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 business tax rates. Furthermore, it is shown that this bias is stronger for smaller jurisdictions. First, a theoretical model is settled with private and public capital and a fixed factor. The fixed factor allows to consider differences between the jurisdictions. The results show that there exists a bias toward low tax rates due to tax competition. This bias generates an underprovision of public capital, and therefore production is smaller with tax competition than with cooperation. Moreover, the bias toward low tax rates is stronger for jurisdictions with less fixed factor. That means that tax competition generates a larger production decrease for smaller jurisdictions. The empirical part aims at estimating the bias toward low tax rates and its dependency with respect to the fixed factor. Panel regressions with temporal and individual fixed effects of the tax rates are implemented with French local data, using the creation of intercity communities. The results indicate that the bias toward low local tax rates is strong: up to 23% decrease for the smaller cities. It is also significantly decreasing with respect to the city size: there is no tax rate decrease due to tax competition for the biggest cities.

Key words: Optimal taxation; Business taxes ; Tax competition ; Public capital; Firm location.
JEL classification: 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 are processing. All developed countries have a decentralized authority. There are several reasons to give local jurisdiction authority. Historical development is one of these. Another important reason is that decentralized authority may make better choices concerning public investments. The nearer to the investment the decision is taken, the more it fits the needs. Therefore, decentralization allows public investments to be more productive. Theoretically, Alesina & Spolaore (1997) use this to build a model explaining the number of countries, with 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 jurisdictions - and therefore jurisdictions with less people - allows local governments to take decisions closer to the inhabitant preferences. Empirically, this result is confirmed by Barankay & Lockwood (2007). They study the case of education in Switzerland, financed locally by the *cantons*.

However, decentralization is not free. Multiplying decision levels also 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 is a very classical tax competition model, which demonstrates that local tax competition generates a bias toward low tax rates. The novelty is that, due to decreasing factor returns, the bias toward low tax rates is stronger for smaller jurisdictions. Then, empirical evidence confirms the model results. The bias is estimated through French intercity agreement modifications. It is found strong (up to 23% for small cities) and significantly decreasing with the city size.

Some papers have already studied tax competition with a local point of view. Theoretically first, Zodrow & Mieszkowski (1986) 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. (2005) introduce at an international level the idea of positive relationship between tax and base. They explain it by public investment arguments.

Haughwout et al. (2004), Haughwout & Inman (2001) and Mutti et al. (1989) study calibrated models. Haughwout et al. (2004) and Haughwout & Inman (2001) conclude that local taxes on business activities are allready too much high in Philadelphia and New-York. Mutti et al. (1989) calibrate a six regions model, and conclude that the relationship between rates and bases of local business taxes may be ambiguous.

From an empirical point of view, Boadway & Hayashi (2001) study the case of Canada. They estimate the tax rate decision interaction in a three provinces model: Ontario, Quebec and the rest of Canada. Buettner (2001) does the same thing with a panel of German jurisdictions. Both confirm the fact that local business tax rates are strategic complements the ones to the others. Furthermore, both find that local and central business tax rates are strategic substitutes. Buettner (2003) tests the impact of local business tax rates on local business tax bases in Germany and finds it negative. Bell & Gabe (2004) measure the policy impact on new establishment location and find that additional public spending and higher taxes may be good to attract firms.

Thornton (2007) 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, this bias is decreasing with respect to the jurisdiction size. 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 an inter-city 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 strong and decreasing with respect to the jurisdiction size. 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, conclusions are presented.

2 Theoretical framework

In order to understand the impact of tax competition on local corporate tax rates, a standard model is settled. The novelty is to consider an asymetrical allocation of the fixed production factor. It allows to catch the city size impact on local corporate tax rate. The model considers a country with a fixed number of 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. No hypothesis is assumed on return to scales.

In order to focus on capital only, l_{it} is supposed exogenous. There is a total amount of fixed factor L_t distributed irregularly among the cities. The point is to understand the impact of l_{it} on the local corporate tax rate τ_{it}. l_{it} may be interpreted as land, that is really a fixed production factor. However, the number of inhabitants, considered in its static point of view, may be a good proxy of the city size.

The public capital is financed by 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 $p_{it} = (1-\delta)p_{it-1} + \tau_{it-1}k_{it-1}$. In each city, entrepreneurs borrow private capital and organise production. In order to maximize employement and income for inhabitants, the objective of the city is to maximize production.

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, as much as the result of international capital partial mobility. Therefore, the total amount K of private capital 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 on p. To measure this variation, the total capital elasticity with respect to local business tax rate $\epsilon_K = -\frac{1-\tau_i}{k_i}\frac{\partial K}{\partial \tau_i}$ is used.

