Decentralization and Tax Competition Between Asymmetrical Local Governments: Theoretical and Empirical Evidence

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ABSTRACT

This article presents a model of tax competition between an arbitrarily large number of asymmetrical jurisdictions. Tax competition induces lower corporate taxes and lower public input provision than tax coordination. This bias decreases with respect to the size and number of jurisdictions. Tax competition constitutes a cost of decentralization that may balance the gains presented by the decentralization theorem. A French panel of municipalities and inter-municipal jurisdictions is used to test these results, which are confirmed. Furthermore, the corporate tax increase due to cooperation leads to an increase of the corporate tax base: the fully decentralized situation is sub-optimal.

Key words: Fiscal federalism; Tax competition; Corporate taxes; Public capital.

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

1. INTRODUCTION

The present paper aims at demonstrating, both theoretically and empirically, that tax competition between decentralized governments generates a bias towards low local corporate tax rates. This bias decreases with the increasing size of administrative divisions: it increases with decentralization. Hence, tax competition constitutes a cost of decentralization that balances the efficiency gains. This paper focuses on decentralization of a specific competence: the provision of public input for private production. Thus, both the firms and the governments' behaviors are studied.

As Arzaghi and Henderson (2005) have noted, several embedded administrative divisions - such as states or regions, counties, municipalities - exist in all developed countries, with different competencies and different levels of autonomy. The central state governments may allocate competencies among them in order to optimize overall governance. Regarding public good provision, Oates' (1972) decentralization theorem states that the more decentralized the administrative division receiving the competence, the better the governance. This comes mainly from the assumption that provision is uniform, while the needs are not. Oates (1999) specifies that the decentralization theorem still applies when governments provide public goods non-uniformly, as soon as information asymmetries arise. Local governments have better knowledge of the value of public goods to the population and adapt provision accordingly. Barankay and Lockwood (2007) give empirical evidence of the increasing efficiency of governance with respect to decentralization through the study of education provided by the cantons in Switzerland.

However, there are not only advantages in decentralization. Alesina and Spolaore (1997) present a model giving the optimal number of countries when administrative costs - increasing with the number of countries - balance the efficiency of decentralization. However, the costs of decentralizing are not only administrative: there may be fiscal costs. For decentralization to be

actually established, local governments need to have financial autonomy. Governments - local or not - should levy taxes to finance public goods' provision. Hence, decentralization may result in tax competition between administrative divisions. The tax competition generates a bias towards low local corporate tax rates and therefore leads to under-provision of public capital. It has been presented theoretically by Zodrow and Mieszcovsky (1986) and empirically confirmed by Buettner (2001 and 2003) and Bell and Gabe (2004) at the local level.

Furthermore, Bucovetsky (1991) and Wilson (1991) show that the effects of tax competition depend on the relative size of the competitors. They study two-country models and find that the smaller one sets lower tax rates. However, the overall well-being may be higher under competition than under coordination. Peralta and Van Ypersele (2006), using different hypotheses, find similar results: lower tax rates in the smaller country. They consider a fixed public budget that has to be financed through taxes. Thus, there is no effect of public investment on firms' relocation or settlement, and therefore none on the tax base. This asymmetrical effect of tax competition is discernable in empirical studies. Boadway and Hayashi (2001) study fiscal interaction between Canadian provinces by considering three areas: Ontario, Quebec and the rest of Canada (ROC). Ontario is large compared to Quebec and ROC and Quebec is large compared to ROC. They find that the Ontario tax rates have an impact on the Quebec and ROC tax rates, that the Quebec tax rates have an impact on the ROC tax rates but not on the Ontario tax rates, and that the ROC tax rates have no impact on tax rates of neither Ontario nor Quebec. In France, Leprince et al. (2007) study corporate tax interactions between local governments. They find actual interactions between municipalities and inter-city units, but not between bigger administrative divisions (*départements* and regions).

The present paper proposes a model of local corporate tax competition between an arbitrarily large number of local governments investing in public input for private production. For a given

country size, the number of local governments indicates the level of decentralization. Some papers already study models of tax competition with a large number of local governments (e.g., Wildasin 1988; Hoyt 1991) but all the jurisdictions are identical. The present paper aims at understanding tax competition between a large number of asymmetrical administrative divisions. This model is presented in section 2. It results in a bias towards low local corporate tax rates. This bias decreases with respect to the administrative division's economic size (relative to its neighbors), and therefore the local corporate tax rate and the public input investment decrease with respect to decentralization.

These results are tested on French local fiscal data. The data, presented in section 3, is composed of the corporate tax rates and bases in all French municipalities, the returns for income taxation aggregated at the level of the municipalities, the geographic coordinates of municipalities' town halls and the date of entry of municipalities into Public Inter-municipal Cooperation Bodies (PICB). The French central government decentralized an important number of competencies to local jurisdictions in 1982-1983, and again in 2003, among them the provision of public input for private production. At the same time, it created incentives for the smaller administrative divisions - the municipalities - to merge through inter-city agreements, the PICB.

The PICB are used in section 4 to test the impact of decentralization on tax competition and the impact of this bias variation on the establishment of firms in the area. First, the bias towards low local corporate tax rates due to tax competition is empirically confirmed; it can even be significantly large. The increase of this bias with respect to decentralization is also confirmed empirically. In addition, the increase of corporate tax rates due to the reduction of tax competition has a positive impact on the corporate tax base, while other kinds of tax rates increases do not. Section 5 concludes.

2. THEORETICAL FRAMEWORK

Existing models of tax competition are either two-country models (e.g., Bucovetsky 1991; Wilson 1991; Baldwin and Krugman 2004) and cannot account for the impact of an increase in the number of competitors, or models with a large number of competitors (e.g., Wildasin 1988; Hoyt 1991) but with identical administrative divisions. The theoretical contribution of the present paper is to construct a tax competition model for an arbitrarily large number *n* of asymmetrical administrative divisions. For a given country, the parameter *n* is therefore an indication of the level of decentralization, as the decentralization of a given competence results in an increase of the actual number *n* of local governments in charge.

In each administrative division i (i=1…n), the factors of production are a fixed factor l_i, private capital k_i and public input for private production p_i. These three production factors allow firms to produce the output y_i according to the production function $F(k_i, l_i, p_i)$. The production function is assumed to be Cobb-Douglas: $y_i = Ak_i^{\alpha} l_i^{\beta} p_i^{\gamma}$. The returns to scale are constant, so $\alpha+\beta+\gamma=1$. The private capital is borrowed at the national level by local entrepreneurs - or firms - and invested locally. There is a labor market in each locality, but only a unique national market for goods. This market is assumed to be perfectly competitive and this good is taken as numéraire. There may be several firms in the same location, they are not assumed to be of the same size. They borrow capital, hire labor, and produce with production function *F* in each location. Because of the constant returns to scale, all firms located in the same locality share the local fixed factor, produce with the same proportion of each factor and with the same marginal productivity. Public input increases global factor productivity. Entrepreneurs pay the return *r* for their capital borrowing and the wages *w* for their labor hiring. As the market for capital is assumed in perfect competition, the returns *r* are equal to the marginal productivity of private capital, that is $\alpha y_i/k_i$. The rest of the production is kept by local agents: it is shared between

local entrepreneurs and local workers.

The fixed factor l_i is assumed to be exogenous and unequally allocated among territories. This exogeneous parameter drives the asymmetry between the competing administrative divisions. It could be land, or a specific advantage for production such as geological or geographical properties, or even the efficient labor force or the number of inhabitants. Concerning this last interpretation, Glaeser and Gottlieb (2009) notice that household mobility is imperfect, strongly so in Europe but also in the United States. The main results stand as soon as capital is more mobile than labor. The exogenous allocation indicates the size of the economy of the administrative divisions and allows us to understand tax competition effects between a large number of local jurisdictions of different sizes.

