Fiscal competition between decentralized jurisdictions, theoretical and empirical evidence

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Abstract

This article provides theoretical and empirical evidence that local fiscal competition generates a bias toward low local business tax rates. First, a theoretical model is settled. The results are that second best optimal business tax rates (Nash equilibrium) are lower than the first best optimal business tax rates. Second, French inter-city reforms are used to estimate the model parameters and the bias toward low rates. This bias is found strong: fiscal competition generates an 18.7% decrease of business tax rates. Finally, this bias is used as a centralization force in an optimal decentralization model. The influence of this bias on the decentralization level is found weak.

Mots clefs: Optimal taxation; Business taxes ; Public capital; Firm location.

Classification JEL: H21; H25 ; H73; R12; R30.

1 Introduction

The level of decentralization is a crucial issue in state organization. For an example, France has begun a decentralization second run since the year 2003. The first run occurred during years 1982 and 1983. However, some local jurisdictions seem to be too much small to take profit from the decentralization. Thus, city unions also occurred since the year 1999. Hence, both decentralization and centralization is processing.

All developed countries have the authority decentralized. There are several reasons to give local jurisdiction authority. Historical development is one of these. Another important reason is that decentralized authority may take better choice as a matter of public investment. The nearer to the investment the decision is taken, the more it fits the needs. Therefore, decentralization allows public investments to be more productive.

However, decentralization is not free. By multiplying the administrations, it multiplies the administration costs. Furthermore, there may be costs due to local tax competition. Indeed, the different local administrations may enter a fiscal competition with their neighbors, which may result in tax rate decreases and then in public investment decreases.

The aim of the present paper is to point out local tax competition. First, theoretical evidence are presented. A local tax model is settled. It demonstrates that local tax competition generates a bias toward low tax rates. Then, empirical evidence confirms the model results. The model parameters are estimated, and the bias is calculated and found strong. Local tax competition leads to an 18.7% local tax rate decrease. Finally, two specification of a decentralization model are settled. The first specification considers public investment efficiency as a decentralization force and administration costs as a centralization force. The second specification adds fiscal competition negative effect on public investment quantity as another centralization force. The results are very similar from one specification to the other.

Some articles have already study tax competition at a local point of view. Theoretically first, Zodrow & Mieszkowski [13] build a model of local jurisdictions. Each local government chooses the business tax rate as the best response to the neighbor rates and the national rate. Private capital elasticity is fixed exogenously as a model parameter. It results in a business tax rates Nash equilibrium. The authors find that local tax rates are strategic complements. However, they do not determine if local tax rates and national tax rates are strategic complements or substitutes. Bénassy-Quéré et al. [4] introduce at an international level the idea of positive relationship between tax and base. They explain it by public investment arguments.

Haughwout et al. [8], Haughwout & Inman [9] and Mutti et al. [11] study calibrated models. Haughwout et al. [8] and Haughwout & Inman [9] conclude that local taxes on business activities are allready too much high in philadeplia and New-York. Mutti et al. [11] calibrate a six region model, and conclude that the relationship between tax and bases of local business taxes may be ambiguous.

From an empirical point of view, Boadway & Hayashi [5] studied the case of Canada. They estimate the tax rate decision interaction in a three province model: Ontario, Quebec and the rest of Canada. Buettner [6] does the same things with a panel of German jurisdictions. Both confirm the fact that local business tax rates are strategic complements the ones for the others. Furthermore, both find that local and central business tax rates are strategic substitutes. Buettner [7] tests the impact of local business tax rates on local business tax bases in Germany and finds it negative. Bell & Gabe [2] measure the policy impact on new establishment location and find that additional public spending and higher taxes may be good to attract firms.

Finally, concerning the optimal number of jurisdictional authorities, Alesina & Spolaore [1] built a model with many countries, total people mobility and preference heterogeneity. Two forces act in this model. In the one hand, creating more jurisdictions has a fixed cost by administration. In the other hand, creating more jurisdiction - and therefore jurisdiction with less people - allows local governments to take decisions closer to the inhabitant preferences. Thornton [12] studies the link between fiscal decentralization and growth from a macroeconomical point of view. Measuring the decentralization by the full-autonomy fiscal revenue of sub-national administration, he finds that there is no significant relationship between fiscal decentralization and growth.

The rest of the article is organized as follows. In section 2, the theoretical model is presented. Subsection 2.1 presents the model without fiscal competition. It results in the first best optimal local business tax rate. Subsection 2.2 introduces fiscal competition and results in the second best optimal business tax rate. The model finds a bias toward low local business tax rates generated by fiscal competition.

In section 3, the data used for the empirical study is presented. The French inter-city reform is explained. Since 1999, some cities choose to sign inter-cities agreement to build a new administrative level: a city union. Then, four data bases are presented. There is an inter-city union data base, a local tax data base, a local social properties data base and a geographical data base.

In section 4, the empirical study is presented. The model parameters are estimated. With this estimates, the bias toward low rate is calculated. It is found equal to an 18.7% decrease of local business tax rate. It also shows that resolving the fiscal competition issue allows increasing the business local tax rates without any negative impact on private capital settlement.

In section 5, a model of optimal decentralization is presented, and calibrated with the previous estimates. It is found that the influence of the bias toward low rate has very little impact on the optimal decentralization level.

In section 6, conclusions are presented.

2 Theoretical model

The model considers a country with n cities. At each period t in each city i ($i = 1..n$), there is l_{it} inhabitants, k_{it} private capital and p_{it} public capital. These production factors allow private firms to produce y_{it} with the production function $y_{it} = F(k_{it}, l_{it}, p_{it})$.

The production function used for this model is a Cobb-Douglas production function $y_{it} = Ak_{it}^{\alpha} l_{it}^{\beta} p_{it}^{\gamma}$, with two kinds of capital, private and public. In a first part, no hypothesis is assumed on return to scales. Later, constant return to scale are considered.

In order to focus on capital only, l_{it} is suppose exogenous. There is a total population L_t distributed among the cities.

The public capital is financed by way of local business taxation. City i taxes private capital k_{it} at rate τ_{it} and invest the revenue $\tau_{it} k_{it}$ as public capital for the following period $t+1$. As public capital is depreciating at rate δ, the public capital quantity p_{it} at time t in city i is $p_{it} = (1-\delta)p_{it-1} + \tau_{it-1} k_{it-1}$.

