Local taxation and tax base mobility: Evidence from a business tax reform in France

Tidiane Ly Sonia Paty

GATE Lyon Saint-Etienne (UMR 5824)

Abstract

This paper investigates the impact of tax base mobility on local taxation. We first develop a theoretical model in order to examine the connection between local business property taxation and tax base mobility within a metropolitan area. We find that decreasing capital intensity in the tax base increases the business property tax rates unambiguously. We then test this result using a French reform, which changes the composition of the main local business tax base in 2010. Estimations using Difference-in-Difference show that the reduction in the mobility of the tax base indeed results in higher business property tax rates. Housing tax rates were not affected by the reform.

Keywords: Local taxation; Tax base; Mobility; Tax competition; Difference-in-difference
JEL: H71; H72; R50; R51

---

1. Introduction

Tax base mobility has many implications on public decisions made by local governments. There now exists an extensive body of literature analyzing the efficiency properties of local public goods provision when firms and households are mobile across jurisdictions. Seminal contributions were introduced by Wilson (1995), Richter and Wellisch (1996), Brueckner (2000), followed by many subsequent articles (see the detailed review by Wellisch, 2006). Most models assume small jurisdictions, whose policies do not affect prices or utility in other jurisdictions, perfectly mobile capital and residents-workers, and a fixed land factor. Since local governments provide congestible local public goods, the main result is that a combination of a residence-based head tax on mobile households, which internalizes congestion costs and an undistortive tax on land are sufficient to achieve Pareto efficiency of the competitive equilibrium between jurisdictions. Such an efficiency-supporting tax structure is therefore "complete". Richter and Wellisch (1996) demonstrate that this efficiency result still holds when introducing several firms and local impure public factors, provided that jurisdictions can raise local poll taxes on mobile firms. Inefficiencies occur whenever one of the above tax instruments is unavailable or replaced by a distortive tax.

All these papers share a common assumption since they consider mobile individuals who work where they reside and, consequently, treat wage as a jurisdiction-specific variable (Ly, 2016). This makes the above models well-suited to study tax competition between large jurisdictions such as regions or states. However, once they have decided on a residential location within a metropolitan area, households commute to work anywhere in the metropolis, which equalizes wages across jurisdictions (Braid, 1996).[1]

In this paper, we first develop a theoretical model in which households do not necessarily work where they reside as in Ly (2016). Within this framework, we derive the connection between local business property taxation and tax base mobility. We show that when the local business property tax is composed of mobile capital and immobile land, the local business property tax rates increases when the share of capital decreases in the overall business property (capital and business land) due to capital mobility. Moreover, the analysis shows that this capital change does not affect household taxes.

We then test this result using a French reform, which changes the composition of the main local business tax base of the so-called '*Taxe professionnelle*' in 2010. The reform indeed removed the capital investment, which was around 80% from the local business tax base. More precisely, while their tax base mainly consisted in the capital investments

[1] Braid (1996) studies sub-metropolitan jurisdictions, which compete for mobile capital and workers, but residents are assumed immobile. Conversely, Hoyt (1991), Krelove (1993) and Wilson (1997) study policy choices of sub-metropolitan governments when households are free to choose their residential location but ignore labor and activities location.

made by firms (machinery and equipment) and property (buildings), local governments ended up with a business property tax only. This change of the composition of tax base has also implied a dramatic change in the degree of mobility of tax base since it turned from a capital taxation into a property taxation. By analyzing the impact of a *qualitative* change in the local business tax base, we address the following question: how and to what extent the tax rate of the local business tax is affected by a change in the composition, i.e. the mobility of its tax base?

Estimations using Difference-in-Difference show that a drastic cut in the amount of a mobile tax base (capital) relative to a far less mobile tax base (buildings) have led French municipalities to raise their business property tax rates. We then provide empirical evidence that there is a negative relationship between local business taxation and the degree of tax base mobility. We also show that this result is not due to a tax competition effect by controlling spatial correlation. In a theoretical model, Lee (1997) indeed shows the effects on interjurisdictional tax competition of the imperfect mobility of capital. He finds that capital tax rates are negatively related to the degree of capital mobility in a tax competition framework. In the empirical literature, many papers provide estimates of the degree of interdependence in capital tax rates among local governments (Brett and Pinkse, 2000; Allers and Elhorst, 2005; Charlot and Paty, 2007; Hauptmeier et al., 2012; Lyytikäinen, 2012) but, to our knowledge, there is no existing empirical literature on the extent to which the presence of a mobile tax base - such as capital - would lead to a downward pressure on local tax rates.