Public input for private production is invested by local governments. As proposed by Oates and Schwab (1991), a corporate tax may be levied locally if it finances public expenditure that benefits local firms. Public input is then financed by a local tax on private capital. The rate τ_i of the local corporate tax allows local government *i* to levy fiscal revenue $\tau_i k_i$. This fiscal revenue is invested in public input that benefits firms located in administrative division *i*. In addition, public capital depreciates at rate δ. Hence the public input in administrative division i is $p_i = \tau_i k_i / \delta$. Production y_i is net of taxes: the tax, proportional to the stock of capital is levied before the production process took place, and the actual production function is therefore $y_i = A[(1-\tau_i)k_i]^{\alpha} l_i^{\beta} p_i^{\gamma}$.

The model considers neither vertical interactions nor embedded jurisdictions. In this perspective, decentralization does not consists in creating a new level of administrative divisions – and thus creating new vertical interactions – but consists in transferring the entirety of a competency to an already existing level of administrative divisions. In addition, the vertical interactions are

ambiguous and weak: from a theoretical point of view, Zodrow and Miescowsky (1986) cannot determine in which way federal tax rates influence local tax rates; from an empirical point of view, Boadway and Hayashi (2001) find federal tax rates have different effects on different provincial tax rates, and Leprince et al. (2007) reject vertical interaction in French local corporate tax system.

The aim of local governments is to maximize the welfare of the locals. This welfare depends positively on the income of local workers and entrepreneurs. Since capital can be invested anywhere and the owners do not live in the area where their wealth is actually invested, local governments do not take capital income into account. The fiscal revenue $\tau_i k_i$ is levied prior to production, so the remaining capital for production is $(1-\tau_i)k_i$[1]. Therefore, the aggregate income of local workers and entrepreneurs is $y_i - rk_i$ because y_i is net of taxes. In the present case, $r = dy_i/dk_i = \alpha y_i/k_i$ because the market for capital is perfect and therefore aggregate income of local workers and entrepreneurs is equal to $(1-\alpha)y_i$. Hence, the objective function of local governments is the local production y_i.

When a local tax rate changes, two phenomena have an impact upon private capital. First, the global quantity of private capital *K* in the country changes. Second, the remaining private capital *K* is reallocated between administrative divisions. Total private capital *K* is the result of the optimization of inter-temporal consumption and of the partial mobility of international capital. Therefore, the total amount *K* of private capital depends on returns to private capital. The parameter which measures the influence of local corporate tax rates τ_i on the national amount of capital *K* is the elasticity $\varepsilon_K = -[(1-\tau_i)/k_i]/[\partial K/\partial \tau_i]$. The aggregate amount of capital *K* is then distributed among the different local administrative divisions, each receiving a local allocation k_i of private capital. Assuming perfect mobility of private capital within the country,

the capital returns rate *r* is the same in every administrative division at the equilibrium. The allocation of private capital between each locality may be derived from this equality.

Proposition 1: The local allocation k_i of private capital in administrative division *i* is a proportion of the aggregate amount *K* of private capital in the country as presented by equation 1. It increases with respect to the relative attractiveness *f(i)/Σf(j)* of administrative division *i* compared to other administrative divisions' attractiveness. The attractiveness function *f(i)* is defined in equation 2 (the proof is presented in appendix A).

$$k_i = \frac{f(i)}{\sum_{j=1}^{n} f(j)} K \tag{1}$$

$$f(i) \equiv (1-\tau_i)^{\frac{\alpha}{1-\alpha}} p_i^{\frac{\gamma}{1-\alpha}} l_i^{\frac{\beta}{1-\alpha}} \tag{2}$$

Function *f(i)* is called attractiveness because it drives actually the local demand for private capital. For any given amount of private capital k_i invested in city *i*, its marginal productivity $dy_i/dk_i = A\alpha k_i^{\alpha-1} f(i)^{1-\alpha}$ increases with respect to *f(i)*. This attractiveness function decreases with corporate tax rate τ_i and increases with fixed factor l_i and public capital p_i.

Local governments set local corporate tax rates being aware of how private capital would respond. Two hypotheses are assumed: cooperation and competition between administrative divisions. First, overall production in the country is maximized using the whole set of tax rates. This is the case of cooperation between local governments. Second, tax competition may occur and each local government maximizes its own production, using its own corporate tax rate. The model is solved in Nash equilibrium. The difference between the tax rates set in cooperation and in competition gives the bias due to tax competition.

2.1 Resolution With Tax Cooperation

This first subsection presents the solving of the model with cooperation between local governments. This is a three steps problem. First, local governments choose collectively the tax

rates for all administrative divisions. Second, entrepreneurs choose where to invest private capital and pay the local tax. Third, the production process is set. The maximization problem is presented by equation 3.

$$max_{\tau_i, i\in[1,n]} \sum_{i=1}^{n} y_i$$
$$st. \begin{cases} y_i = A[(1-\tau_i)k_i]^{\alpha} l_i^{\beta} p_i^{\gamma} & (i) \\ p_i = (\tau_i k_i)/\delta & (ii) \\ k_i = \left[\frac{f(i)}{\sum_{j=1}^{n} f(j)}\right] K & (iii) \\ -\frac{1-\tau_i}{k_i}\frac{\partial K}{\partial \tau_i} = \varepsilon_K & (iv) \end{cases} \quad (3)$$

As the objective function for each local government is the local output, the objective function of cooperating governments is the sum of the local outputs: the global output. The tools to do so are the investment in public capital and the corporate taxes. The constraints are the production function (*i*), the relationship between taxes and public capital (*ii*), the behavior of entrepreneurs (*iii*) and the behavior of savers (*iv*).

Proposition 2: The problem of maximization of the aggregate output with the corporate tax rates as control variables (presented by equation 3) has a unique solution consisting in setting the same tax rate τ^* in each administrative division. This optimal tax rate is given by equation 4 (the proof is presented in appendix B).

$$\tau^* = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\varepsilon_K} \quad (4)$$

The main property of the first best optimum is that all administrative divisions set the same corporate tax rate. This tax rate does not depend on the number of divisions - and therefore on the decentralized level nor does it depend on the size of each division. The optimal rate formula is composed of two different terms. The first term – $\gamma/(\alpha+\gamma)$ – indicates the optimal ratio between private and public capital k_i and p_i in the production function. This term comes from the maximization of $\tau_i^{\gamma}(1-\tau_i)^{\alpha}$. Consequently, τ^* decreases with respect to α because it is the

parameter of the private capital productivity in the Cobb-Douglas production function: the more productive private capital, the higher the cost of taxing it. In addition, τ^* increases with respect to γ because it is the productivity parameter of the public capital in the Cobb-Douglas production function: the more productive public capital, the higher the benefits of taxation as its revenue is invested in public input. The second term – $1/(1+\varepsilon_K)$ – comes from the fiscal arbitrage between tax rate and tax base: the higher the base elasticity with respect to the tax rate, the lower the optimal tax rate, and vice versa.

2.2 Resolution With Tax Competition

In this second subsection, fiscal competition is introduced. This is also a three steps problem. First, local governments choose their own tax rates, considering the neighbors' tax rates as given (Nash equilibrium). Second, entrepreneurs choose where to invest private capital and pay the tax. Third, the production process is set. The maximization problem for each local government is presented by equation 5.

$$max_{\tau_i} y_i = A(1-\tau_i)^{\alpha} {k_i}^{\alpha} {l_i}^{\beta} {p_i}^{\gamma}$$
$$st. \begin{cases} \tau_j \text{ for } j \neq i & (i) \\ p_i = (\tau_i k_i)/\delta & (ii) \\ k_i = \left[\frac{f(i)}{\sum_{j=1}^{n} f(j)}\right] K & (iii) \\ -\frac{1-\tau_i}{k_i}\frac{\partial K}{\partial \tau_i} = \varepsilon_K & (iv) \end{cases} \tag{5}$$

The objective function for each local government is the local output and the control variables are the investment in public capital and the corporate taxes. The constraints are the neighbors' tax rates (*i*), the relationship between taxes and public capital (*ii*), the behavior of entrepreneurs (*iii*) and the behavior of savers (*iv*). Constraints (*i*), (*iii*) and (*iv*) may be replaced by a unique constraint (*v*) giving the reaction of private capital investment in an administrative division as a response to its tax rate: it is the local elasticity of private capital $\varepsilon_k^i = -[(1-\tau_i)/k_i][\partial k_i/\partial \tau_i]$.