When a city tax rate varies, two phenomenon impact private capital. The total quantity in the country K varies, and remaining private capital is reallocated betweens cities. Total private capital K is the result of inter-temporal consumption optimization of agent utility $u(c_t, ..., c_{t+k}, ...)$, where c_t is the consumption at period t. Therefore, it depends on the private capital returns. At period t, the impact of tax τ_{it} on public capital p_{it} has not occurred yet. Therefore, the elasticity of K with respect to τ do not depend p. To measure this variation, the total capital elasticity with respect to business tax rate $\epsilon_K = -\frac{1-\tau_i}{k_i} \frac{\partial K}{\partial \tau_i}$ is used.

The private capital quantity k_{it} in each city is the result of the total capital K_t allocation between cities. This allocation is done in order to equalize the capital returns between cities. Equation (1) is the condition for the capital returns to be equal in each city.

$$\frac{\partial y_i}{\partial k_i} = g_1 = A\alpha k_i^{\alpha-1}(1-\tau_i)^{\alpha} l_i^{\beta} p_i^{\gamma} \tag{1}$$

Where g_1 is equal for all cities i. Equation (2) gives the resulting private capital allocation k_i, as a function of p_i, l_i, τ_i end K.

$$\begin{cases} k_i = \frac{f(i)}{\sum_{j=1}^{n} f(j)} K \\ f(i) = (1-\tau_i)^{\frac{\alpha}{1-\alpha}} p_i^{\frac{\gamma}{1-\alpha}} l_i^{\frac{\beta}{1-\alpha}} \end{cases} \tag{2}$$

Equation (2) gives k_i as a fraction of K. Moreover, as $\sum_{i=1}^{n} f(i)$ is the same for all cities, the fraction of K is higher when $f(i)$ is higher. The cities with more inhabitants, more public capital or less taxes attract more private capital.

Two resolutions of this model are implemented. First, the optimization process is done in order to maximise the overall production. In this case, no fiscal competition impacts tax rate choices. Second, fiscal competition may occur and each city maximizes its own production, with using its own rate. The model is solved in Nash equilibrium.

In this section, n is assumed fixed. Section 5 will consider the first best and second best optimal number of cities with sections 2 and 4 results considered as parameters.

2.1 Resolution without fiscal competition

This first subsection consists in resolving the model without fiscal competition. This is a three step problem. First, cities choose a tax rate. Second, private capital owners choose where they invest their savings. Finally production is done. The optimisation problem without fiscal competition consists in determining the set tax rates among all the cities that maximizes the overall production, under private capital settlement constraints. Resolution is done at the permanent equilibrium. Therefore, equation (3) gives the permanent equilibrium public capital, as a function of permanent equilibrium tax rate and private capital.

$$p_i = \frac{\tau_i}{\delta} k_i \tag{3}$$

Thus, production in city i can given as a function of k_i and τ_i, as presents equation (4).

$$y_i = A[(1-\tau_i)k]^{\alpha} l^{\beta} \left[\frac{\tau_i}{\delta} k_i\right]^{\gamma} = \frac{A}{\delta^{\gamma}} l^{\beta} k^{\alpha+\gamma} \tau_i^{\gamma} (1-\tau_i)^{\alpha} \tag{4}$$

As there is no fiscal competition, then point of the optimization problem is to maximise $Y = \sum_{i=1}^{n} y_i$ en $(\tau_i)_{i=1..n}$, with the τ_i as control variables. First order conditions in τ_i are given by equation (5).

$$\begin{aligned} &\tfrac{A}{\delta^{\gamma}} k_j^{\alpha+\gamma} l_j^{\beta} (1-\tau_j)^{\alpha} \tau_j^{\gamma} \left[\tfrac{\gamma}{\tau_j} - \tfrac{\alpha}{1-\tau_j}\right] \\ &= -\textstyle\sum_{i=1}^{n} (\alpha+\gamma) A \tfrac{\partial k_i}{\partial \tau_j} k_i^{\alpha+\gamma-1} (1-\tau_i)^{\alpha} l_i^{\beta} \tfrac{\tau_i^{\gamma}}{\delta^{\gamma}} \end{aligned} \tag{5}$$

Left hand term of equation (5) is decreasing from $+\infty$ to $-\infty$ when τ_j go from 0 to 1. Right hand term of this equation is positive and finite. Hence, there exists a solution strictly between 0 and 1. This solution is a maximum because y_i is positive for τ_i between 0 and 1 and y_i is equals to zero for $\tau_i = 0$ and $\tau_i = 1$.

In order to calculate the optimal tax rates τ_i^*, condition (5) has to be simplified. Left hand term of equation (5) is equal to right hand term of formula (6). Right hand term of equation (5) is equal to formula (7) term. According to these two simplifications, equation (8) gives the value of the optimal tax rates in each city.

$$\frac{A}{\delta^\gamma} k_j^{\alpha+\gamma} l_j^\beta (1-\tau_j)^\alpha \tau_j^\gamma \left[\frac{\gamma}{\tau_j} - \frac{\alpha}{1-\tau_j}\right] = \frac{k_j}{\alpha\delta^\gamma}\frac{\partial y_i}{\partial k_i}\left[\frac{\gamma}{\tau_j} - \frac{\alpha}{1-\tau_j}\right] \tag{6}$$

$$-\sum_{i=1}^{n}(\alpha+\gamma)A\frac{\partial k_i}{\partial \tau_j} k_i^{\alpha+\gamma-1}(1-\tau_i)^\alpha l_i^\beta \frac{\tau_i^\gamma}{\delta^\gamma}\frac{\alpha+\gamma}{\alpha}\frac{\partial y_i}{\partial k_i}\frac{k_j}{1-\tau_j}\epsilon_K \tag{7}$$

$$\tau_i^* = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\epsilon_K} \tag{8}$$

The main property of that first best optimum is that all cities have the same optimal tax rate. This tax rate does not depend on the number cities and not either on the city sizes. The optimal rate formula is composed of two different terms.

The first term is $\frac{\gamma}{\alpha+\gamma}$ and reflects the optimal ratio between k_i and p_i. This term comes from the maximization of $\tau_i^\gamma(1-\tau_i)^\alpha$. Therefore, τ^* is decreasing with respect to α because it represents the private capital productivity in the Cobb-Douglas production function. The more productive private capital is, the higher is the cost of taxing it. In addition, τ^* is increasing with respect to γ because it represent the productivity of the public capital in the Cobb-Douglas production function. The more productive public capital is, the higher are the benefits of taxation. As this first term represents an optimal ratio between private and public capital, it does not depend on the city size.

The second term is $\frac{1}{1+\epsilon_K}$, and represents the classical fiscal arbitrage between tax rate and tax base. If base elasticity with respect to tax rate is high, optimal tax rate is low, and vice versa.

