin and Hudak, 1992).

Panel data models including either a spatially lagged dependent variable or spatial error autocorrelation are not very well documented in the spatial econometrics literature. Recently, Elhorst (2005) surveys panel data models extended to either spatial error autocorrelation or a spatially lagged dependent variable.

The aim of the present paper is to account for spatial dependence in a panel data context. In the classical fixed effect panel data model[1], spatial dependence is accounted for by including a spatially lagged term of the dependent variable so that the model assumes the following notation:

$$\tau_{i,t} = \alpha_i + \rho W \tau_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \tag{4}$$

with i ($i = 1, \ldots, N$) denoting jurisdictions, and t ($t = 1, \ldots, T$), denoting time periods. The dependent variable τ is the local tax rate set by each jurisdiction. W is the weight matrix, ρ is the so-called spatial-autoregressive, and ε_i is the classical i.i.d. error. It should be noted that α_i are assumed to be fixed parameters and account for any jurisdictional-specific effect not included in the regression equation.

All spatial dependence effect is assumed to be captured by the spatially lagged variable term. This model takes the name of *fixed effect spatial lag model.* The standard estimation method for the fixed effect model is to eliminate the intercept term from the regression equation by taking the variables in deviation of their average in time, and then using OLS. Instead of estimating the demeaned equation by OLS, it can also be estimated by ML. The only difference is that ML estimators do not make corrections for the degree of freedoms (Elhorst, 2003). A simple two-stage procedure can be used to maximize the log-likelihood function of this model (Anselin, 1988).

The alternative way to incorporate the spatial effects is called *fixed effect spatial error model.* The spatial effects are then incorporated in the error term, assuming that:

$$\tau_{i,t} = \alpha_i + \beta \tau_{i,t} + \varepsilon_{i,t} \tag{5}$$

$$\varepsilon_{i,t} = \lambda W_{\varepsilon_{i,t}} + \mu_i \tag{6}$$

where W is the spatial weight matrix, λ is the spatial autocorrelation coefficient and the μ_i are assumed to be i.i.d. The parameters may be also estimated by using maximum likelihood method. In this case, an iterative two-stage procedure can be used to maximize the log-likelihood function of this model (Anselin, 1988).

[1] Fixed effect model is particularly indicated when the regression analysis is limited to a precise set of jurisdictions. Random effect, instead, in an appropriate specification when a certain number of jurisdictions is randomly drawn from a large set of jurisdictions (see Baltagi, 2001, for more details).

Anselin and Hudak (1992) give instructions on how to implement both procedures in routines written for spatial cross section but that can be generalized to spatial panel models. Thus, in this paper we use the routines of spatial lag model (SAR) and spatial error model (SEM) developed by Paul Elhorst and which are freely downloadable on the James P. LeSage's website www.spatial-econometrics.com.

Concerning the spatial weight matrix, there are several ways in which a jurisdiction can be neighbour to another jurisdiction. Following the empirical literature, we first choose arbitrarily a geographical definition of neighbourhood. In this case, the weighted matrix will assign higher values to jurisdictions geographically close. More precisely, we use the Euclidian distance between each jurisdiction's centroid to build our set of weights, so that:

$$w_{ij}^{d} = \frac{1/d_{ij}}{\sum_{j} 1/d_{ij}}$$

where is the ij element of the weighted matrix W^d and d_{ij} is the Euclidian distance between the centroid of jurisdiction i and jurisdiction j. This distance decay matrix is standardized.