To resolve the maximization problem 5, this local elasticity of private capital should first be derived from the behavior of savers and entrepreneurs.

Proposition 3: The local elasticity ε_k^i of private capital k_i invested in administrative division *i* with respect to the corporate tax rate τ_i, given the other administrative divisions' tax rates, is equal to a weighted sum of the elasticity ε_K of aggregate capital and the ratio *α/(1-α)*, as presented in equation 6 (the proof is presented in appendix C).

$$\varepsilon_k^i = \frac{\sum_{j \neq i} f(j) \frac{\alpha}{1-\alpha} + f(i)\varepsilon_K}{\sum_{j=1}^{n} f(j)} \quad (6)$$

In the formula of local elasticity, ε_K gives the change of the overall stock of capital to be allocated among administrative divisions; this change is due to changes in savings or to the international mobility of private capital. The ratio *α/(1-α)* represents the reallocation of this overall stock from one administrative division to another. This term *α/(1-α)* increases with respect to *α*, which means that the private capital flow from one administrative division to another due to changes in corporate taxes is larger when private capital productivity is higher.

The local capital elasticity ε_k^i could either be smaller or larger than the aggregate capital elasticity ε_K, depending on whether *α/(1-α)* is smaller or larger than ε_K. The classical assumption is that local elasticity is larger than total elasticity. When a local government increases its corporate tax rate, not only some capital is no longer saved, but also some capital is relocated to other administrative divisions. The smaller the administrative division, the larger the difference between the elasticities ε_K and ε_k^i. Indeed, the weight of the global term ε_K is $f(i)/\sum_{j=1}^{n} f(j)$ and increases with respect to the municipality size l_i. The weight of the local term *α/(1-α)* is $\sum_{j \neq i} f(j) / \sum_{j=1}^{n} f(j)$ and decreases with respect to the municipality size l_i.

The maximization problem for each firm is then maximization problem 5 with only two constraints, constraint (*ii*) and constraint (*v*) given by equation 6. The solution of this problem is

given by proposition 4.

Proposition 4: The Nash equilibrium of the simultaneous game of maximization of the local output with the local corporate tax rate as control variable (presented by equation 5) has a unique solution consisting in setting different tax rates τ_i^o in each administrative division *i*, depending on local elasticity of capital ε_k^i given by equation 6. These tax rates are given by equation 7 (the proof is presented in appendix D).

$$\tau_i^o = \frac{\gamma}{\alpha+\gamma}\frac{1}{1+\varepsilon_k^i} \tag{7}$$

Corollary to proposition 4: If ε_k^i is superior to ε_K, the corporate tax rates τ_i^o resulting from tax competition between administrative divisions are lower than the optimal tax rate τ^*. Furthermore, the smaller the administrative division, the larger the difference between the two tax rates.

Tax competition generates therefore a bias towards low local corporate tax rates. This bias is larger for smaller administrative divisions. Indeed, the decreasing factor returns are less constraining if there is a large amount of fixed factor. The aim of the following sections is to test the results presented in the present section. Econometrics is used in order to measure the bias towards low local corporate tax rates generated by tax competition between administrative divisions, to confirm its significance and its variations with respect to the administrative division sizes - and therefore its variation with respect to decentralization.

In addition, even if the decrease of corporate tax rates with respect to decentralization occurs, it may be contended that it is inefficient. It may be argued that the contrasting tax rate increase when administrative divisions unite is the consequence of the creation of a fiscal cartel established by these united administrative divisions. If these groupings constitute cartels, their creation - and the subsequent corporate tax rate increases - should induce a private capital

outflow. On the other hand, if decentralization causes inefficient tax competition, administrative division groupings - and the subsequent corporate tax increases - should induce private capital inflow. The following econometrical sections also test if corporate tax increases due to centralization induce capital inflow or outflow. It allows us to address the question of whether grouped administrative divisions constitute fiscal cartels, or a way to decrease tax competition inefficiencies.

3. DATA

The theoretical results summarized in the corollary of proposition 4 are tested with French data. In France there are four decentralized levels of local government. There are 24 regions, 100 *départements* and more than 36,000 municipalities. This is a mean of 360 municipalities per *département* and a mean population of 1,700 inhabitants per municipality. Furthermore, neighbor municipalities may federate. Various kinds of cooperation have existed for many years, but the introduction of *law 99-586 of July 12, 1999* simplified these arrangements for inter-municipal cooperation and led to their rapid increase. The law provided for three Public Inter-municipal Cooperation Bodies (*PICB*, in French *Etablissement Public de Coopération Intercommunale, EPCI*) with self-financing powers through direct local taxes. Central incentives were also introduced to promote such inter-municipal cooperation. Since 1999 many new *PICBs* have been created, as shown in figure 1.

[Figure 1]

Inter-municipal cooperation provides a good opportunity of testing theoretical results concerning local tax competition; and reciprocally, the local tax competition model offers a way of understanding local corporate tax changes due to inter-municipal cooperation. Indeed, this model may be used to analyze different kinds of government interaction. This might be international interaction, or interaction between regions inside a country, or between municipalities inside a

region or a country. In the French case, when municipalities federate in a *PICB* this increases the size of the administrative division levying local corporate taxes, and therefore decreases the intensity of tax competition.

As the model may be applied to a large number of asymmetrical administrative divisions it fits every kind of inter-municipal cooperation. It may be an urban agglomeration structure, with the metropolis federating with its suburban municipalities: one big municipality with smaller ones. It may be peri-urban cooperation: small municipalities federating with each other close to a large metropolis and other small municipalities. Lastly, it may be rural cooperation, where small municipalities federate in a region dominated by small municipalities and federations of small municipalities.

French inter-municipal cooperation also fits the theoretical model since municipalities and *PICB* are important sources of public investment for private production, with local corporate taxes financing these investments. Therefore creating a *PICB* decreases the intensity of tax competition for local corporate taxes. At the time the data was collected the local corporate tax in France was the *taxe professionnelle*, a flat tax whose rate was set by local governments. The tax base was the rental value of tangible assets actually owned in the administrative division. This consequently fits the model for a local corporate tax per unit of private capital invested within the administrative division.

Different local governments and agencies may set a rate for *taxe professionnelle*: regions, *départements*, *PICBs* or municipalities. However, revenue from this tax is collected by the central fiscal service, which aggregates the different rates, applies the sum of rates to the local tax base, levies revenue and distributes it to the local governments according to the rates they have set. Hence from the point of view of the individual firms, they pay a single corporate tax at one global rate and do not deal directly with the various administrative divisions levying *taxe professionelle*.

Therefore in the following we consider the local corporate tax rate paid by firms in one location without taking any account of which public body the levied income benefits.

In practice, two kinds of *PICB* are differentiated in the present paper, depending on the local corporate tax regime. After a new Public Inter-municipal Cooperation Body is created, its local government has two ways of collecting revenue. It may add a new *taxe professionnelle* rate to the three existing ones (regions, *départements* and municipalities), creating a *PICB* with four *taxe professionnelle* rates ($PICB_{4RT}$). These *PICB* are mainly in rural municipalities. It may also levy a unique *taxe professionnelle* (*UTP*). In that case, other administrative levels – regions, *départements* and municipalities – cease setting *taxe professionelle* rates and the *PICB* is the only beneficiary of the revenue of this tax. These kinds of *PICB* ($PICB_{UTP}$) are mainly urban and assume a larger part of overall public input investments (regions and *départements* assume less investment in their territory). Table 1 presents the evolution of each kind of *PICB* in France during the years 2002 to 2004. There has been a general increase of inter-municipal cooperation and an increase in the fiscal integration of *PICB*. Indeed, during this period, no municipality left a *PICB*, nor did a $PICB_{UTP}$ become a $PICB_{4RT}$. Instead, a significant number of $PICB_{4RT}$ increased inter-municipal cooperation by becoming a $PICB_{UTP}$.