Lastly, we find that housing tax rates were not affected by the reform. Although municipalities have raised their housing tax rate in order to compensate the cut in tax revenue due to the loss of an important tax base, they also had incentives to reduce the housing tax since it is less costly to tax business property relative to residents.

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework underlying our empirical analysis. Section 3 describes the institutional structure of municipalities in France and the tax reform of 2010. Section 4 outlines the identification strategy. Section 5 describes the data. Section 6 reports the regression results. Section 7 concludes.

2. Theoretical background

We now develop our theoretical model in order to examine the connection between local business property taxation and tax base mobility within a metropolitan area.[2]

Consider a small representative municipality i inhabited by R_i perfectly mobile residents. Each resident derives utility from private consumption x_i, a congestible public

[2]See Ly (2016) for a more general presentation of this theoretical framework.

good G_i and one unit of land paying the land rent ρ_i.[3] Thus, a resident is characterized by the utility function $U(x_i, G_i, R_i) = x_i + \alpha \log(G_i/R_i)$. Note that utility is decreasing in the jurisdiction's population R_i due to congestion. Since households are assumed to be perfectly mobile across jurisdictions, we have:

$$x_i + \alpha \log\left(\frac{G_i}{R_i}\right) = u \tag{2.1}$$

where u is the exogenous level of utility prevailing in the economy. Each resident of the economy possesses an identical capital endowment k which she invests in the jurisdiction where she receives the highest return. Since capital is perfectly mobile across jurisdictions, in equilibrium the same return to capital r prevails across jurisdictions. From the perspective of a small jurisdiction, r is exogenous. For tractability reasons, two simplifying assumptions are made. First, labor considerations are absent from the present framework.[4] Second, the total exogenous land endowment of jurisdiction i, denoted $\mathcal{L}_i$ is assumed to be owned by some immobile residents of i who are not explicitly modeled for notational convenience.[5]

The local government i collects a head tax τ_i^R on its residents.[6] The budget constraint of a representative resident of jurisdiction i can be written as

$$x_i + \rho_i = y - \tau_i^R \tag{2.2}$$

where $y \equiv rk$ is the exogenous income of a resident. The production technology in jurisdiction i is described by the well-behaved homogeneous production function $F(K_i, L_i)$, and firms choose capital K_i and land L_i so as to maximize profits $F^i(K_i, L_i) - [r + (1-\theta)\tau_i^P]K_i - (\rho_i + \tau_i^P)L_i$, where τ_i^P is the business property tax rate, and θ is the exogenous share of the capital tax base which is exempted from tax. Factor prices and taxes are taken as given by firms. Profit maximization implies:

$$F_K^i(K_i, L_i) = r + \tau_i^P(1-\theta), \tag{2.3}$$

$$F_L^i(K_i, L_i) = \rho_i + \tau_i^P, \tag{2.4}$$

where subscripts stand for derivatives. The land market clearing condition entails:

$$\mathcal{L}_i = R_i + L_i. \tag{2.5}$$

[3] The one-unit land consumption could alternatively be replaced by an exogenous value l_i.

[4] But the results derived in this section would be strictly identical when introducing mobile labor (Ly, 2016).

[5] This simplifying assumption is innocuous to the results presented in this section. Richter and Wellisch (1996) also consider two types of households with the immobile ones owning all land. Alternatively, Wilson (1995), Wellisch and Hulshorst (2000) and Ly (2016) consider only mobile households and assume that land is uniformly distributed among them.

[6] Because individuals consume a single unit of land, τ_i^R can be interpreted either as a unit tax on land consumption or as a head tax.