2.2 Resolution with fiscal competition

In this second subsection, fiscal competition is introduced. The optimization problem consists for each city in maximizing its own production, with its own tax rate as only control variable. Tax rate choices are made according to the local elasticity of the capital $\epsilon_{k_i} = -\frac{1-\tau_i}{k_i}\frac{\partial k_i}{\partial \tau_i}$. According to equation (2), this elasticity depends on the $f(i)$ derivative with respect to τ_i, which is given by equation (9).

$$\frac{\partial f(i)}{\partial \tau_i} = -\frac{\alpha}{1-\alpha} A p^{\frac{1}{1-\alpha}} l^{\frac{\beta}{1-\alpha}} (1-\tau_i)^{\frac{\alpha}{1-\alpha}-1} = -\frac{\alpha}{1-\alpha}\frac{1}{1-\tau_i} f(i) \tag{9}$$

When calculating this derivative, one have to notice that p_i does not depends on τ_i. Equation (9) measures the firm location reaction to tax rate changes, which does not take future public investment into account because firm can delocalise in the future. Hence, choices are made as a function of the tax rate and the still existing public capital. According to equations (2) and (9), equation (11) gives the capital elasticity ϵ_{k_i} observed in city i, as a function of real capital elasticity ϵ_K, attracting function $f(i)$ and the production function parameters.

$$\frac{\partial k_i}{\partial \tau_i} = \frac{K}{\left(\sum_{j=1}^{n} f(j)\right)^2} \left(\frac{\partial f(i)}{\partial \tau_i} \sum_{j=1}^{n} f(j) - f(i) \frac{\partial f(i)}{\partial \tau_i} \right) + \frac{f(i)}{\sum_{j=1}^{n} f(j)} \frac{\partial K}{\partial \tau_i} \tag{10}$$

$$\epsilon_{k\tau,i} = -\frac{1-\tau_i}{k}_i \frac{\partial k_i}{\partial \tau_i} = \frac{\frac{\alpha}{1-\alpha} \sum_{j \neq i} f(j) + \epsilon_K f(i)}{\sum_{j=1}^{n} f(j)} \tag{11}$$

Local capital elasticity ϵ_{k_i} is then the weighted sum of two parameters, the real capital elasticity ϵ_K on the one hand and $\frac{\alpha}{1-\alpha}$ on the other hand. In this local elasticity term, ϵ_K represent the capital saving variations, and $\frac{\alpha}{1-\alpha}$ represent the capital moving from a city to another. The term $\frac{\alpha}{1-\alpha}$ is increasing with respect to α. It means that private capital run away from a city to another more easily when private capital productivity is higher.

The local capital elasticity ϵ_{k_i} could either be smaller or higher than the real capital elasticity ϵ_K depending on whether $\frac{\alpha}{1-\alpha}$ is smaller or higher than ϵ_K. The classical assumption is that local elasticity is higher than real elasticity. When a city increases its business tax rate, not only some capital is not saved anymore, but also some capital relocated into other cities. However, the opposite is also possible. Whatever lower or higher, the local capital elasticity is farer from the real capital elasticity when the cities are smaller.

At the permanent equilibrium, this local capital elasticity induces that the public capital variation with respect to taxes is as in equation (12).

$$\frac{\partial p_i}{\partial \tau_i} = \frac{k_i}{\delta} + \frac{\tau_i}{\delta} \frac{\partial k_i}{\partial \tau_i} = \frac{k_i}{\delta} \left(1 - \frac{\tau_i}{1-\tau_i} \frac{\frac{\alpha}{1-\alpha} \sum_{j \neq i} f(j) + \epsilon_K f(i)}{\sum_{j=1}^{n} f(j)} \right) \tag{12}$$

Resolving the decision to tax as a Nash equilibrium, the first order condition for a city best answer to other city tax rates is given by equation (13).

$$\gamma \frac{\partial p_i}{\partial \tau_i} p_i^{\gamma-1} (1-\tau_i)^{\alpha} k_i^{\alpha} + \alpha p_i^{\gamma} \left[(1-\tau_i)^{\alpha} \frac{\partial k_i}{\partial \tau_i} k_i^{\alpha-1} - (1-\tau_i)^{\alpha-1} k_i^{\alpha} \right] = 0 \tag{13}$$

The within brackets term is always negative when $\tau_i \in [0,1]$ and its limit when τ_i tends to 0 is finite. The other part of the left hand term tends to $+\infty$ when tau_i tends to 0 and is decreasing with respect to τ_i. Hence, equation (12) has a solution and this solution maximizes the production. With introducing equations (11) and (12) in condition (13), the first order condition (14) for the second best optimal tax rate τ_i^o is obtained.

$$\tau_i^o = \frac{\gamma}{\alpha+\gamma} \frac{1}{1+\epsilon_{k_i}} = \frac{\gamma}{\alpha+\gamma} \frac{1}{1 + \frac{\frac{\alpha}{1-\alpha} \sum_{j \neq i} f(j) + \epsilon_K f(i)}{\sum_{j=1}^{n} f(j)}} \tag{14}$$

The second best optimal tax rate τ_i^o may be either higher or lower than the first best optimal tax rate, depending on ϵ_K being higher or lower than ϵ_{k_i}. Whatever lower or higher, the second best optimal tax rate is farer from the first best optimal tax rate when the cities are smaller. Under that hypothesis that ϵ_K is lower than $\frac{\alpha}{1-\alpha}$, that is the most probable hypothesis, the second best optimal tax rate is lower than the first best optimal tax rate. Tax competition is then producing a bias toward low local business tax rates.

The point of the followings section is to calibrate the model presented in this section, in order to measure the bias toward low local business tax rates generated by fiscal competition between local jurisdictions.

3 Data

In order to calibrate the previous model parameter, econometrical work on French fiscal data is implemented. More precisely, French *taxe profesionnelle*, is studied. It is the main direct local tax on firms, and is yet based on capital. Before 1999, the *taxe profesionnelle* base was composed of two parts, the first part calculated on capital and the second part calculated on wages. Between 1999 and 2002, the wage part of the *taxe profesionnelle* base has disappeared. Therefore, data after 2002 are used to have the business tax base as proxy of private capital invested in the city territory.

The main source of variation used to calculate the estimates is linked with intercommunality reforms.

The intercommunality reforms consist mainly on the possibility for cities to unite (e.g. Bernard et al. [4]). There were three local administrative levels in France. The smallest is the *commune* level, they are the cities. There are more than 36000 cities, which makes a mean of 1700 inhabitants in each. Then is the *département* level. There are 100 *départements* in France, which makes a mean of 360 cities in each. At the end, there is the *régions* level. There are 24 *régions* in France, which makes a mean of 4 *départements* in each *région*. Each level settles a rate for the local business tax. The national fiscal administration calculates the business tax base and takes the sum of rates, then redistribute.