A second way to deal with neighbourhood is to test whether or not jurisdictions follow some leaders such as the most populated jurisdictions. In this case, a higher weight is assigned to jurisdictions with higher value of population. We also take into account the geographical proximity in this third standardized matrix where:

$$w_{ij}^{Pop/d} = \frac{Pop_j/d_{ij}}{\sum_{j} Pop_j/d_{ij}}$$

An alternative way to deal with proximity is to consider a demographic criterion. We assign a higher weight to the tax choice of a jursidiction j that is similar (on a population criterion) to a jurisdiction i. In this case,

$$w_{ij}^{dem} = \frac{1}{|Pop_i - Pop_j| * \sum_{\substack{j=1 \\ j \neq i}}^{j=342} \frac{1}{|Pop_i - Pop_j|}}$$

A fourth way of considering weights is based on a contiguity matrix, where the value 1 is assigned if two jurisdictions share the same border and 0 otherwise. We can not use this matrix because our jurisdictions do not necessarily share a border.

3.2.2 Empirical framework

To assess the existence of a taxable agglomeration rent in the local tax setting, one has to test the relationship between the tax rate and the fiscal base and to control for possible horizontal as well as vertical tax interdependencies. Therefore, we will use the appropriate econometric specification and estimation procedure based on spatial statistics developed in the previous subsection. 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 jurisdiction. Thus, the relation (4) can be rewritten as:

$$\tau_{i,t} = \alpha_i + \rho W \tau_{i,t} + \beta_1 t_{i,t}^R + \beta_2 t_{i,t}^D + \beta_3 Base_{i,t} + \beta_4 Density + \beta_5 Income_{i,t} \\ + \beta_6 Elec_{i,t-1} + \beta_7 Elec_{i,t} + \beta_8 Elec_{i,t+1} + \beta_9 Ad\_rate_{i,t} + \beta_{10} S\_rate_{i,t} + \varepsilon_{i,t} \quad (7)$$

with:

$\tau_{i,t}$ represents local business tax rate of the municipality i in year t.

$t_{i,t}^R$ is the regional tax rate and $t_{i,t}^D$ represents the tax rate of the county to which jurisdiction i belongs.

$Base_{i,t}$ is the fiscal base per capita of each municipality in year t. A significant and positive sign for β_3 means that there is a taxable rent in the jurisdictions.

$Density_{i,t}$ and $Income_{i,t}$ are respectively the population density and the income per capita of juridiction i in year t.

$Elec_{i,t-1}$ is a dummy variable which takes the value 1 the year before the municipal election, and zero otherwise.

$Elec_{i,t}$ is a dummy variable which takes the value 1 for each election year, and zero otherwise.

$Elec_{i,t+1}$ is a dummy variable which takes the value 1 the year after the election, and zero otherwise. An opportunistic cycle is verified if β_6 and/or β_7 are statistically different from zero and inferior to zero while β_8 is significantly positive.

Both variables $Ad\_rate_{i,t}$ and $S\_rate_{i,t}$ are dummy variables which take the value 1 when the municipality i belongs respectively to an addititional rate regime and a single rate regime in year t.This will be discussed later in the section on data set.

$\varepsilon_{i,t}$ is a the classical i.i.d. error.

One additional problem might arise: the possible endogeneity of three variables, that is the county rate, the regional rate and the tax base. To evaluate the existence of this problem, we use a Hausman exogeneity test (Hausman 1978), using various instruments for each variable, that is variables that are correlated with business tax rates but are uncorrelated with the regression error[2]. We conclude to the exogeneity of these three variables.

[2] To test the possible endogeneity of the county's and the regional tax rates, we use as instruments some lagged

3.3 Data set

In order to test the tax interdependence hypothesis, we use data the business tax rates set by the French localities, counties and regions for the period 1993-2002. These data come from the Direction Générale des Collectivités Locales (DGCL, Ministère de l'Intérieur) and from different French census. Table 1 in appendix provides some descriptive statistics for each variable used.