Assume that the cost function of the provision of local public goods is $C(G_i) = G_i + f_i$. The fixed costs f_i comprise, for instance, running and maintenance costs, and interest of past debt. The local authorities must satisfy the following budget constraint:

$$\tau_i^R R_i + \tau_i^P[(1-\theta)K_i + L_i] = G_i + f_i. \tag{2.6}$$

The local government maximizes the local land rent $\rho_i \mathcal{L}_i$ while accounting for the private behavior as described in (2.1)-(2.5) and satisfying the local budget constraint (2.6).[7] Let us consider that the local government freely chooses τ_i^R and G_i, while adjusting τ_i^P so as to satisfy (2.6). When $\theta = 0$ - which can be interpreted as the pre-reform situation -the optimal behavioral rules of the local authorities are:[8]

$$\tau_i^{R0} = \alpha + \left(1 + \frac{K_i^0}{L_i^0}\right)\tau_i^{P0}, \tag{TR^0}$$

$$\tau_i^{P0} = \frac{R_i^0}{K_i^0 + L_i^0}\left(\alpha - \tau_i^{R0} + \frac{f_i}{R_i^0}\right) \tag{BC^0}$$

$$G_i^0 = \alpha R_i^0, \tag{2.7}$$

where the superscript 0 stands for the equilibrium value of the variables when $\theta = 0$. Thus, each variable only depends on the exogenous parameters of the model f_i, $\mathcal{L}_i$, α, y, u and r. The optimal taxation rule (TR^0) shows that local authorities choose the level of the tax on residents so as to internalize the costs of households and capital mobility. To see this, suppose that a new resident enters the jurisdiction. She brings τ_i^R tax revenues (left-hand side of (TR^0)) but she entails three marginal costs for the jurisdictions (right-hand side of (TR^0)): a congestion cost, $R_i|\partial v^i/\partial R_i| = \alpha$, since she decreases the utility of all other residents; a fiscal cost τ_i^P due to the crow-out of one unit of business land; and an additional fiscal cost $(\partial K_i/\partial R_i)\tau_i^P = (K_i/L_i)\tau_i^P$ due to capital mobility. This last marginal fiscal cost is central to our analysis. It stems from the fact that the new resident, by crowding-out business land, also generates an outflow of capital from the jurisdiction. Condition (BC^0) simply states that τ_i^P allows to satisfy the budget constraint (2.6). Condition (2.7) is the Samuelson rule which shows that the public good is provided efficiently.[9]

When $\theta = 1$ - which can be interpreted as the post-reform situation - the optimal

[7] Land rent maximization is a widespread objective for local governments in tax competition models with atomistic jurisdictions and perfectly mobile households (Wilson, 1995; Wellisch and Hulshorst, 2000; Wellisch, 2006; Ly, 2016). In the present framework, the rationale for this behavior is that the local government cannot affect utility of mobile residents. Therefore, a benevolent local government aims at maximizing utility of immobile residents which means maximizing their income from land ownership.

[8] See the appendix for more details about the derivations of the first-order conditions.

[9] Indeed, condition (BC^0) states that the sum of the marginal willingness to pay for the public good of all residents ,$R_i(\partial v^i/\partial G_i) = R_i/G$, equals its marginal cost $C'(G_i) = 1$. Efficiency of local public good provision is typical to models with small jurisdictions, perfectly mobile residents paying a head tax (Wellisch and Hulshorst, 2000).

behavioral rules of the local authorities are:

$$\tau_i^{R1} = \alpha + \tau_i^{P1} \tag{TR^1}$$

$$\tau_i^{P1} = \frac{R_i^1}{L_i^1}\left(\alpha - \tau_i^{R1} + \frac{f_i}{R_i^1}\right), \tag{BC^1}$$

$$G_i^1 = \alpha R_i^1, \tag{2.8}$$

where the superscript 1 stands for the equilibrium value of the variables when $\theta = 1$. Similarly to (BC^0), (BC^1) states that τ_i^P allows to satisfy the budget constraint and similarly to (2.7),(2.8) is the Samuelson rule. The main change with respect to the pre-reform situation ($\theta = 0$), appears in (TR^1). Compared to (TR^0), we observe that the marginal fiscal cost due to capital mobility disappears. Since capital is not taxed anymore, a new resident becomes less costly relatively to new firms.