[Table 1]

In addition, it should be noted that there have been a number of changes to *taxe professionnelle*. Prior to 2002, half the tax base was the rental value of tangible assets and the other half was the total amount of wages paid to employees hired in the administrative division. After 2005 many new restrictions were placed on the *taxe professionnelle*: national tax supplements or tax repayments were linked to the ratio of total local corporate tax paid to the overall Value-Added generated by the firm - if the firm were located in several municipalities. Lastly, the *taxe*

professionnelle was abolished in 2010. Therefore the present analysis uses data collected in the years 2002 to 2004 only, when the *taxe professionnelle* was actually a local tax on private capital. As direct local taxes are collected nationally by *DGI* (*Direction Générale des impôts*: the French national fiscal agency) all the data on *taxe professionelle* are compiled by the same administration. *DGI* provides one database per year and per *département* called *données de fiscalité directe locale* (direct local tax database). Each database gives for each municipality of the *département* the local corporate tax base and the tax rate for each administrative division levying tax on this territory (the municipality itself plus *PICB, département* and region). All the French municipalities - excluding overseas *départements* and territories – are considered here. All tax rates for each administrative division are summed in order to obtain the full local corporate tax paid by firms in each location. Table 2 presents this data. Standard deviations seem high because municipalities have very different sizes and properties. The mean population is around 1,700 inhabitants, but many are larger than 100,000 and there are also many very small ones. Standard deviations are high for tax rates but less for bases. The high standard deviation for tax rates is important for the present study since it represents variations addressed in the econometric analysis.

[Table 2]

Other databases are used to obtain additional information on municipalities. First, *IRCOM* databases (*Impôts sur le Revenu des COMmunes*: Income tax at municipality level) gives, by *département* and year, a summary of national household income tax returns for each municipality: number of households in each tax bracket (differentiated by their age), mean wealth declared by kind of income (wages, asset returns, retirement pension). In particular, these databases are used to calculate the number of households in each municipality, which gives an approximation of the municipality size. Furthermore, information on households' ages and wealth

allows a control for socioeconomic characteristics.

Lastly, a geographical database is used. It provides the *x* and *y* coordinates of each French town hall in the Lambert projection. Thanks to this dataset the distance between municipalities may be calculated, and therefore neighbor values of the variables may be determined. The neighbor value of a variable in one municipality is the sum or the mean of this variable values for municipalities closer than 30 kilometers around the municipality under consideration.

4. EMPRICIAL ANALYSES

The municipal databases are used to test the theoretical results summarized in the corollary to proposition 4: there is tax competition between municipalities, leading to a suboptimal provision of public capital; this tax competition has a stronger influence on small administrative divisions than on large ones, and therefore the cost of tax competition with respect to public capital investment increases with decentralization. The main idea of this empirical section is to consider Public Inter-municipal Cooperation Bodies (*PICB*) as a form of centralization: the creation of *PICB* increases cooperation between its member with regard to local corporate taxes and public input investments – with perfect integration in the case of a *PICB* with a single *taxe professionnelle* ($PICB_{UTP}$). Therefore, the creation of a *PICB* increases the size of administrative divisions competing over local corporate taxes.

As in the theoretical part, the empirical part of this paper neglects vertical interactions and focuses only on horizontal interactions. The reasons for this are the same: the aim of the paper is to understand horizontal fiscal interactions between decentralized administrative divisions. In addition, vertical interactions are weak and ambiguous (e.g., Boadway and Hayashi 2001; Leprince et al. 2007). The tax rates considered for the regressions are the overall local corporate taxes paid by firms located on municipal territory. This is the unique *PICB* rate if the municipality is part of a $PICB_{UTP}$, and otherwise the sum of the municipal, *départemental*,

regional (and inter-municipal if any) corporate tax rates. These global rates before and after *PICB* entry or creation may be compared because the rates are applied to the same local business tax base calculated by the central fiscal administration.

The empirical analysis is run in two steps. First, fiscal interaction between municipalities is tested against the alternative hypothesis that no horizontal fiscal interaction occurs at the municipal level. These results are presented in subsection 4.2. Second, the under-optimality of the resulting public investment is tested against the alternative hypothesis that inter-municipal cooperation is a cartel creation to raise local corporate taxation inefficiently. These results are presented in subsection 4.3.

4.1 Endogenity of entry in a *PICB*

Before presenting the results, the issue of endogeneity of the instrument should be addressed. I use the entry in a *PICB* as an instrument for tax competition reduction. However, the choice of joining a *PICB* is clearly endogenous to the setting of tax rates. However, the entries during the period considered – 2002 to 2004 – occurred because of new incentives from central government; the local existence of *PICB* also had a significant impact on the choice to enter a *PICB*. The comparison is not on the actual being in a *PICB* but on the entry occurring before 2002, in 2002, in 2003, in 2004 or after 2004, as the central law states that every municipality should eventually be part of a *PICB*.

Furthermore, the econometric analysis presented in this section consists of panel regressions with both temporal and individual fixed effects. Municipal fixed effects allow us to compare the same municipality before and after its entry into a *PICB* instead of comparing municipalities inside or outside *PICB*. This method corrects endogeneity biases if the part of the municipality's unobserved propensity to set low or high tax rates which is actually correlated to the decision to enter the *PICB* is constant over time. I assume that there is no exogenous shock which changes

the unobserved propensity of municipalities entering new arrangements to set low or high tax rates at the time of their entry. The main factors that may change such propensities are business cycles and mayoral changes, but there were no mayoral changes during the three years which are studied: French municipal elections took place in 2001 and 2008. In addition, the temporal fixed effects allow us to control for potential estimation bias due to overall changes in economic conditions: during the period of investigation there was a general increase in the local tax rate.

Furthermore, the exogeneity is tested by searching common characteristics of municipalities entering (and not entering) a *PICB* during the period studied. This is done by regressing the different probabilities of transitions (from nothing to any *PICB*, from nothing to $PICB_{4RT}$, from nothing to $PICB_{UBT}$, from $PICB_{4RT}$ to $PICB_{UBT}$) on the characteristics of municipalities. For each dependent variable, several specifications are run, with some or all of following regressors: deviations from neighbors of the number of firms (overall, industrial, construction, trade, services, less than 10 employees, between 10 and 100 employees, more than 100 employees), the ratio of households paying a positive income tax, the mean income tax rate and the ratio of the three local direct taxes levied in the municipality (on land, on housing and on capital) actually allocated to the municipality; regressors are also the direct values and the deviation from neighbors of the bases and rates of the three local direct taxes, the number of households and the ratio of wages on total income of the inhabitants of the municipality. For all regressions but one, the regressors explain less than 2% (and often less than 1%) of the variance of the transitions. Only regression of the transition from $PICB_{4RT}$ to $PICB_{UBT}$ on the set of all the regressors previously described has a R^2 of 4.2%, which keeps very small.

This confirms the exogeneity of the transitions since a very precise and numerous set of municipality characteristics could not explain even a small part of the transitions used as instrument for tax competition changes. The actual year of entry is indeed exogenous. It is not

due municipalities' own characteristics, nor deviations from neighbors', but it is due to the administrative delays of *PICB* creation and the heterogenous pressure from the *préfets*. The *préfets* are the representatives of the central government in each *département*, whose mission was, among others, to encourage then force municipalities to create or enter *PICB*.

4.2 Evidence of Horizontal Interactions

In the present subsection is presented the test of the existence of local corporate tax interaction between municipalities and the decreasing impact of this interaction with the size of administrative divisions. The dependent variable is the overall local corporate tax rate applied to firms settled in the municipal territory. If municipal fiscal interaction exists, a municipality's total local corporate tax rate increase should be larger the year it enters a *PICB* than the years before and after. A dummy variable *PICB* is used as an independent variable - it is equal to 1 if the municipality i is part of a *PICB*, and 0 otherwise. Furthermore, the variable *PICB**ln(h) – the product of this dummy variable by the municipality size approximated by the number of income tax returns – is used as an independent variable. This product variable captures the impact of municipality size on the bias towards low local corporate tax rates due to tax competition.