As noted above, local tax policies also reflect the impact of differences in economic and demographic factors grouped in the vector X in equation (4). Following the empirical literature, we include two sets of variables:

- the first one is an economic resource variable: the local business tax base. The expected sign is positive, due to the existence of a taxable rent.
- the second data set is composed of "expenditure needs" variables, such as the density and the personal income per capita. 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.
- the third data set is linked to the political cycle[3]. We introduce three dummy variables to check the existence of an opportunistic cycle that would characterizes the budgetary choices of our jurisidictions.
- the final data set concerns the tax regime of the jurisdiction. There are three possibilities. First, the municipality does not belong to any groups of localities and therefore alone fixes its tax rate. When municipalities belong to a group of localities with its own taxation, there are two cases; either the municipality keeps its own taxation and the jurisdictional taxation is additional ($Ad\_rate_{i,t} = 1$), or there is a single tax rate for all municipalities that belong to the group ($S\_rate_{i,t} = 1$).

3.4 Results

Our goal is to test the presence of fiscal externalities which may imply that the tax rates set by any given local government depend upon the tax rates set by other horizontally related

business tax rates for the county (resp. region) to explain the cross-sectional variation in the county's (resp. regional) tax rates. For the tax base, we use the share of old people (more than sixty years old) and the share of scholars in the municipality.

[3] French municipal elections hold each 6 years and permit to design a political assembly formed by elected members (named "conseil municipal") whose number depends on the size of population. The ballot is a proportional representation list system with two rounds. The election years on the period 1993-2002 are 1995 and 2001.

governments, that is the equation (7), which represents the reaction function of one jurisdiction's tax choice to other jurisdictions decisions. Therefore, we never tested the spatial lag model against the spatial error model. Column 1 shows the estimation results of the model without fixed effects and without spatial lag. We then run spatial tests that indicate the presence of spatial correlation. We thus tested the fixed effects spatial lag model against the spatial lag model without fixed effects (column 2). We have rejected the latter as the spatial lag model with spatial (or jurisdiction) fixed effects gives the better results. The results of the spatial lag model with time period fixed effects are not presented as they did not give better results than the spatial lag model without fixed effects. Columns 3 to 5 report the regression results of the model with spatially lagged dependent variable with spatial (or jurisdiction) fixed effets using ML method with respect to three weight matrices based respectively on demographic proximity W^{dem}, on distance W^{d} and on population and distance $W^{Pop/d}$. Columns 3 to 5 show the estimation results of the model with spatially lagged dependent variable and with spatial fixed effects respectively for each weight matrix. Finally, table 3 in appendix shows the estimation results of the model with spatially lagged dependent variable but without spatial fixed effects using the two other weight matrices.

Table 2: Estimation results of the model with spatial fixed effects

	(1)	(2)	(3)	(4)	(5)
Weight matrix	-	W^d	W^{dem}	W^d	$W^{Pop/d}$
Estimation method	OLS	ML	ML	ML	ML
ρ	-	0.591** (0.000)	0.045 (0.291)	0.289** (0.000)	0.282** (0.000)
Regional rate	0.076** (0.001)	0.065** (0.005)	0.032* (0.073)	0.020 (0.262)	0.020 (0.258)
County rate	0.286** (<.000)	0.236** (0.000)	0.041* (0.016)	0.034* (0.044)	0.033* (0.046)
Fiscal base p.c.	-0.072 (<.000)	-0.052** (0.000)	0.056** (0.000)	0.055** (0.000)	0.055** (0.000)
Density	0.072 (<.000)	0.074** (0.000)	-0.166* (0.013)	-0.144* (0.031)	-0.144* (0.031)
Income p.c.	-0.050* (0.087)	-0.139** (0.000)	0.338** (0.000)	0.265** (0.000)	0.266** (0.000)
Election year (t-1)	-0.013 (0.234)	-0.004 (0.664)	-0.009* (0.010)	-0.006 (0.075)	-0.007 (0.052)
Election year (t)	-0.017 (0.125)	0.004 (0.708)	-0.012** (0.000)	-0.008* (0.030)	-0.008* (0.029)
Election year (t+1)	-0.009 (0.428)	-0.006 (0.562)	0.011** (0.002)	0.010** (0.003)	0.010** (0.005)
Additional rate regime	0.002 (0.757)	0.003 (0.671)	-0.001 (0.968)	-0.002 (0.622)	-0.002 (0.622)
Single rate regime	0.017 (0.223)	0.007 (0.580)	-0.018* (0.003)	-0.019** (0.001)	-0.019** (0.002)
Intercept	2.646** (<.000)	1.737** (0.000)	-	-	-
Jurisdiction fixed effects	no	no	yes	yes	yes
R^2	0.19	0.25	0.92	0.92	0.92
Log-likelihood	-	92.312	4112.48	4138.39	4137.16
Observations	342	342	342	342	342