From (TR^0),(TR^1),(BC^0) and (BC^1), we can derive the reduced form of the tax on resident and the business property tax before and after the institutional change:

$$\tau_i^{R0} = \alpha + \frac{f_i}{\mathcal{L}_i}, \tag{2.9a}$$

$$\tau_i^{R1} = \alpha + \frac{f_i}{\mathcal{L}_i}, \tag{2.9b}$$

$$\tau_i^{P0} = (1 - \kappa_i^0)\frac{f_i}{\mathcal{L}_i}, \tag{2.9c}$$

$$\tau_i^{P1} = \frac{f_i}{\mathcal{L}_i}. \tag{2.9d}$$

where $\kappa_i^0 \equiv K_i^0/(K_i^0 + L_i^0)$.Expressions (2.9a) and (2.9b) show that the tax on residents τ_i^R does not directly depend on the share of the taxable capital base, θ. In other words, the tax reform should not have had a significant impact on τ_i^R. However, expressions (2.9c) and (2.9d) reveal that the same may not be said about the business property tax: municipalities should have increased τ_i^P due to the reform. Moreover:

$$\frac{\partial(\tau_i^{P1} - \tau_i^{P0})}{\partial \kappa_i^0} = \frac{f_i}{\mathcal{L}_i} \quad > 0. \tag{2.10}$$

Municipalities with higher capital intensity before the reform - that is a higher value of κ_i^0 - are expected to be more affected by the reform relatively to others, that is their tax rates increased more than other municipalities. The rationale behind this is that before the reform, in jurisdictions with more capital-intensive firms, capital mobility exerted a stronger downward pressure on τ_i^P than in less capital-intensive jurisdictions.

To provide further understanding of this key result, equations (TR^0),(TR^1),(BC^0) and (BC^1) are drawn on Figure 1.

[9]The graph on Figure 1 corresponds to the following values: $R_i^0 = 3.50$, $L_i^0 = 1.50$, $K_i^0 = 3.50$, $R_i^1 = 3.20$, $L_i^1 = 1.80$, $\alpha = 0.05$, $f_i = 1.05$, $\mathcal{L}_i = 5$.

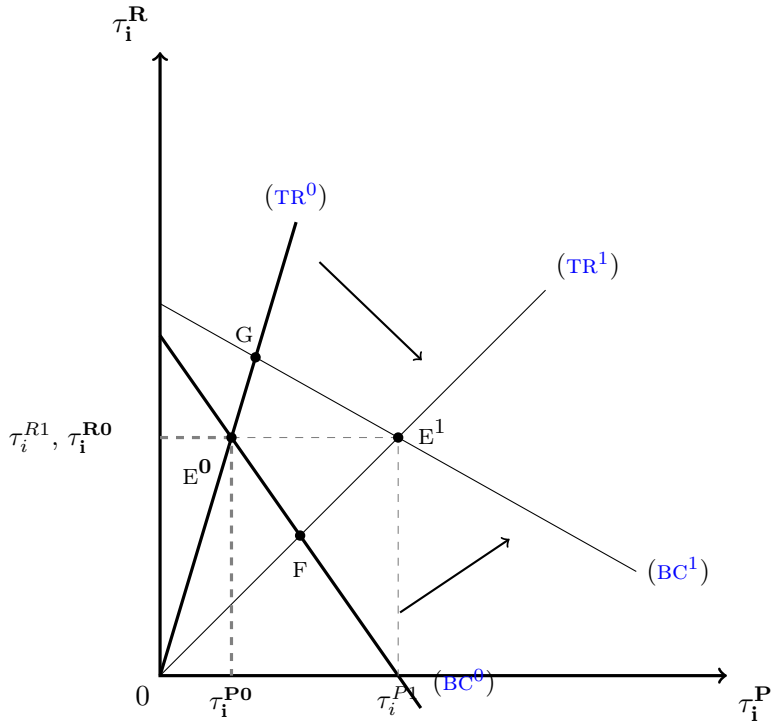


Figure 1. Effect of a removal of the capital tax base K_i on τ_i^R and τ_i^P.