Then, 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 and 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 $\sum_{j=1}^{n} f(j)$ is not depending on city i, the fraction of K is higher when $f(i)$ is higher. The cities with more fixed production factor, more public capital or less taxes attract more private capital. The intensity of this attractiveness is increasing with the productivity parameters α, β and γ. The private capital productivity α impacts the low tax rate attractiveness. The public capital productivity γ impacts the public capital attractivitness. The fixed factor productivity β impacts the city size attractivitness.

Two ways of resolving this model are implemented. First, the optimization process is done in order to maximise the overall production. It is the case of cooperation between cities, with no fiscal competition. Second, fiscal competition may occur and each city maximizes its own production, with using its own rate. The model is solved in Nash equilibrium.

2.1 Resolution with cooperation

This first Subsection consists in resolving the model with cooperation between cities. This is a three steps problem. First, cities choose a tax rate. Second, private capital owners choose where they invest their savings. Finally, the production process is settled. The optimisation problem without fiscal competition consists in determining the set tax rates for each city 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 may be given as a function of k_i and τ_i, as presented in 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, the goal of the optimization problem is to maximise $Y = \sum_{i=1}^n y_i$, controling with the tax rates $(\tau_i)_{i=1..n}$. First order conditions depending on τ_i are given by equation (5).

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

The left hand term of equation (5) is decreasing from $+\infty$ to $-\infty$ when τ_j goes from 0 to 1. The 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 equal 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 of 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 represents 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 the 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 represents the capital saving variations, and $\frac{\alpha}{1-\alpha}$ represents 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 runs 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 is relocated into other cities. However, the opposite is also possible. Whatever the local capital elasticity is lower or higher than the real capital elasticity, the difference between both elasticities is bigger when the cities are smaller.

At the permanent equilibrium, this local capital elasticity induces public capital variations with respect to taxes 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 response 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 τ_i tends to 0 and is decreasing with respect to τ_i. Hence, equation (13) 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 the second best optimal tax rate is lower or higher than the first best optimal tax rate, the difference between both tax rates is bigger 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. Furthermore, this bias is higher for smaller cities. The cause of this bias variation is that the decreasing factor returns are less constraining with a large amount of fixed factor.

The point of the following Sections is to test the results presented in this Section, in order to measure the bias toward low local business tax rates generated by fiscal competition between local jurisdictions, and to confirm its variation with respect to the city size.

3 Data

In order to calibrate the previous model parameters, 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. Benard et al. (2004)). 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 there 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 levies the sum of rates, then redistributes.

There exists another administrative level: the EPCIs[1] that are city unions. Some kinds of EPCI have existed for long time, but the recent reforms encourage this kind of cooperation. There are among 20 cities in each EPCI. The cities themselves choose to create a new EPCI or to enter one. There is no obligation. Different ways to finance the EPCIs are available. First of all, a fourth

[1] Etablissement Public de Coopération Intercommunale

business tax rate may be settled (EPCI with four tax rate, 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 an EPCI. It does not consist in comparing city inside city-unions with cities outside city-unions. For each one of the three years studied: 2002, 2003 and 2004, Table 1 presents the number of cities for each category: outside any EPCI, in EPCI 4RT or in EPCI UBT.

[Table 1]

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[2]. Each tax is collected nationally then redistributed. Therefore, the national fiscal administration can compile rate, base and fiscal revenues 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]

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

[2]Direction Générale des impôts: French national fiscal administration.

with individual fixed effects, the temporal variations for each city are the only source of variation considered.

An important reform about the local business tax took place in 1999. This reform changed the way of calculating tax bases. That could have been 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[3] 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 kind of income (wages, capital incomes, retirement pension...). According to this data set, 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 closer than 30 kilometres to the city considered.

4 Estimations

To estimate the bias toward low local corporate tax rate, it is necessary to find variations in fiscal competition. For that purpose, city status in term of EPCI member is used. Indeed, taking part in an EPCI - and specially in an EPCI UBT - increases the cooperation with the other members. The choice of entering an EPCI is clearly endogenous, but controling with city fixed effects allows to compare only cities with themselves, before and after entering an EPCI. If a bias toward low local corporate tax rates exists, the city rate relative increase should be higher the year of its entering in an EPCI.

[3]Impôts sur le Revenu des COMmunes: national income tax return agregated at the city level.