Note: all variables are log-transformed. Probability values are given into brackets. **: significant at 5%. *: significant at 10%.

The most important results in table 2 are the estimates of the parameter for the local tax base. We find a positive and significant sign for the local tax base in the model with fixed effects. These results suggest that jurisdictions can tax more as their local tax base increases and that there is a taxable rent in the urban jurisdictions in France.

Let us turn to the estimates of the three tax parameters: the horizontal tax interaction parameter, the vertical tax interaction parameter between counties and municipalities and the vertical tax interaction parameter between municipalities and regions.

First, for both matrices based on distance, we find that the coefficient of the local business tax rate of the jurisdictions is significant and positive. On the other hand, there is no interaction using the demographic matrix[4]. The results show that horizontal fiscal interactions between neighbouring jurisdictions are quite strong. With both weight matrices based on distance (columns 4 and 5), the estimate takes a value of about $0,285$. This implies that an average business tax increase of 10% in the neighbouring municipalities induces an increase of around 3% in the jurisdictional business tax rate. This result suggests that jurisdictions mainly look at their geographical neighbours to set their tax choices. This result can be explained by a standard tax competition argument. Indeed, French jurisdictions tend to develop strong local economic programs to maintain or attract some new firms. Municipalities 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. One can note that this result of horizontal tax interactions in the French jurisdictional 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 jurisdictional level of local government is also consistent with those obtained by Jayet, Paty and Pentel (2002) using a sample of northern France municipalities.

Second, the tax parameter β_1 associated to the regional rate is indeed never significant in any specification. Thus the estimation of the spatial tax model with two overlapping levels of local government leads to reject the hypothesis of business tax interactions between French counties 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

[4] Another possible explanation of tax interactions among jurisdictions could be related to a common "intellectual" trend, as suggested by Manski (1993). If this was the case, we should observe the same level of interactions for all matrices.

(around 10%) of the sum of the municipal, county 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 the tax behaviour of jurisdisctions.

Furthermore, the county tax rate is statistically significant and the estimate of its parameter has a positive sign in the three colums. The estimate of parameter β_2 takes a value of about $0,034$ using both weight matrices based on distance. This result suggests that for the business tax, county tax rates and municipal tax rates are strategic complements. More precisely, this means that a tax increase of 10% in the county tax rates induces an increase of around 0,3 % in the jurisdictional business 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, 2002) 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 (Esteller-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, this result can be explained by the complementarity of public services provided by municipalities and counties. 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 counties.

Concerning the other control variables, another interesting result concerns the political dummies which confirm the existence of an apportunistic cycle in the tax choices. Jurisdictions tend to decrease their tax before and during the year of election while they increase their tax rate the year after the election. The density exhibits a negative sign (in the model with fixed effects) which means that there is probably some economies of scale in the supply of local public goods. The parameter associated to the income per capita is positive (also in the model with fixed effects). This result captures the positive effect of income per capita on the demand in local public services, hence on business tax rates. Finally, concerning the tax regime, we observe the expected results: the choice of an additional tax regime has no effect on jurisdictional tax rates while municipalities that have chosen a single tax rate tend to set higher tax rates than the others.