The taxation-rule curve (TR^0) on Figure 1 depicts the positive relationship that links τ_i^R to τ_i^P in the pre-reform context: an increase in τ_i^P implies a rise in the marginal fiscal cost of new residents. The budget-constraint curve (BC^0) represents the negative relationship that links τ_i^P to τ_i^R in the pre-reform context: increasing τ_i^R allows local authorities to alleviate the tax burden on firms by cutting τ_i^P. Thus, point E^0 which intersects (TR^0) and (BC^0), represents the pre-reform equilibrium in tax rates.

The reform consisting in a removal of capital from the business property tax base, induces two different effects. The first effect is a budgetary effect resulting in an increase of both tax rates to compensate the loss in tax revenues entailed by the tax base cut. This effect is illustrated by the rightward move of the budget-constraint curve from (BC^0) to (BC^1) which shifts the equilibrium from from E^0 to G.[10] The second effect due to capital mobility is characterized by a decrease in τ_i^R and an increase in τ_i^P. It is illustrated by the downward move of the taxation-rule cure from (TR^0) to (TR^1) and a shift of the equilibrium from E^0 to F. Indeed, after the reform the local government does not incur the marginal fiscal cost due to capital mobility any more. Thus, the marginal cost of hosting residents instead of firms becomes lower after the reform. Therefore, local authorities shift part of the burden of financing public services on firms.

[10] An increase in the fixed costs f_i would also imply a rightward shift of (BC^0). Note also that we assumed for expositional purpose that the equilibrium population level decreased ($R_i^0 > R_i^1$) so that the intercept of the budget constraint increased. But an increase in R_i is also possible.

The new equilibrium E^1 results from the combination of the two preceding effects. Since both the budgetary effect and the capital-mobility effect imply a rise in the business property tax, this tax increases non-ambiguously: $\tau_i^{P0} < \tau_i^{P1}$. Figure 1 also illustrates the result of equation (2.10): a higher capital-intensity makes (TR^0) steeper which widens the gap $\tau_i^{P1} - \tau_i^{P0}$. However, the tax on residents is pushed up by the budgetary effect but pulled down by the capital-mobility effect. As visible on Figure 1, the present framework predicts that both effects exactly compensate: $\tau_i^{R0} = \tau_i^{R1}$. In practice, such a perfect balancing is rather unlikely.[11] But the reform should have affected τ_i^R to a lesser extent.

3. Institutional setting and the policy intervention

Since 10 January 1981, French municipalities have granted power to vote the rate of several local taxes. Until 2010, the tax instruments available to French municipalities mainly consisted in four direct taxes whose rate was voted by a Municipal Council:[12] (1) the business property tax paid by firms whose base consisted in the capital investments made by firms (machinery and equipment) and the personal and real property (land and buildings) they used, regardless of whether they own it; (2) the housing tax on residents; (3) the tax on developed property charged on owners of constructed land (buildings and housing); (4) the tax on undeveloped property paid by owners of vacant land.

These four direct taxes rely on the rent assessed value of their tax base. While the capital rent is evaluated according to its depreciation rate, the rent to owners of vacant and constructed land are based on a national determination achieved respectively in 1960 and 1970. Each year, the national government reassesses the rents to land owners by applying a unique rate which is based on the inflation rate of commodities. Finally, there was another local tax on firms based on the value added. Contrary to the aforementioned taxes, the choice of its rate was not left to the Municipal Council but was nationally fixed at a level of 1.5%. However, this tax had a limited importance since only firms with sales revenue over 7.6 millions euros was concerned.

The French business property tax reform of 2010 leads to several changes in the fiscal environment of the municipalities. The most significant change is the removal of capital

[11] In the present framework, perfect compensation of the two effects is due to the homogeneity of the production technology. It implies that when decreasing slightly τ_i^R, the amount of capital by units of crowded-out business land $(\partial K_i/\partial \tau_i^R)/(\partial L_i/\partial \tau_i^R)$ is equal to K_i/L_i. That is, the capital-intensity of firms remains constant. With alternative assumptions, a decrease (resp. increase) in capital intensity - i.e. $(\partial K_i/\partial \tau_i^R)/(\partial L_i/\partial \tau_i^R)$ lower (resp. higher) than K_i/L_i - could appear so that $\tau_i^{R0} < \tau_i^{R1}$ (resp. $\tau_i^{R0} > \tau_i^{R1}$).