Since 1999, a new administrative level exists: the EPCI that are city unions. There are among 20 cities in each EPCI. The cities themselves choose to create a new EPCI and to enter one. There is no obligation. The EPCI may choose different kinds of financing. First of all, a fourth business tax rate may be settled. Such EPCI are called EPCI with four rates (EPCI 4RT). They are mainly rural city unions. Second, a unique business tax rate may be settled. The business tax revenue is shared between the EPCI members and the other administrative levels do not receive business tax revenue. Such EPCI are called EPCI with a unique business tax (EPCI UBT). They are mainly urban city unions.

The choice of creating or entering an EPCI is clearly endogenous. However, the empirical work will always use individual fixed effects, and compare the cities properties before and after entering EPCI, and never compare city inside city-unions with cities outside city-unions.

Table 1 gives the city number in the sample taking part of EPCI (and there fiscal properties) for each one of the three years studied: 2002, 2003 and 2004.

Table 1: French cities and there being in EPCIs

	Alone	EPCI 4RT	EPCI UBT	Overall
2002 number	8 409	15 302	7 907	31 618
2002 percentage	27 %	48 %	25 %	100 %
2003 number	5 954	15 343	10 321	31 618
2003 percentage	19 %	48 %	33 %	100 %
2004 number	4 509	15 597	11 512	31 618
2004 percentage	14 %	49 %	37 %	100 %

Note: There are more than 36 000 city in France. the present panel has only 31 618 because there is some lacks in different data bas or years. The main lacks comes from the geographicall data base.

Table 1 indicates that significant inter-city status variations occurred between 2002 and 2004. The number of cities outside any inter-city agreement has decreased as the number of cities in EPCI UBT has increased. The number of cities in EPCI 4RT has been stable. More precisely, no city exited an EPCI. Outside EPCI cities enter both kinds of EPCI, and some EPCI 4RT city unions adopt a Unique Business Tax system.

Concerning the local taxes, the data set used is "*données de fiscalité directe locale*", compiled by DGI[1]. Each tax is collected nationally then redistributed. Therefore, the national fiscal administration can compile rate, base and fiscal revenue for each local administrative level in each city. Table 2 summarizes the overall business tax rates and business tax bases in French cities.

Table 2: Business tax rates and bases

	Mean	Standard deviation	Spatial standard deviation	Temporal standard deviation
Rates	21.0 %	7.2 %	6.4 %	3.3 %
Bases	2.4	16.2	16.1	1.8
City part	28 %	25 %	22 %	11 %
EPCI part	51 %	17 %	14 %	9 %
Rates (vs neighbors)	100 %	27 %	23 %	13 %
Bases (vs neighbors)	0.66 %	3.31 %	3.29 %	0.32 %

Notes: The tax base unity is million of euros. Rates vs neighbors is the ratio between the city rate and the mean rate among cities closer than 30 kilometers. Therefore, rate vs neighbors mean is 1. Bases vs neighbors is the ratio between the city base and the total base among the city not farer than 30 kilometers. Therefore, base vs neighbors mean is 0.66 because there is a mean of 150 cities in a 60 kilometer diameter circle.

Spatial standard deviations are all very high. The reason is the very high level of inequality between

[1]Direction Générale des impôt: French national fiscal administration.

French cities. The size is very different from one city to another. The mean inhabitant number is little higher than 1600 by city. However, there are a lot of much bigger cities, and even more of even smaller cities.

The high temporal standard deviations are less obvious to explain. Nevertheless, this high temporal variation is very important for the present study. As empirical analyses are panel estimations with individual fixed effects, the temporal variations for each city are the only source of variation considered.

We present an inter-city reform in previous paragraphs. Another reform about the local business tax began in 1999. This reform changed the way of calculating tax bases. That could be a problem if bases would have been calculated differently one year from the previous in the data set studied. However, this reform ended in 2002, so the present study is not impacted by this reform.

Another data set is used to determine the city properties: IRCOM[2] data set. It provides a summary of income tax declaration for each French city. As an example, there is information on the number of fiscal declarations. This number is used as proxy of the city size. Indeed, the number of inhabitants in each city is really known only after each census. There was a population census in 1999 and the following in 2004. Census data source can not be used for yearly variation size.

Moreover, IRCOM data base provides information on income: both the amount and the kinds of incomes (wages, capital incomes, retirement pension...). According to this data set some, the empirical work can control for some sociologic composition variables for each city.

At last, a geographic data set is used. It provides the x and y coordinates of each town hall in the Lambert projection. Thanks to this data set, distance between cities may be calculated, and therefore neighbor values of the variables may be determined. The neighbor value of one variable in one city is the sum or the mean of the values of this variable for cities less than 30 kilometres far from the city considered.

4 Estimations

The present section is divided into two subsections. The point of the first subsection is to calibrate the section 2 model, by estimating the parameters of this model. It is done by measuring the impact on business tax rate of diminishing local fiscal competition. The point of the second section is to measure the impact on production of local fiscal competition.

4.1 Parameter estimates

The model presented in section 2 assumes four parameters: α, β, γ and ϵ_K. The point of the present subsection is to estimate these parameters. In that purpose, four equations with these four parameters are needed. Before implementing regressions, two hypotheses can be made, that give two equations. First, constant returns to scale are assumed: $\alpha+\beta+\gamma=1$. Second, classical empirical results state that the value added distribution between labor and capital is $\frac{2}{3}$ for labor remuneration and $\frac{1}{3}$ for capital remuneration.

[2]Impôts sur le Revenu des COMmunes: Income tax for the cities.