As there are municipal fixed effects u_i, these independent variables only capture a municipality status change vis-à-vis inter-municipal cooperation. As a consequence, the regressions are made up of double difference analysis with the treatment group being municipalities changing their inter-municipal cooperation status and the control group being municipalities which either remain in, or remain out of, inter-municipal cooperation. A municipality may be in the treatment group in one year and in the control group in another. Therefore the regression should control for temporal difference due to the business cycle, which is done by the time fixed effect v_t. Two kinds of OLS panel regressions are carried out. First, a regression following equation 8 is run. It considers inter-municipal cooperation as a unique phenomenon, without differentiating the

degree of fiscal integration of the *PICB*. Second, a regression based on equation 9 is run. It differentiates fiscal integrations by using different independent variables for controlling the creation of *PICB* with low (*4RT*) or high (*UTP*) fiscal integration.

$$\ln(\tau_{it}) = a + bPICB_{it} + cPICB_{it} * \ln(h_{it}) + u_i + v_t + \varepsilon_{it} \quad (8)$$

$$\ln(\tau_{it}) = a + b_1 4RT_{it} + b_2 UBT_{it} + c_1 4RT_{it} * \ln(h_{it}) + c_2 UBT_{it} * \ln(h_{it}) + u_i + v_t + \varepsilon_{it} \quad (9)$$

In these regressions, estimate b (respectively b_1 and b_2) proves the existence of corporate tax horizontal interaction between municipalities. If b is significantly positive, administrative divisions increase their local corporate tax rate when cooperating with their neighbors. As the regression controls for municipality size, the actual values of these estimates are the maximum effect of tax interaction for an infinitely small administrative jurisdiction. Estimate *c* (respectively c_1 and c_2) gives the influence of the municipality size on the effect of horizontal tax interaction upon local corporate tax rates. If *c* is significantly negative, horizontal tax interaction leads to smaller local corporate tax rates for small administrative divisions than for large ones.

Triple difference regressions are run in addition to double difference regressions. In these, the dependent variable is no more the logarithm of the tax rate levels but their variations from one year to another. The independent variables are no more the status vis à vis the inter-municipality but their variations form one year to another. These regressions capture the inflexion in the trend of local corporate tax rates at the entry in a *PICB*. As for double difference, both regressions pooling all *PICB* type and regressions differentiating for the fiscal intergration (*4RT* or *UBT*) are run. Furthermore, additional controls are used: the number of households living in the municipality, the logarithm of the local corporate tax rate previous year and the previous year deviation from neighbors' tax rate. Results of double and triple difference regressions are presented in table 3.

[Table 3]

First of all, these results are very significant. Nearly all estimates are statistically significant at the level of 1%, or at least at the level of 5%. Second, all four regressions show that local tax rates increased after a municipality joined a *PICB*, and the increase is substantial. When pooling all kinds of *PICB*, double difference regression gives that entry induces an increase of about 26%[2] of the tax rate, which correspond of an increase of 5.5 percentage points as the mean tax rate is 21%. This is very close to the increase of 6.5 percentage points found by the triple difference regression.

This increase has two aspects: it means that for a given municipality, the difference of tax rate increase relative to other municipalities is larger the first year of inter-municipal cooperation than in the years before and after. This highlights the existence of local corporate tax horizontal interaction, leading to lower local corporate tax rates when administrative divisions are smaller. On the other hand, local corporate tax rates increase when horizontal interaction is diminished by the creation of Public Inter-municipal Cooperation Bodies. According to the theoretical model presented in section 2, it also means that the local capital elasticity ε_k^i is larger than the total capital elasticity ε_K, which implies that $\alpha/(1-\alpha) > \varepsilon_K$. Previous results are true when pooling all kinds of *PICB* and when differentiating for their fiscal properties. Both $PICB_{4RT}$ and $PICB_{UBT}$ coefficients are significant in the double difference regression, but only $PICB_{4RT}$ is significant in the triple difference regression.

Furthermore, the attractiveness function *f(i)* increases with respect to the size of municipality *i* and $\sum_{j \neq i} f(j)$ decreases with respect to the size of municipality i. Hence, equation 6 implies that local capital elasticity ε_k^i considered by a small municipality *i* should be larger than capital elasticity ε_k^j considered by a large municipality *j*. This result is confirmed by the coefficients of the crossed independent variable (*PICB* dummy multiplied by the number of households). These

coefficients are significantly negative in the pooling regressions (double and triple difference) and for the $PICB_{4RT}$*ln(h) parameter in the double difference regression and the $PICB_{UBT}$*ln(h) parameter in the triple difference regression. This means that the tax rate increase arising from the initiation of inter-municipal cooperation is lower for larger municipalities than for smaller ones. hence, the fiscal competition bias is larger for smaller administrative divisions.

4.3 Decrease of Tax Competition or Cartel Creation?

The theoretical model predicts that the tax rate decrease due to decentralization is not optimal. It induces an under-optimal investment in public input for private production. This should cause a decrease in private capital investment, because the municipal attractiveness for private capital *f(i)* depends on the amount of public capital in the territory of the municipality. An alternative interpretation of this tax rate decrease with respect to decentralization may be presented. The increase in tax rates after the creation of a *PICB* would not be due to a bias towards low tax rate because of tax competition; it would be due to a bias towards high tax rates because of the creation of fiscal cartels between cooperating municipalities. In the interpretation of the theoretical model, the cooperating local corporate tax rate is optimal. In the alternative interpretation, the local corporate tax rate of the smallest administrative division is optimal.

The present subsection presents econometric analysis arbitrating between these two interpretations. For that purpose, two different variations of local corporate tax rates are considered. First of all, variations of local corporate tax rates because of new inter-municipal cooperation leads to cooperating business tax rates (optimal or cartelized). These variations are calculated as the prediction from regressions 8 or 9. They are called τ^p. They have a positive impact on the corporate tax base – which is the amount of private capital invested within the municipal territory – if the cooperation tax rate is optimal; they have a negative impact on corporate tax base if it is a cartel rate. Second, all the other variations of local corporate tax rates

are considered. These other variations are calculated as the residue out of regressions 8 or 9. They are called τ^r. These variations do not lead to the cooperation corporate tax rate. They should not have a positive impact on corporate tax base.

To compare the impact on private capital investment of both kinds of tax rate variations $\Delta\tau^p$ and $\Delta\tau^r$, the local corporate tax base in each municipality is regressed on these two independent variables. Indeed, local corporate tax bases are good proxies for private capital invested in the municipality territory. A panel regression with time and municipal fixed effects is run. Furthermore, variations of the tax bases are regressed on variations of the tax rates 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 10.

$$\ln(b_{i,t+1}) = A + B.\ln(h_{i,t+1}) + C.\ln(\tau_{it}^p) + D.\ln(\tau_{it}^r) + u_i + v_t + \varepsilon_{it} \qquad (10)$$

With $b_{i,t+1}$ being the local corporate tax base in municipality *i* for year *t+1* and $h_{i,t+1}$ the number of income tax returns from municipality *i* for the year *t+1*. Two different regressions are run according to equation 10. First, regression 10a uses results of regression 8 to estimate τ^p and τ^r. Second, regression 10b uses the results of regression 9 to estimate τ^p and τ^r. The results of these two regressions are presented in table 4.

[Table 4]

Regressions 10a and 10b confirm the theoretical model presented in section 2 and contradict the alternative cartel interpretation. Estimates *D* are statistically significant for neither of the two regressions. Because standard errors are very small (0.005) the conclusion should be that other variations of the business tax rates ($\Delta\tau^r$) have no positive impact on private capital investment, and therefore on production. Estimates *C* are statistically significant at the level of 1% for regression 10a and at the level of 10% for regression 10b. They are both positive. This means that

the increase of the local corporate tax rate occurring after a municipality begins inter-municipal cooperation ($\Delta\tau^p$) has a significant positive impact on the tax base one year later. Hence, it has a positive impact on private production. This relationship between tax rates and private capital investment is mediated by public capital investment.