[12] Note that we focus on the municipal level. Thus, we describe the tax structure of French municipalities only. But the reform also affected upper governments layers, that is the departments and the regions.

investments from the tax base of the business property tax, which was around 80 % of its tax base (see Table 1).[13] This deletion affected municipalities in a twofold way.

First, *ceteris paribus*, it has indeed shrunk municipalities' own resources. A compensation mechanism was implemented to maintain the level of resources just after the reform. Two state grants called "dotation de compensation de la reforme de la taxe professionnelle" (DCRTP) and "fonds de garantie individuelle des ressources" (FNGIR) aimed at compensating the net loss in fiscal revenue from each level of government by transferring fiscal revenue from richer local governments to poorer ones due to the reform. The level of compensation is based on the level of fiscal revenue in 2010. [14] Due to this budget compensation, no effect is expected on business property tax rates.

Second, this automatic budget effect is accompanied by a change in the nature of business property tax base. Before the reform it had a significant share of highly mobile tax base, that is capital, and a smaller portion of business land which is far less mobile. This contrasts drastically with the post-reform situation where the business property tax rate now only applies to land. As a result of this transformation of the tax base, the property tax rate is expected to increase.

Table 1. Removal of the capital investment tax base by the French business property tax reform of 2010

Pre-reform		Post-reform	
Tax rate	*Tax base*	*Tax rate*	*Tax base*
τ^P_{pre}	K_{pre} : capital	τ^P_{post}	-
	L_{pre} : business land use		L_{post}
τ^R_{pre}	R_{pre} : residents' housing	τ^R_{post}	R_{post}
$\tau^{\mathcal{L}^C}_{pre}$	$\mathcal{L}^C_{pre}$: constructed land property	$\tau^{\mathcal{L}^C}_{post}$	$\mathcal{L}^C_{post}$
$\tau^{\mathcal{L}^U}_{pre}$	$\mathcal{L}^U_{pre}$: unconstructed land property	$\tau^{\mathcal{L}^U}_{post}$	$\mathcal{L}^U_{post}$

The reform has also involved several additional changes in the tax instruments of municipalities.

First, the base of the value added tax has been considerably widened since the threshold above which it applies decreased from 7.6 millions euros to only 206 euros of sales revenue, so that almost all firms are now concerned. Its rate is maintained at a

[13] Removal of the capital investments base was the initial stated purpose of the reform. It aimed at boosting business investment capacity in France.

[14] The compensation grant is based on the difference between fiscal revenues in the new system and the theoretical fiscal revenue a local government would have received if tax rates of 2009 had been set on new fiscal bases in 2010. There is no possible evolution over time.

fixed value of 1.5%.[15]

Second, a flat-rate tax on network businesses which concerns transport, energy and telecommunications, has been introduced. The level of this tax paid by each firm depends on its sector and its size. Municipalities have no decision-making power on it.[16]

Third, the municipal level has been transferred shares of direct taxes revenue previously allocated to upper sub-government layers. Municipalities now benefit from the departments' housing tax share and from the departments' and regions' portions of the tax on unconstructed land property.

Fourth, the additional tax created is the complementary property tax on land, which compensates the losses due to the cancellation of the regional and departmental components of TFNB. This fiscal revenue goes to the intermunicipal level of governments. Finally, following the reform, municipalities were transferred new fiscal revenues from the state level (tax on commercial building (TASCOM) and management costs on housing tax and property tax.