With the Cobb-Douglas production function presented in section 2, it means that $\beta = 2\alpha$. Two other equations on α, β, γ and ϵ_K are needed to estimate these parameters. In that purpose, regressions (15) and (16) are implemented. They take profit from the EPCI reform to estimate the impact on business tax rates of diminishing fiscal competition between neighbor cities.

$$\begin{aligned} \ln(Taux_{TP,it}) &= a + b\ln(nb_{habt}) + c\mathbf{1}_{i\in EPCI,t} \\ &+ d\mathbf{1}_{i\in EPCI,t} * ln(nb_{habt}) + e\mathbf{1}_{an=2003} + u_i + \epsilon_{it} \end{aligned} \tag{15}$$

$$\begin{aligned} \ln(Taux_{TP,it}) &= a + b\ln(nb_{habt}) + c_1\mathbf{1}_{i\in EPCI_{4TX},t} + c_2\mathbf{1}_{i\in EPCI_{TPU},t} \\ &+ d_1\mathbf{1}_{i\in EPCI_{4TX},t} * ln(nb_{habt}) \\ &+ d_2\mathbf{1}_{i\in EPCI_{TPU},t} * ln(nb_{habt}) + e\mathbf{1}_{an=2003} + u_i + \epsilon_{it} \end{aligned} \tag{16}$$

When cities are not unified into EPCI, fiscal competition occurred between the neighbour cities and business tax rates are as in equation (14). Hence, the constant coefficient of regressions (15) and (16) is $a = ln\left(\frac{\gamma(1-\alpha)}{\alpha+\gamma}\right)$. This gives the third condition on α β and γ. Therefore, these three parameters values may be calculated, according to system (17).

$$\begin{cases} \alpha + \beta + \gamma = 1 \\ \beta = 2\alpha \\ \frac{\gamma(1-\alpha)}{\alpha+\gamma} = \exp(a) \end{cases} \tag{17}$$

If neighbor cities unite into EPCI, they protect themselves from fiscal competition and their business tax rate is given by equation (8). Therefore, inter-city dummy coefficient gives $\exp(c) = \frac{\tau^*}{\tau^o}$ with τ^o the second best optimal tax rate for an infinitely small city[3]. Therefore, it is possible to estimate ϵ_K, knowing α from system (17) and according to equation (18).

$$\epsilon_K = \left(1 + \frac{\alpha}{1-\alpha}\right)\exp(c) - 1 \tag{18}$$

Table 3 presents the results of the two regressions (15) and (15).

First of all, these results are very significant. Quite all estimates are significant at the level of 1%. The inhabitant number coefficient is the only one not significant, because temporal inhabitant variations are not large enough. Furthermore, the temporal R^2 are very high (28%), which indicates that the variables used for this regression explain a large share of the tax rate variance.

Second, both regressions show that local tax rates increased after the city enter an EPCI. This illustrates that local fiscal competition generates a bias toward low local tax rates. The business tax rates increase when fiscal competition is diminished by inter-city unions. According to theoretical results presented in section 2, this also means that local capital elasticity is higher than the real capital elasticity, which implies that $\frac{\alpha}{1-\alpha} > \epsilon_K$. Furthermore, $f(i)$ is increasing with respect to the size of city i and $\sum_{j\neq i} f(j)$ is decreasing with respect to the size of city i. Hence, equation (11) implies that capital elasticity faced by small cities should be higher than capital elasticity faced by big cities. This result is confirmed

[3]It is for an infinitely small city because there is also a cross variable (EPCI dummy and city size) in the regression.

Table 3: Regressions

		Taux de TP	
		(15)	(16)
Constant	a	7.249***	7.277***
		(0.100)	(0.100)
Habitants	b	0.027	0.022
		(0.017)	(0.017)
EPCI	c	0.231***	
		(0.041)	
EPCI*Habt.	d	-0.027***	
		(0.007)	
EPCI 4TX	c_1		0.168***
			(0.047)
EPCI 4TX*Habt.	d_1		-0.013
			(0.008)
EPCI TPU	c_2		0.215***
			(0.047)
EPCI TPU*Habt	d_2		-0.029***
			(0.008)
Observations		51 444	51 444
R^2 temporel		28 %	28 %
R^2 spacial		2 %	1 %
R^2 général		9 %	8 %

***: significant at 1%, **: significant at 5%, *: significant at 10%. Standard errors in parentheses.

by the d coefficients of regressions (15) and (16): These d coefficients are negative. The tax rate increase is lower for bigger cities. The fiscal competition bias is higher for smaller cities.

The previous results are true whatever looking at all EPCI together or differentiating for the fiscal kind of EPCI. When differentiating for the fiscal kind of EPCI, it appears that local business tax rates increase more for EPCI with a unique tax rate that for others. Indeed, the fiscal competition is more decreased in these EPCI, because they share a higher part of their local business tax revenues.

Moreover, according to the equation system (17) and equation (18), α, β, γ and ϵ_K can be estimated with a and c estimates. The results of these α, β, γ and ϵ_K estimates are presented in table 4.

The results presented in table 4 indicate that public capital has a quite low importance in the production process. This importance is however far from being negligible. The main important results concerned capital elasticity estimates. The true capital elasticity ϵ_K is only 0.15, which is weak. The capital elasticity due to capital moving between cities is more important: α estimate indicates that this elasticity is

Table 4: Parameter estimates

α	β	γ	ϵ_K
0.31	0.61	0.08	0.15

$\frac{\alpha}{1-\alpha} = 0.44$. The local capital elasticity is then found three times higher than the real capital elasticity, which explains why local competition generate a substantial bias to low local business tax rates.

4.2 Rate impact on bases

The previous results signal that lonely city business tax rates are under-optimal. Tax competition decrease implies local business tax rate increase. This increase brings the local business tax rates closer to the optimal value. Hence, this tax rate increase should increase the production in the long run. The process is the following: fiscal competition decrease allows cities to increase their business tax rates without private capital investment run away. Therefore, it allows cities to increase their fiscal revenue. With this additional revenue, cities can invest in public capital. These investments increase private capital productivity in the city. The productivity increase attracts new private capital investments. As a final result, business tax rate increase because of city unions should induce business tax base increase in the long run.

The point of this subsection is to test this assumption. In that purpose, two different rate variations are separated. First of all, local business tax rate variations because of inter-city agreements are considered. These variations bring the business tax rates closer to the optimal tax rate, and should have a positive impact on business tax base. These tax rate variations are calculated as the prediction out of regressions (15) or (16). They are called $\tau_{predicted}$. Second, all the other local business tax rate variations are considered. These variations do not bring the business tax rate closer to the optimal tax rate. They should have a negative impact on business tax base. These other business tax rate variations are calculated as the residue out of regressions (15) or (16). They are called $\tau_{residue}$.

To compare the impact on business tax base of both tax rate variations $\Delta\tau_{predicted}$ and $\Delta\tau_{residue}$, business tax base is regressed on that two variables. It is a panel regression with temporal and individual fixed effects. The point is to measure the impact of tax rate variations on tax base variations. Moreover, tax base variations are regressed on tax rate variations the year before. This delay in regression is chosen because there is a delay in public investments. Fiscal revenue one year is invested the following year. The regressions follow equation (19).

$$\begin{aligned} \ln(Base_{TP,t+1}) &= A + B\ln(nb_{habt,t+1}) + C\ln(\tau_{predicted,t}) \\ &+ D\ln(\tau_{residue,t}) + E\mathbf{1}_{an=2003} + u_i + \epsilon_{it} \end{aligned} \tag{19}$$

Two different regressions are made according to equation (19). First, regression (19a) uses regression (15) results to estimate $\tau_{predicted}$ and $\tau_{residue}$. Second, regression (19b) uses regression (16) results to estimate $\tau_{predicted}$ and $\tau_{residue}$. The results of these two regressions are presented in table 5.