Therefore, a dummy variable $1_{[i \in EPCI]}$ is used as a regressor. Furthermore, a crossed variable $1_{[i \in EPCI]} * ln(Hbts)$ of this dummy and the city size (approximated by the number of inhabitants) is used to catch the bias variation with respect to the city size. Hence, regressions (15) and (16) are implemented.

$$\ln(\tau_{it}) = a + b\mathbf{1}_{i \in EPCI,t} + c\mathbf{1}_{i \in EPCI,t} * ln(Hbts_i) + v_t + u_i + \epsilon_{it} \tag{15}$$

$$\begin{aligned} \ln(\tau_{it}) = a + b_1\mathbf{1}_{i \in EPCI_{4RT},t} + b_2\mathbf{1}_{i \in EPCI_{UBT},t} + c_1\mathbf{1}_{i \in EPCI_{4TX},t} * ln(Hbts_i) \\ +c_2\mathbf{1}_{i \in EPCI_{UBT},t} * ln(Hbts_i) + u_i + v_t + \epsilon_{it} \end{aligned} \tag{16}$$

These are panel regressions with both individual and temporal fixed effects. The individual fixed effects allow to avoid an estimation bias due to the endogeneity of the EPCI entering or creating. The temporal fixed effects allow to avoid an estimation bias due to conjonctural tax rate variations: there has been an overall local tax rate increase at the studied times. Regressions (15) differentiate the effects of the EPCI entering depending on their fiscal integration (EPCI 4RT or EPCI UBT), as regression (16) considers only the global EPCI category. Table 3 presents the results of these two regressions.

[Table 3]

First of all, these results are very significant. Quite all estimates are significant at the level of 1%. Furthermore, the temporal R^2 are 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 entered 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 $\frac{\alpha}{1-\alpha} > \epsilon_K$. This bias can go up to 23% for small cities.

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 by the c coefficients of regressions (15) and (16): these d coefficients are significantly negative. It means that tax rate increase is lower for bigger cities, then the fiscal competition bias is higher for smaller cities.

The previous results are true if considering all EPCI together or if differentiating for their fiscal properties. 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, the model presented in Section 2 assumes four parameters: α, β, γ and ϵ_K. It is possible to calculate them with a and b estimates. In that purpose, four equations with these four parameters are needed. 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. 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.

When cities are not unified into EPCI, fiscal competition occurs between the neighbour cities and business tax rates are as in equation (14). Hence, the constant coefficient of regressions (15) and (16) is $a = ln\left(\frac{\gamma(1-\alpha)}{\alpha+\gamma}\right)$.

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 $\exp(b) = \frac{\tau^*}{\tau^o}$ with τ^o the second best optimal tax rate for an infinitely small city[4]: according to equations (8) and (14), $\frac{\tau^*}{\tau^o} = \frac{1+\frac{\frac{\alpha}{1-\alpha}\sum_{j\neq i} f(j)+\epsilon_K f(i)}{\sum_{j=1}^{n} f(j)}}{1+\epsilon_K}$.

This gives the third and forth conditions on α β, γ and ϵ_K. Therefore, these four parameter values may be calculated, according to system (17).

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

Table 4 presents the α β, γ and ϵ_K estimates according to system (17) and regression (15) results.

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

[Table 4]

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

5 Conclusion

This paper presents the costs of decentralization. The benefits of decentralization 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 attempts to measure it. Moreover the decreasing factor returns in the production function induce that tax competitions has stronger effect on smaller city tax rates than on bigger city ones.

Then, the paper estimates the model results through French local tax data and gives evidence of the bias toward low local business tax rates. Fiscal competition between French cities generates up to 23% local corporate tax rate decrease. This tax rate decrease induces a public investment decrease, which should causes a private capital investment decrease, because the private capital attractiveness of cities ($f(i)$ in the model presented here) depends on the amount of public capital in the city.

Despite these negative effects of decentralization, a majority of countries keeps a decentralized administrative organization. This is because local decisions may fit the local needs better, as in term of inhabitants asking as in term of public investments. That for, it could be interesting to compare this two forces - decentralization force due to efficiency of decisions and centralization force due to fiscal competition - in an optimal decentralization level model.

In addition, 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, two problems remain. 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. Smart (1998) studies theoretically the impact of perequation and shows the existence of a deadweight loss.

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Tables

Table 1: French cities and there being in EPCIs

	None	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 %

Notes: EPCI are city unions. The EPCI 4RT are less fiscaly intergrated than the EPCI UBT. There are more than 36 000 city in France. The present panel has only 31 618 because there is some lacks in different data bases or years. The main lacks comes from the geographical data base.

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.

Table 3: Regressions

		Local tax rate	
		(15)	(16)
Constant	a	7.249***	7.277***
		(0.100)	(0.100)
EPCI	b	0.231***	
		(0.041)	
EPCI*Inhabitants	c	-0.027***	
		(0.007)	
EPCI 4RT	b_1		0.168***
			(0.047)
EPCI 4RT*Inhabitants	c_1		-0.013
			(0.008)
EPCI UBT	b_2		0.215***
			(0.047)
EPCI UBT*Inhabitants	c_2		-0.029***
			(0.008)
Observations		51 444	51 444
Temporal R^2		28 %	28 %
Spatial R^2		2 %	1 %
Overall R^2		9 %	8 %

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

Table 4: Parameter estimates

α	β	γ	ϵ_K
0.31	0.61	0.08	0.15

Notes: These are the estimation of the parameters of the Section 2 model. These estimation are made through regression (15) and hypotheses system (17).