The municipal economic situation is improved by this increase of the local corporate tax rate because it compensates a bias towards low local corporate tax rates generated by fiscal competition between municipalities, and therefore it increases public input provision from a sub-optimal level.

5. CONCLUSIONS

This paper presents the costs of decentralization due to tax competition between decentralized governments. It studies the decentralization of a specific competence: the provision of public input for private production, financed by a corporate tax levied by the decentralized administrative division deciding of the investments. The benefits of this decentralization of competence lie in the increase of the efficiency of public capital: investment decisions are better fitted to local needs if they are taken at a local level. The cost of decentralization, the object of this study, is a decrease in the quantity of public capital: decentralized administrative divisions compete to attract private capital; this tax competition generates a bias towards low local corporate tax rates; under-optimal corporate tax rates induce under-optimal corporate tax revenue, and consequently under-optimal public investments. With a model solved at Nash equilibrium, it is shown how fiscal competition generates this bias towards low local corporate tax rates. Moreover, the decreasing factor returns in the production function induce a stronger effect of tax competition on the corporate tax rates of smaller administrative divisions than on those of larger divisions. This means that decentralizing the competence to make decisions on public input provision – e.g. decreasing the size of administrative divisions in charge of public

input provision – increases tax competition and therefore decreases the local corporate tax rates and the provision of public input.

This paper uses the creation of Public Inter-municipal Cooperation Bodies to understand the impact of inter-municipal cooperation on local corporate tax rates. It appears that horizontal corporate tax interaction between municipalities actually occurs and is quite strong. Furthermore, this interaction is tested to determine whether it improves or worsen economic situations. The impacts of different variations of corporate tax rates on private capital investment are compared. The corporate tax increases due to a growth of inter-municipal cooperation have a positive impact on the local corporate tax base – e.g. on private capital investment. Other variations of the corporate tax rates have no positive impact. The hypothesis that inter-municipal cooperation leads to the creation of cartels setting over-optimal corporate tax rates is rejected: tax competition leads to sub-optimal provision of public input.

Because of the existence of these contrasting forces resulting from the decentralization of competences – the decentralization force due to the efficiency of decisions, and the centralization force due to the corporate tax competition – it should be relevant to compare them in an optimal competence decentralization model. Indeed, the solution for a central government is not to fully centralize decisions – which is inefficient in term of investment quality – nor to devolve decision-making over public input provision to the most decentralized administrative division – which is inefficient in terms of investment quantity. The appropriate level of competence in decentralization has yet to be found. It could appear attractive for a central government to decentralize decision-making while centralizing the administration of taxes. However, the local government is not actually the decision taker if it has no real power on the financing of its supposedly own decisions.

Inter-municipal inequality is another issue directly linked to competence decentralization. Indeed,

this paper shows that fixed factor quantity has important consequences on tax competition and private capital investment, and therefore has important consequences for the wealth of the municipality. This fixed factor is not only the city size or the number of its inhabitants, but it may also come from geographical or geological advantages, or the path of economic development. Therefore, decentralization may result in increasing inequalities between regions or municipalities. This may prompt central governments to introduce mechanisms for redistributing income between decentralized administrative divisions. The cost of such mechanisms – Smart (1998) presents a theoretical study of the impact of inter-municipal equalization mechanisms and shows the existence of a deadweight loss – should also be considered in the design of an optimal level of competence in the process of decentralization.

APPENDIX

1. PROOF OF PROPOSITION 1

Because of the Cobb-Douglas production function, the returns of capital invested in administrative division *i* is given by equation 11.

$$r_i = \frac{\partial y_i}{\partial k_i} = A\alpha {k_i}^{\alpha-1}(1-\tau_i)^{\alpha} {l_i}^{\beta} {p_i}^{\gamma} = \frac{\alpha y_i}{k_i} \quad (11)$$

At the equilibrium the rate of capital returns r_i is the same for all administrative divisions *i* because capital is perfectly mobile and there should be no opportunity of arbitrage in perfect competition. It is equal to the national interest rate *r*. Hence, equation 12 may be directly derived from equation 11; it gives the allocation k_i of private capital in administrative division *i* as a function of the national interest rate *r* and the local corporate taxes τ_i, fixed factor l_i and public capital p_i.

$$k_i = \left(\frac{\alpha A}{r}\right)^{1/1-\alpha} (1-\tau_i)^{1/1-\alpha} {l_i}^{\beta/1-\alpha} {p_i}^{\gamma/1-\alpha} \quad (12)$$

The sum of the local allocations k_i is equal to the aggregate amount of private capital *K*. Therefore, the coefficient $(\alpha A/r)^{1/(1-\alpha)}$ is equal to the formula in equation 13.

$$\left(\frac{\alpha A}{r}\right)^{1/1-\alpha} = \frac{K}{\sum_{j=1}^{n}(1-\tau_j)^{\alpha/1-\alpha} {l_j}^{\beta/1-\alpha} {p_j}^{\gamma/1-\alpha}} \quad (13)$$

Combining equation 12 and equation 13 gives equation 14 and the proof of proposition 1.

$$k_i = \frac{(1-\tau_i)^{\alpha/1-\alpha} {l_i}^{\beta/1-\alpha} {p_i}^{\gamma/1-\alpha}}{\sum_{j=1}^{n}(1-\tau_j)^{\alpha/1-\alpha} {l_j}^{\beta/1-\alpha} {p_j}^{\gamma/1-\alpha}} K \quad (14)$$

This gives equation 1 considering the definition of *f(i)* presented by equation 2.

2. PROOF OF PROPOSITION 2

Incorporating the constraints (*i*) and (*ii*) in the objective function of maximization problem 3, this global output is rewritten $Y = \sum y_j = \sum \frac{A}{\delta^{\gamma}} {\tau_j}^{\gamma} (1-\tau_j)^{\alpha} {k_j}^{\alpha+\gamma} {l_j}^{\beta}$. Hence, the first order condition

with respect to τ_i is given by equation 15.

$$\frac{\partial Y}{\partial \tau_i} = \frac{A}{\delta^\gamma}{\tau_i}^\gamma (1-\tau_i)^\alpha {k_i}^{\alpha+\gamma} {l_i}^\beta \left[\frac{\gamma}{\tau_i} - \frac{\alpha}{1-\tau_i}\right] + \sum_{j=1}^n \frac{A}{\delta^\gamma}{\tau_j}^\gamma (1-\tau_j)^\alpha {k_j}^{\alpha+\gamma-1} {l_j}^\beta \frac{\partial k_j}{\partial \tau_i} = 0 \qquad (15)$$

Yet:

$$\frac{A}{\delta^\gamma}{\tau_j}^\gamma (1-\tau_j)^\alpha {k_j}^{\alpha+\gamma-1} {l_j}^\beta = A(1-\tau_j)^\alpha {k_j}^{\alpha-1} {l_j}^\beta {p_j}^\gamma = \frac{r}{\alpha} = \frac{y_i}{k_i} \qquad (16)$$

Equation 16 is verified whatever *i* and *j* because *r* is unique. Therefore, the first order condition is given by equation 17.

$$\frac{\partial Y}{\partial \tau_i} = y_i \left[\frac{\gamma}{\tau_i} - \frac{\alpha}{1-\tau_i}\right] + (\alpha+\gamma)\frac{y_i}{k_i}\sum_{j=1}^n \frac{\partial k_j}{\partial \tau_i} = 0 \qquad (17)$$

Given constraint (*iii*), the derivative of k_j with respect to τ_i is given by equation 18.

$$\frac{\partial k_j}{\partial \tau_i} = \frac{\left[\frac{\partial f(j)}{\partial \tau_i}K + f(j)\frac{\partial K}{\partial \tau_i}\right]\sum_{m=1}^n f(m) - f(j)K\sum_{m=1}^n \frac{\partial f(m)}{\partial \tau_i}}{\left[\sum_{m=1}^n f(m)\right]^2} \qquad (18)$$