Table 5: Impact of tax rate variations on tax bases

		(19a)	(19b)
		prediction with (15)	prediction with (16)
		Business tax base	
$\tau_{predicted}$	C	0.221***	0.125*
		(0.081)	(0.070)
$\tau_{residue}$	D	0.008	0.008
		(0.005)	(0.005)
Observations		51 435	51 435
Temporal R^2		3 %	3 %
Spacial R^2		38 %	40 %
Overall R^2		12 %	10 %

***: significant at 1%, **: significant at 5%, *: significant at 10%. Standard errors in parenthese.

Regression (19a) and (19b) results confirm the assumption of this section 4.2. Both coefficient D are non significant. Because standard errors are very small (0.005), it can be conclude that other business tax rate variations ($\Delta\tau_{residue}$) has no positive impact on production. Both coefficients C are significantly positive. This means that business tax rate increase occurring after a city union creation ($\Delta\tau_{predicted}$) has significant positive impact on tax base one year later. Then it has positive impact on production. The economic situation is improved by this tax rate increase because it compensates a bias to low business tax rate generated by fiscal competition.

Furthermore, it can be concluded that the production loss due to fiscal competition is high. Indeed, parameter C estimate is high. There is a 0.2% local business tax base increase after a 1% local business tax rate increase. Therefore, with both results of tables 3 and 5, inter-city agreement impact can be measured. After entering an EPCI, cities decide a 23% local business tax rate increase. Because of this 23% increase of the fiscal revenue - and therefore of public investments - there is a 5% increase of business tax bases one year later.

5 Decentralization model

Previous results present negative impact of decentralization. Decentralization generates local fiscal competition and that local fiscal competition has a significantly negative impact on production. A conclusion may be that countries have to be very centralized, in order to avoid these negative effects. However, main developed countries are decentralized, and France, that has been very centralized, is since 2002 in a second process of decentralization[4]. The reason is mainly the efficiency of the local decisions. The point of the present section is to model the optimal decentralization level, with and without local fiscal competition.

[4]The first decentralization process occurred in 1982 and 1983.

Before presenting the theoretical model, an empirical illustration is shown.

5.1 Empirical illustration

If decentralization has a negative impact on public capital quantity, it has a positive impact on public capital quality. To illustrate this fact, two regressions are implemented, based on data presented in section 3. This regressions are given by equations (20) and (21).

$$\begin{aligned} \ln(Base_{it+1}) &= \alpha + \beta ln(\tau_{it}) + \gamma ln(\tau_{neigh.,it}) \\ &+\delta ln(pop_{it+1}) + \eta \mathbf{1}_{i\in EPCI\ 4RT,t} + \theta \mathbf{1}_{i\in EPCI\ UBT,t} \\ &+\zeta \mathbf{1}_{year=2003} + u_i + \epsilon_{it} \end{aligned} \tag{20}$$

$$\begin{aligned} \ln(Base_{it+1}) &= \alpha + \beta_1 ln(\tau_{city,it}) + \beta_2 ln(\tau_{EPCI,it}) \\ &+\beta_3 ln(\tau_{dep,it}) + \beta_4 ln(\tau_{reg,it}) \\ &+\gamma ln(\tau_{neigh,it}) + \eta \mathbf{1}_{i\in EPCI\ 4RT,t} + \theta \mathbf{1}_{i\in EPCI\ UBT,t} \\ &+\delta ln(pop_{it+1}) + \zeta \mathbf{1}_{year=2003} + u_i + \epsilon_{it} \end{aligned} \tag{21}$$

Equation (20) directly measures the impact of business tax rate variations on business tax base variations one year later. Equation (21) measures differently the impact of the different business tax levels. If there was no investment efficiency differences between public investments of different decentralized levels, the different coefficient β_1, β_2, β_3 and β_4 should be equal to each other and equal to β. The results of these regressions are presented in table 6.

The results of table 6 illustrate the efficiency of decentralized public investments. The direct fiscal incidence of business taxes is the same whatever the jurisdiction earning the fiscal revenue. The central fiscal administration gives the global rate to the firm and redistribute after the tax collection. Hence, the difference between the different rate impacts is due to the fiscal revenue expenditure. Coefficients β_i are increasing with respect to the decentralization level. Thus, the efficiency of these jurisdiction expenditures is increasing with respect to the decentralization level.

This difference may be due to the kinds of expenditures and not their efficiency. It is the quite true concerning *départements*, whose fiscal revenue is rarely spend for public infrastructures. But this is false for *régions*. Therefore, city and EPCI public investments are more efficient than *régions* public investments. In the following subsections, this fact is included in a decentralization model.

5.2 Decentralization without fiscal competition

The decentralization model is based on the section 2 framework. A hypothesis is added concerning the efficiency of public capital. A new parameter p_{it}^e is introduced, it is the effective public capital. If public capital p_{it} is rightly invested, the effective public capital is $p_{it}^e = Dp_{it}$. If it is badly invested, the effective public capital is $p_{it}^e = Cp_{it}$, with $C < D$. Let π be the probability for a public investment to have been done rightly. The hypothesis is that π increasing with closeness between investment and decision. The

Table 6: Efficacity of public investment depending on the decentralization level

	(20)	(21)
	Business tax base	
Overall ratel	0,007	
β	(0,005)	
City rate		0,003**
β_1		(0,001)
Inter-city rate		0,000
β_2		(0,002)
Département rate		-0,005*
β_3		(0,003)
Région rate		-0,006***
β_4		(0,002)
Neighbor rate	0,009	0,058**
γ	(0,017)	(0,025)
Inhabitants	0,006	0,006
δ	(0,012)	(0,013)
EPCI 4RT	0,002	0,001
η	(0,007)	(0,010)
EPCI UBT	0,020**	0,040**
θ	(0,008)	(0,016)
Observations	51 403	51 403
Temporal R^2	3 %	3 %
Spacial R^2	31 %	22 %
Overal R^2	10 %	9 %

***: significant at 1%, **: significant at 5%, *: significant at 10%. Standard errors in parenthese.

number n of cities is the parameter that measures decentralization. Therefore, the control variable is the number n of cities, and $\pi(n)$ is increasing with respect to the city number n. There are a high number of public investments. Therefore, the efficiency probability indicates the mean of public investment efficiency. Hence, the effective public capital is given by equation (22).

$$p^e = \{[1 - \pi(n)]C + p(n)D\pi\}\, p = \Pi(n)p \tag{22}$$

The efficiency function $\Pi(n)$ is assumed to be convex. In the present model, public investment efficiency increase with respect to decentralization is an incentive to decentralize. However, it costs. As in Alesina & Spolaore [1], fixed costs c by administration are assumed. Hence, the global cost of a decentralization at level n is cn. Another cost may be the fiscal competition between the decentralized jurisdictions.