4. Estimation strategy

Our objective is to investigate the connection between local business property taxation and tax base mobility. We would like here to test the main result of our theoretical model, i.e. the fact that decreasing capital-intensity increases the business property tax rates, as described in the theoretical model set out in section 2. To test for result (2.10), we consider the following difference-in-differences regression equation:[17]

$$\tau_{it}^{P} = \beta_0 + \beta_1 Post_t + \beta_2 \kappa_i + \beta_3 Post_t \times \kappa_i + \mathbf{x}_{it}'\delta + \varepsilon_{it} \tag{4.1}$$

where τ_{it}^{P} is the tax on firm (outcome variable), $Post_t$ a dummy variable which equals 1 after the reform ($t > 2009$) and 0 otherwise, $\mathbf{x}_{it}$ socio-demographic control variables, κ_i the capital share in the total business property in 2009 (treatment intensity). Assume that the treatment intensity is exogenous: $E[\varepsilon_{it}|Post_t,\ \kappa_i] = 0$.[18] The time effect for an individual i with treatment level $\bar{\kappa}$ is:

$$E[\tau_{it}^{P}|Post_t = 1,\ \kappa_i = \bar{\kappa}] - E[\tau_{it}^{P}|Post_t = 0,\ \kappa_i = \bar{\kappa}] = \beta_1 + \beta_3 \bar{\kappa} \tag{4.2}$$

[15] As illustrated by the expansion of the value added tax, the reform has not been limited to remove the capital base of the business property tax. Most of the other changes introduced by the reform consisted in providing new resources to municipalities to compensate for the budget cost of limiting the business property tax base.

[16] An additional flat-rate tax on basic nuclear installations has also been introduced.

[17] The regression equation is a difference-in-difference method with continuous treatment intensity, as in e.g. Card (1992)and Jordahl and Liang (2010).

[18] This assumption is consistent with our theoretical model since in the optimal decision rule (2.9c) only depends on exogenous parameters.

The time effect for an individual i with treatment level $\bar{\kappa} + d\kappa$ is:

$$E[\tau_{it}^P | Post_t = 1,\ \kappa_i = \bar{\kappa} + d\kappa] - E[\tau_{it}^P | Post_t = 0,\ \kappa_i = \bar{\kappa} + d\kappa] = \beta_1 + \beta_3 \bar{\kappa} + \beta_3 d\kappa \quad (4.3)$$

Substracting the time effect of the individual receiving $\bar{\kappa}$, (4.4), to the time effect of the individual receiving $\bar{\kappa} + d\kappa$, (4.3), we obtain the Average Treatment Effect (ATE) of receiving a marginal dose $d\kappa$, for all initial treatment level $\bar{\kappa}$:

$$\frac{\partial}{\partial \kappa}\{E[\tau_{it}^P | Post_t = 1,\ \kappa_i = \kappa] - E[\tau_{it}^P | Post_t = 0,\ \kappa_i = \kappa]\}_{\kappa = \bar{\kappa}} = \beta_3 \quad (4.4)$$

In other words, the ATE β_3 is the small difference between a the time variation in the mean outcome of a group receiving a treatment dose $\kappa + d\kappa$ and the time variation in the mean outcome of a group receiving a slightly smaller treatment dose κ.