Recombining the terms of equation 18 and summing all the $\partial k_j/\partial \tau_i$ for all administrative divisions *j* gives equation 19.

$$\sum_{j=1}^n \frac{\partial k_j}{\partial \tau_i} = \frac{\sum_{m=1}^n f(m)\sum_{j=1}^n \frac{\partial f(j)}{\partial \tau_i}K - \sum_{j=1}^n f(j)K\sum_{m=1}^n \frac{\partial f(m)}{\partial \tau_i}}{\left[\sum_{m=1}^n f(m)\right]^2} + \frac{\sum_{j=1}^n f(j)\frac{\partial K}{\partial \tau_i}}{\sum_{m=1}^n f(m)} \qquad (19)$$

The first term is clearly zero, the second one is equal to $\partial K/\partial \tau_i$. Hence, $\sum_j \partial k_j/\partial \tau_i = \partial K/\partial \tau_i$, which is very intuitive: aggregation of local variations of private capital is equal to the variation of the aggregate private capital. Furthermore, last constraint (*iv*) gives that $\frac{\partial K}{\partial \tau_i} = -\varepsilon_K k_i/(1-\tau_i)$. Consequently, the first order condition 17 becomes equation 20.

$$\left[\frac{\gamma}{\tau_i} - \frac{\alpha}{1-\tau_i}\right] = \frac{(\alpha+\gamma)\varepsilon_K}{1-\tau_i} \qquad (20)$$

This gives directly the optimal tax rate of equation 4. This solution is a maximum as equation 20 has a unique solution $\tau_i=\gamma/[(\alpha+\gamma)(1+\varepsilon_K)]$ between 0 and 1, $y_i(\tau_i=0)=y_i(\tau_i=1)=0$ and $y_i>0$ for τ_i strictly between 0 and 1.

3. PROOF OF PROPOSITION 3

As $k_i = f(i)K/\sum_j f(j)$, the local elasticity ε_k^i depends on the derivative of the attractiveness function *f(i)* with respect to the tax rate τ_i. This derivative is given by equation 21.

$$\frac{\partial f(i)}{\partial \tau_i} = -\frac{\alpha}{1-\alpha} A p^{\frac{1}{1-\alpha}} l^{\frac{\beta}{1-\alpha}} (1-\tau_i)^{\frac{\alpha}{1-\alpha}-1} = -\frac{\alpha}{1-\alpha}\frac{1}{1-\tau_i} f(i) \tag{21}$$

Future public investments are not considered because firms can reallocate capital in the future: private capital is assumed to be perfectly mobile within the country. The variations of private capital in an administrative division with respect to the corporate tax rate depend on $\partial f(i)/\partial \tau_i$ as in equation 22.

$$\frac{\partial k_i}{\partial \tau_i} = \frac{K}{\left(\sum_{j=1}^n f(j)\right)^2}\left(\frac{\partial f(i)}{\partial \tau_i}\sum_{j=1}^n f(j) - f(i)\frac{\partial f(i)}{\partial \tau_i}\right) + \frac{f(i)}{\sum_{j=1}^n f(j)}\frac{\partial K}{\partial \tau_i} \tag{22}$$

Hence, combining equation 21 and equation 22, the variation of private capital allocation in an administrative division with respect to the corporate tax rate of this division is as presented in equation 23.

$$\frac{\partial k_i}{\partial \tau_i} = -\frac{\alpha}{1-\alpha}\frac{1}{1-\tau_i}\frac{f(i)K}{\left(\sum_{j=1}^n f(j)\right)^2}\sum_{j\neq i} f(j) + \frac{f(i)}{\sum_{j=1}^n f(j)}\frac{\partial K}{\partial \tau_i} \tag{23}$$

As $f(i)K/\sum_j f(j) = k_i$, this equation leads to equation 24.

$$-\frac{1-\tau_i}{k_i}\frac{\partial k_i}{\partial \tau_i} = \frac{\alpha}{1-\alpha}\frac{\sum_{j\neq i} f(j)}{\sum_{j=1}^n f(j)} - \frac{1-\tau_i}{k_i}\frac{\partial K}{\partial \tau_i}\frac{f(i)}{\sum_{j=1}^n f(j)} \tag{24}$$

This gives directly equation 7.

4. PROOF OF PROPOSITION 4

The problem of maximization is as equation 5 with replacing constraints (*i*), (*iii*) and (*iv*) by constraint (*v*) as given by equation 6. The first order condition of this maximization problem is given by equation 25.

$$y_i\left(-\frac{\alpha}{1-\tau_i} + \frac{\alpha}{k_i}\frac{\partial k_i}{\partial \tau_i} + \frac{\gamma}{p_i}\frac{\partial p_i}{\partial \tau_i}\right) = 0 \tag{25}$$

Constraint (*ii*) implies that $\partial p_i/\partial \tau_i = k_i/\delta + (\tau_i/\delta)\partial k_i/\partial \tau_i$, and therefore the first order condition is equivalent to equation 26.

$$y_i\left(-\frac{\alpha}{1-\tau_i}+\frac{\alpha}{1-\tau_i}\varepsilon_k^i+\frac{\gamma k_i}{\delta p_i}\left[1-\frac{\tau_i}{1-\tau_i}\varepsilon_k^i\right]\right)=0 \quad (26)$$

And it is then equivalent to equation 27.

$$-\frac{\alpha}{1-\tau_i}-\frac{\alpha}{1-\tau_i}\varepsilon_k^i+\frac{\gamma}{\tau_i}-\frac{\gamma}{1-\tau_i}\varepsilon_k^i=0 \quad (27)$$

Introducing equation 6 in equation 27 gives the result of proposition 4. This solution is a maximum as equation 27 has a unique solution between 0 and 1, $y_i(\tau_i=0)=y_i(\tau_i=1)=0$ and $y_i>0$ for τ_i strictly between 0 and 1.

Endnotes

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1. This modeling is equivalent to the one where entrepreneurs have to borrow an amount $m/(1-\tau_i)$ of private capital to invest m.

2. The dependent variable is $\ln(\tau)$ and the coefficient 0.231, therefore the tax rate variation is $(\tau_1 - \tau_0) / \tau_0 = \exp(0.231) - 1 = 26.0\%$.

References

Alesina Alberto, and Enrico Spolaore. 1997. On the number and size of nations. Quaterly Journal of Economics 112: 1027-1056.

Arzaghi Mohammad, and Vernon J. Henderson. 2005. Why countries are fiscally decentralizing. Journal of Public Economics 89: 1157-1189.

Baldwin Richard E., and Paul Krugman. 2004. Agglomeration, integration and tax harmonisation. European Economic Review 48: 1-23.

Barankay Irwan, and Ben Lockwood. 2007. Decentralization and the productive efficiency of government: Evidence from Swiss cantons. Journal of Public Economics 91: 1197-1218.

Bell Kathleen P., and Todd M. Gabe. 2004. Tradeoffs between Local Taxes and Government Spending as Determinent of Business Location. Journal of Regional Science 44: 21-41.

Bénassy-Quéré Agnès, Nicolas Gobalraja, and Alain Trannoy. 2005. Concurrence fiscale et facteur public. Rapport du Conseil d'administration économique 56: 157-186.

Boadway Robin, and Fumio Hayashi. 2001. An empirical analysis of intergovernmental tax interaction: the case of business income taxes in Canada. Canadian Journal of Economics 34: 481-503.

Bucovetsky Sam. 1991. Asymmetric Tax Competition. Journal of Urban Economics 30: 167-181.

Buettner Thiess. 2001. Local business taxation and competition for capital: the choice of the tax rate. Regional Science and Urban Economics 31: 215-245.

Buettner Thiess. 2003. Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of German jurisdictions. Journal of Urban Economics 54: 110-128.

Hoyt William H. 1991. Property Taxation, Nash Equilibrium, and Market Power. Journal of Urban Economics 30: 123-131.

Keen Michael, and Christos Kotsogiannis. 2002. Does federalism lead to excessively high tax rates? American Economic Review 92: 363-370.