Benefit and costs of decentralizing a country may be include in a maximization problem. It results in the optimal number of jurisdictions. Two resolutions of such a maximization problem are made. First of all, the first best optimal number of cities is found when the local business tax rates are chosen in order to maximise the overall production. It is when there is no fiscal competition. This resolution is made in the present subsection. Second, the second best optimal number of cities is found when each city chooses its own business tax rate in order to maximise its own production. It is when there is fiscal competition. This resolution is made in the following subsection.

In the present decentralization model, it is assumed that each city has the same size ($l_i = \frac{L}{n}$). Hence, $k_i = \frac{K}{n}$ at the equilibrium. Furthermore, the business tax rate in each city is the first best optimal tax rate $\tau^* = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\epsilon_K}$ calculated in subsection 2.1. Therefore, public capital is also the same in each city. It is given by equation (23).

$$p^* = \frac{\gamma K}{\delta(\alpha+\gamma)(1+\epsilon_K)n} \tag{23}$$

At that point, $p^*(n)$, $\tau^*(n)$, $l(n)$ and $k(n)$ are known. The maximisation problem is given by system (24).

$$\begin{aligned} &\max_n Y - nc = nAp^{e\gamma}\left[(1-\tau)k\right]^\alpha l^\beta \\ &sc\ :\ \left| \begin{array}{l} p^e = \Pi(n)p \\ p = \frac{\gamma K}{\delta(\alpha+\gamma)(1+\epsilon_K)n} \\ \tau = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\epsilon_K} \\ k = \frac{K}{n} \\ l = \frac{L}{n} \end{array} \right. \end{aligned} \tag{24}$$

As in section 2 model, constant return to scale in the production function (e.g.: $\alpha+\beta+\gamma=1$) are assumed. The first order condition of this maximization problem is then given by equation (25).

$$\frac{1}{\frac{\Pi'}{\Pi}} = \gamma\frac{Y}{c} \tag{25}$$

The left hand term $\frac{1}{\frac{\Pi'}{\Pi}}$ is increasing with respect to n because Π is convex. Therefore, the first best optimal number of cities is increasing with respect to the production capacity Y and with respect to the public capital productivity γ. If a country output increases, the number of its local jurisdictions has to increase too. This result is true whatever the reason of the country output increase. It may be because of an inhabitant L increase, because of more technology A or more private capital K. Equation (25) also indicates that the first best optimal number of cities is decreasing with respect to the fixed cost c. The decentralization level is obviously chosen lower when decentralization costs more.

In order to have a simpler formula of the first best decentralisation level n^*, additional hypotheses on $\Pi(n)$ have to be assumed. As $\gamma\frac{Y}{c}$ is very high (a local administration cost is negligible compared to the total country output) n^* is also very high. Thus, results can be calculated as equivalents for n high. As the concavity of Π is the relevant point, 5 Π categories are considered, by increasing concavity. Table 7 presents these categories and the equivalent of n^* for each of them.

Table 7: Efficient function and first best optimal level of decentralization

Category		$\frac{\Pi'}{\Pi}$	n^*
1:	n^d	$\frac{d}{n}$	$d\gamma\frac{Y}{c}$
2:	$\ln(n)$	$\frac{1}{n\ln(n)}$	$\gamma\frac{Y}{c} < .. < \sqrt{\gamma\frac{Y}{c}}$
3:	$\frac{n-1}{n}$	$\frac{1}{n(n-1)}$	$\sqrt{\gamma\frac{Y}{c}}$
4:	more concave		$<< \sqrt{\gamma\frac{Y}{c}}$
5:	$1-\exp(-n)$	$\frac{\exp(-n)}{1-\exp(-n)}$	$\ln(\gamma\frac{Y}{c})$

Notes: Column n^* presents equivalent of n^* for high $\gamma\frac{Y}{c}$. Category 5 is a particular exemple of category 4.

Table 7 results confirm that the first best optimal number of cities is increasing with respect to the production capacity Y and with respect to the public capital productivity γ. It is decreasing with respect to the fixed cost c. Furthermore, it shows that this dependence is less than proportional, except in the non concave case. For an example, if country A has an output twice the size of country B output, country A should be decentralized in more cities than country B. However, country A should have less than twice more cities than country B. Hence, if country A is bigger than country B, country A cities should be bigger than country B cities.

5.3 Decentralization with fiscal competition

The present subsection model assumed quite the same hypotheses as in previous subsection. However, the second best optimum is here considered. The tax rates are τ^o and no more τ^*. All cities have same size. Hence, $f(i)$ is the same for each i and the second best optimal tax rate is $\tau^o = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\frac{n-1}{n}\frac{\alpha}{1-\alpha}+\frac{\epsilon K}{n}}$. Under these hypotheses, the equation system (26) presents the maximisation problem with the number of cities as control variable.

$$\max_n Y - nc = nAp^{e\gamma}\left[(1-\tau)k\right]^{\alpha} l^{\beta} \text{ -nc}$$
$$sc : \left| \begin{array}{l} p^e = \Pi(n)p \\ p = \frac{\gamma K}{\delta(\alpha+\gamma)n}\frac{1}{1+\frac{n-1}{n}\frac{\alpha}{1-\alpha}+\frac{\epsilon K}{n}} \\ \tau = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\frac{n-1}{n}\frac{\alpha}{1-\alpha}+\frac{\epsilon K}{n}} \\ k = \frac{K}{n} \\ l = \frac{L}{n} \end{array} \right. \qquad (26)$$

To resolve this maximization problem, $\frac{\partial\tau}{\partial n}$ and $\frac{\partial K}{\partial n}$ have to be determinate. According to the model specifications presented in section 2, these differentiates are calculated in equation (27).