4 Conclusion

The main purpose of this paper is to test the existence of a taxable rent in the French local tax setting by taking account the tax interactions among the jurisdictions. First we build a simple economic geography model with fiscal interactions. We estimate a model of tax setting for the local business tax using the econometrics techniques on panel data for 1993 to 2002. We observe that the relationship between tax rate and fiscal base gives presumption of the existence of a "taxable agglomeration rent" in the local French setting.

5 Appendix

Table 1: summary statitics

Variable	Mean	Maximum	Minimum	Standard dev.
Population	45866	2143364	4845	131597
Local business tax rate (%)	16.15	29.53	5.54	4.09
County's business tax rate (%)	7.06	12.36	0	1.81
Regional business tax rate (%)	2.17	3.33	0	0.42
Fiscal base (euros/inhabitant)	1888.27	9435.16	189.94	1003.18
Density (inhabitants/km^2)	1354.56	20335.52	35.11	1684.44
Income per capita (euros/inhabitant)	7081.71	18384.49	3701.27	1075.60

Table 3: Estimation results of the model without fixed effets

	(1)	(2)
Weight matrix	W^{dem}	$W^{Pop/d}$
Estimation method	ML	ML
ρ	0.156**	0.588**
	(0.000)	(0.000)
Regional rate	0.075**	0.067**
	(0.002)	(0.004)
County rate	0.283**	0.235**
	(0.000)	(0.000)
Fiscal base p.c.	-0.059**	-0.052**
	(0.000)	(0.000)
Density	0.063**	0.075**
	(0.000)	(0.000)
Income p.c.	-0.097**	-0.140**
	(0.001)	(0.000)
Election year (t-1)	-0.009	-0.005
	(0.429)	(0.594)
Election year (t)	-0.009	-0.004
	(0.404)	(0.712)
Election year (t+1)	-0.004	-0.007
	(0.705)	(0.511)
Additional rate regime	0.002	0.003
	(0.760)	(0.689)
Single rate regime	0.014	0.007
	(0.306)	(0.565)
cst	2.591**	1.749**
	(0.000)	(0.000)
Jurisdiction fixed effects	no	no
R^2	0.20	0.25
Log-likelihood	-7.47	91.84

6 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. 2003. Tax competition and economic geography. *Journal of Public Economic Theory* **5**(2): 279-304

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

Anselin L, Hudak S. 1992. Spatial econometrics in practice; a review f software options. *Regional Science and Urban Economics* **22**: 509-536

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

Baltagi B. 2001. *Companion to Theoretical Econometrics.* Blackwell Companions to Contemporary Economics, Basil Blackwell, Oxford, U.K.

Besley T, Case A. 1995a. Incumbent behavior: Vote seeking, tax setting and yardstick competition. *American Economic Review* **85**: 25-4.

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

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

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

Brueckner JK. 2003. Strategic interaction among governments: An overview of empirical studies. *International Regional Science Review* **26**: 175-188.

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

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.

Elhorst JP. 2003. Specification and estimation of spatial panel data models. *International Regional Science Review* **26**(3): 244-268

Elhorst JP. 2005. Panel data models extended to spatial error autocorrelation or a spatially lagged dependent variable. *mimeo*

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* **156**(5): 43-49

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

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

Goodspeed TJ. 2002. Tax competition and tax structure in open federal economies: Evidence from OECD countries with implications for the European Union. *European Economic Review* **46**(2): 357-374

Hausman J. 1978. Specification tests in econometrics. *Econometrica.* Econometric Society **46**(6): 1251-71

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

Jayet H, Paty S, Pentel A. 2002. Existe-t-il des interactions fiscales stratégiques entre les collectivités locales ?. *Economie et Prévision* **154**: 95-105

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

Manski C. 1993. Identification of endogenous social effects: The reflection problem. *Review* *of Economic Studies* **60**: 531-542

Ottaviano G. 2001. Home market effects and the (in)efficiency of international specialization. Mimeo. Graduate Institute of International Studies.

Ottaviano G, van Ypersele T. 2005. Market size and tax competition. *Journal of International Economics* **67**(1): 25-46

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

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

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