Krugman Paul. 1991. Increasing Returns and the Economic Geography. Journal of Political Economy 99: 483-499.

Leprince Matthieu, Thierry Madiés, and Sonia Paty. 2007. Business tax interactions among local governments: an empirical analysis of the French case. Journal of Regional Science 47: 603-621.

Oates Wallace E. 1972. Fiscal federalism. New york: Hartcourt Brace Jovanovitch.

Oates Wallace E. 1999. An essay on fiscal federalism. Journal of Economic Literature 37: 1120-1149.

Peralta Suzanna, and Tanguy Van Ypersele. 2006. Coordination of capital taxation among asymmetric countries. Regional Science and Urban Economics 36: 708-726.

Schwab Robert M., and Wallace E. Oates. 1991. Community composition and the provision of local public goods: A normative analysis. Journal of Public Economics 44: 217-237.

Smart Michael. 1998. Taxation and deadweight loss in a system of intergovernmental transfers. Canadian Journal of Economics 31: 189-206.

Tiebout Charles. 1956. A pure theory of local expenditure. Journal of Political Economy 64: 416-424.

Wildasin David E. 1988. Nash Equilibria in Models of Fiscal Competition. Journal of Public Economics 35: 229-240.

Wilson John D. 1991. Tax competition with interregional differences in factor endowments. Regional Science and Urban Economics 212: 423-451.

Zodrow Georges R., and Peter Mieszkowski. 1986. Pigou, Tiebout, property taxation, and the underprovision of local public goods. Journal of Urban Economics 19: 356-370.

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Tables

Table 1. French municipalities and there inter-municipal cooperation

	None	$PICB_{4RT}$	$PICB_{UTP}$	Overall
2002	8,409 (27%)	15,302 (48%)	7,907 (25%)	31,618 (100%)
2003	5,954 (19%)	15,343 (48%)	10,321 (33%)	31,618 (100%)
2004	4,509 (14%)	15,597 (49%)	11,512 (37%)	31,618 (100%)

Notes: *PICB* are Public Inter-municipal Cooperation Bodies. $PICB_{4RT}$ fiscal integration is more limited than $PICB_{UTP}$ fiscal integration. There are more than 36,000 municipalities in France. The present panel has only 31,618 because there are some inconsistencies between different data bases or years. The main deficiency lies in the geographical data base.

Source: Compiled by author.

Table 2. Local corporate tax rates and bases

	Mean	Standard Deviation	Between standard deviation	Within standard deviation
Rates	21.0%	7.2%	6.4%	3.3%
Bases	2.4	16.2	16.1	1.8
Municipal share	28%	25%	22%	11%
PICB share	51%	17%	14%	9%
Rates (vs neighbors)	100%	27%	23%	13%
Bases (vs neighbors)	0.66%	3.31%	3.29%	0.32%

Notes: *PICB* are Public Inter-municipal Cooperation Bodies. The tax base unit is one million euros. Rates vs neighbors is the ratio of the local corporate tax rate on the municipal territory to the mean rate among municipalities closer than 30 kilometers. Therefore the mean of the rate vs neighbors is 1. Bases vs neighbors is the ratio of the local corporate tax base in the municipal territory to the total base over the municipalities not further away than 30 kilometers. Therefore the base vs neighbors mean is 0.66 because there is a mean of 150 municipalities within a radius of 30 kilometers.

Source: Compiled by author.

Table 3. Regressions of the local corporate tax rate

Dependent variable		Logarithm of tax rate (Double difference)		Increase of tax rate (Triple difference)	
PICB	b	0.231***		0.0652***	
		(0.041)		(0.0232)	
*PICB**ln(h_i)	c	-0.027***		-0.0087**	
		(0.007)		(0.0042)	
$PICB_{4RT}$	b_1		0.168***		0.0882***
			(0.047)		(0.0322)
$PICB_{4RT}$*ln(h_i)	c_1		-0.013		-0.0135**
			(0.008)		(0.0061)
$PICB_{UTP}$	b_2		0.215***		-0.0473
			(0.047)		(0.0257)
$PICB_{UTP}$*ln(h_i)	c_2		-0.029***		0.0055
			(0.008)		(0.0043)
Observations		77,166	77,166	63,041	63,041
R^2		9%	8%	99%	99%

Notes: *PICB* are Public Inter-municipal Cooperation Bodies. $PICB_{4RT}$ fiscal integration is more limited than $PICB_{UTP}$ fiscal integration. These are the results of panel regressions with individual and temporal fixed effects. *PICB* (respectively $PICB_{4R}$ or $PICB_{UTP}$) measures the impact of entering an *PICB* (respectively $PICB_{4RT}$ or $PICB_{UTP}$) on the total local corporate tax rate. *PICB**ln(h_i) measures the marginal variations of this impact depending on the marginal municipality size variations (municipality size being approximated by the number of income tax returns). ***: significant at 1%, **: significant at 5%. Standard errors in parentheses.

Source: Compiled by author.

Table 4. Impact of tax rate variations on tax bases

Dependent variable		Business tax base	
Regression equation		(10a)	(10b)
Prediction with regression		(8)	(9)
τ^p	C	0.221***	0.125*
		(0.081)	(0.070)
τ^r	D	0.008	0.008
		(0.005)	(0.005)
Observations		77,152	77,152
R^2		12%	10%

Notes: These are the results of OLS panel regressions with municipal and temporal fixed effects. τ^p measures the marginal impact of local corporate tax rate variations due to *PICB* creation or entry on private capital investment. τ^r measures the marginal impact of the other local corporate tax rates variations on private capital investment. ***: significant at 1%, **: significant at 5%, *: significant at 10%. Standard errors in parenthese.

Source: Compiled by author

Figure

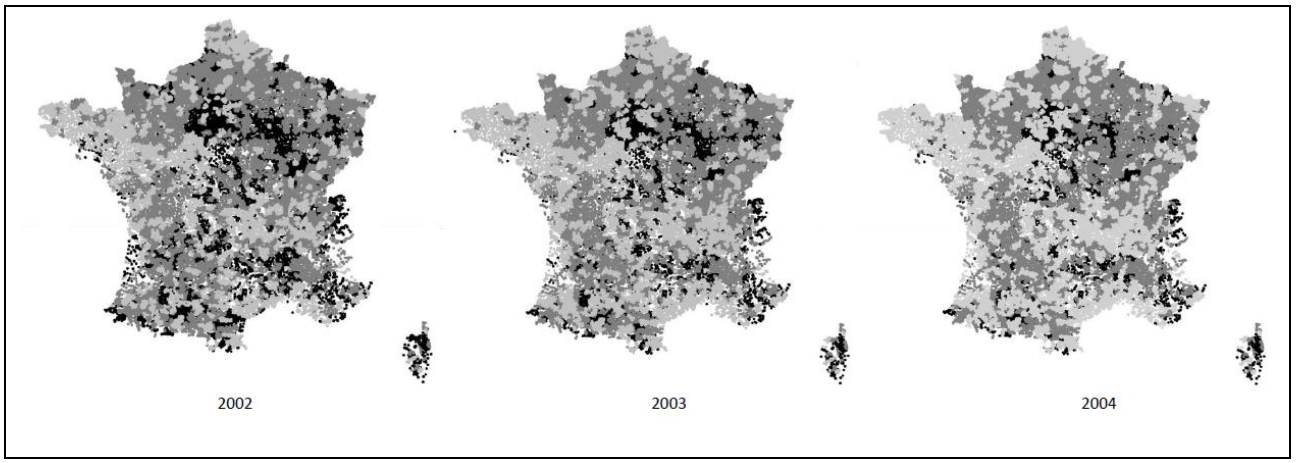

Figure 1. Fench Public Inter-municipal Cooperation Bodies

Notes: Black dots show municipalities not part of any Public Inter-municipal Cooperation Body (*PICB*). Dark grey dots show municipalities in $PICB_{4RT}$ (limited corporate tax integration). Light grey points show municipalities part of $PICB_{UTP}$ (full corporate tax integration). For the sake of clarity only those municipalities with more than 5000 inhabitants are shown.