$$\begin{cases} \frac{\partial\tau}{\partial n} = -\frac{1}{n^2}\tau z \\ \\ \frac{\partial K}{\partial n} = \frac{\partial K}{\partial \tau}\frac{\partial \tau}{\partial n} = -\epsilon_K K \frac{1}{n^2}\frac{\tau}{1-\tau} z \\ \\ z = \frac{\frac{\alpha}{1-\alpha} - \epsilon_K}{1 + \frac{\epsilon_K + (n-1)\frac{\alpha}{1-\alpha}}{n}} \end{cases} \tag{27}$$

According to this equation, the first order condition of this second best maximisation problem can be determined. This condition on n is given by equation (28).

$$\frac{1}{\frac{\Pi'}{\Pi} + \frac{1}{n^2} z \left[\frac{1}{\gamma}\frac{\tau}{1-\tau}\left(\alpha - (\alpha+\gamma)\epsilon_K\right) - 1\right]} = \gamma\frac{Y}{c} \tag{28}$$

From the first order condition (28), n^o or its equivalent for $\gamma\frac{Y}{c}$ high is calculated. The additional term is equivalent to $\frac{1}{n^2}$. If public investment efficiency function is part of categories 1 or 2, the additional term is negligible compared to $\frac{\Pi'}{\Pi}$, and n^o is still high. If public investment efficiency function is part of category 3, the additional term is equivalent to $\frac{\Pi'}{\Pi}$, and n^o is still high. For these three categories, the equivalent of n^o for n^o high is calculated. If public investment efficiency function is part of categories 4 or 5, $\frac{\Pi'}{\Pi}$ is negligible compared to the additional term, and n^o is no more high. For category 5, the actual value of n^o is calculated, and not its equivalent. The results are presented in table 8.

Table 8: Efficient function and second best optimal level of decentralization

Category		n^o
1:	n^d	$d\gamma\frac{Y}{c} = n^*$
2:	$\ln(n)$	$\gamma\frac{Y}{c} < .. < \sqrt{\gamma\frac{Y}{c}} = n^*$
3:	$\frac{n-1}{n}$	$n^*\sqrt{1 + [\alpha - (1-\alpha)\epsilon_K]\left[\frac{1-\alpha}{\alpha(\gamma+1)}[\alpha - (\alpha+\gamma)\epsilon_K] - 1\right]}$
4:	more concave	very small
5:	$1 - \exp(-n)$	3

Notes: For categories 1, 2 and 3, column n^o presents equivalent of n^o for high $\gamma\frac{Y}{c}$. Category 5 is a particular exemple of category 4.

It appears from these results that if Π belong to category 1 or category 2, the equivalent of the second best optimal number of town n^o is the same that the equivalent of the first best optimal number of town n^*. With this public investment efficiency function, fiscal competition has no incidence on the optimal decentralization level, although it has incidence on local business tax rates and on public investment quantities.

If Π belongs to category 3, the equivalent of the second best optimal number of town n^o is different from n^*. However, calculating the n^o equivalent value with the section 4 estimates gives $n^o = 0.95n^*$. In this case, fiscal competition has very few incidences on the optimal decentralization level. The second best optimal number of towns n^o is very close to the first best optimal number of towns n^*.

Finally, if Π belongs to category 4 or category 5, the right hand side of equation (28) is negative for low n. Hence, n^o is very small, and there is quite no decentralization at all.

6 Conclusion

This paper presents the benefits and costs of decentralization. The benefits are the increase of public capital efficiency: investment decision fits more local needs if they are taken at a local level. The costs are the decrease of public capital quantity: local jurisdictions compete to attract capital, and fiscal competition generates a bias toward low local business tax rates. Low rates induce low fiscal revenue, and consequently low public investments.

With model resolved at Nash equilibrium, the present paper presents how fiscal competition generates the bias toward low local business tax rate, and attempt to measure it through 4 parameters.

Then, the paper estimates the model parameters through French local tax data and gives evidence of the bias toward low local business tax rates. Fiscal competition between French cities generates an 18.7% local business tax rate decrease. This tax rate decrease induces a public investment decrease, which causes a 4.8% private capital investment decrease.

Although these negative effects of decentralization, a majority of countries keep a decentralized organization. The reason is explained in the end of the present paper. A decentralization model is presented. Its point is to calculate the optimal level of decentralization. This model uses the same parameters as the tax rate choice model. Hence, it is calibrated with these parameter estimates. The results are that if public investment efficiency returns to decentralization are high enough, there is no need for diminishing the decentralization level because of fiscal competition.

It seems that inter-city agreement should have a positive impact on business development because it keeps political decision decentralized but it centralizes fiscal revenue. However, it remains two problems. First, there is the question of the allocation of the somehow centralized fiscal revenue. Second, with the increasing importance of inter-city and other local taxation, perequation questions may arise, with the existence of its deadweight loss (e.g. Smart [11]).

References

[1] A. Alesina, E. Spolaore, On the number and size of nations, Quaterly Journal of Economics 112 (1997) 1027-1056.

[2] K. Bell, T. Gabe, Tradeoffs between Local Taxes and Government Spending as Determinent of Business Location, Journal of Regional Science 44 (2004) 21-41.

[3] Y. Benard, C. Bonnard, O. Fouquet, E. Jalon, Commission de reforme de la taxe professionnelle, rapport au premier ministre, France (2004).

[4] A. Bénassy-Quéré, N. Gobalraja, A. Trannoy, Concurrence fiscale et facteur public, La documentation française, Rapport du Conseil d'administration économpique 56 (2005) 157-186.

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

[6] T. Buettner, Local business taxation and competition for capital: the choice of the tax rate, Regional Science and Urban Economics 31 (2001) 215-245.

[7] T. Buettner, Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of German juridictions, Journal of Urban Economics 54 (2003) 110-128.

[8] A. Haughwout, R. Inman, S. Craig, T. Luce, Local Revenue Hills: Evidence from four U.S. Cities, The Review of Economics and Statistics 86 (2004) 570-585.

[9] A. Haughwout, R. Inman, Fiscal policies in open cities with firms and housholds, Regional science and Urban Economics 31 (2001) 147-180.

[10] J. Mutti, W. Morgan, M. Partridge, The incidence of regional taxes in a general equilibrium framework, Journal of Public Economics 39 (1989) 83-107.

[11] M. Smart, Taxation and deadweight loss in a systrem of intergovernmental transferts, Canadian Journal of Economics 31 (1998) 189-206.

[12] J. Thornton, Fiscal decentralization and economic growth reconsidered, Journal of Urban Economics 61 (2007) 64-70.

[13] G. Zodrow, P. Mieszkowski, Pigou, Tiebout, property taxation, and the underprovision of local public goods, Journal of Urban Economics 19 (1986) 356-370.