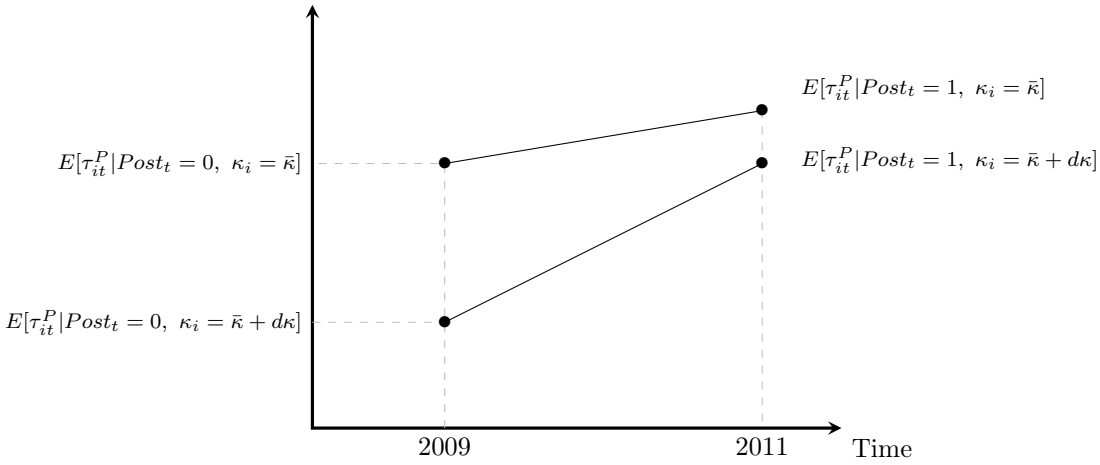


Figure 2. Graphical representation of the ATE

In the case of the business property tax, the ATE β_3 will thus be the increase in the average tax rate τ_i^P of a group of municipalities having a large capital intensity $\kappa_i = K_i/(K_i + L_i)$ minus the increase in the average tax rate of a group of municipalities having a slightly smaller capital intensity. From the theoretical model exposed above, we therefore expect that $\beta_3 > 0$. In other words, municipalities with less capital intensity are expected to be less affected by the reform relatively to others, that is their tax rates increased less than other municipalities. Note also that one can also expect that $\beta_2 < 0$, since municipalities with a higher capital intensity κ_i in 2009 should relatively have lower business property taxes τ_i^P. Finally, β_1 is expected to be positive since suppressing the capital base from the business property tax base has made the tax base less mobile and therefore provided municipalities with incentives to raise their tax rates.

5. Data and summary statistics

We use a yearly database gathered by the French Minister of Public Finance which comprises a wide range of local public finance variables.[19] We use data of years 2009 (pre-reform) and 2011 (post-reform). For each of the four main direct local taxes, this database provides the voted tax rates for each level of jurisdictions (municipalities, inter-municipal communities, counties or départements and regions), the associated tax base net of exemptions, and the net revenues collected from each tax. The net tax bases corresponding to capital and business land are not provided before 2010. But the database provides their gross values, which allows us to build the treatment variable :[20] the capital share in the business property in 2009. Economic and socio-demographic variables are obtained from the National Institute of Statistics and Economic Studies (INSEE).

Table 2. Comparison 2009 and 2011 for the main control variables

	Single business tax	**Population**	**Med. income**	**Work outside**	**Young**
2009	0.60	3.73	3.31	0.82	0.36
2011	0.64	3.77	3.47	0.82	0.35

Since the reform has been enforced in 2011, we focus on the years 2009 and 2011.[21] We ignore municipalities located in the French overseas departments and territories. Each urban area is composed of a centre (*pôle*) and generally a ring (*couronne*) periphery.[22] We consider only municipalities in large urban centre - with more than 10,000 jobs - and their rings.[23] Thus, from the 36,684 municipalities initially in the database, our sample keeps 12,655 municipalities.

The municipal tax institutional context is characterized by the presence of two main regime concerning the vote of the business property tax. One part of the municipalities autonomously vote their business property tax rate, while the other part have delegated authority to vote this tax rate to the federation of municipalities they belong to. Table 3 shows that 60% of the municipalities in our sample had transferred the power to vote their business property tax rate in 2009 (see variable *Single business tax*). Table 3 also indicates that the capital share in the business property tax base was around 80% in 2009, so that its removal by the reform should have had a significant impact. One can

[19] It is entitled the *Recensement des éléments d'impositions*.

[20] A correlation test shows that the gross and net tax base of the business land tax are highly correlated (around 93%) during the period 2011-2014.

[21] The main results presented in this paper also hold when integrating the years 2012 to 2014.

[22] An urban centre is a set of municipalities in a continuously built-up area with more than 2000 inhabitants and 1500 jobs. The ring of a urban centre is composed of municipalities where at least 40% of the residents work in the centre (or in a municipality attracted by the centre).

[23] The INSEE separates urban centre in three categories: large (more than 10 000 jobs), medium (between 5 000 and 10 000 jobs) and small (between 5 000 and 1 500) ones.

also notice that the business property tax was the most important source of local tax revenue in 2009.

Table 3. Descriptive statistics (2009)

	Mean	**(Std. dev.)**	**Min.**	**Max.**	**N**
Capital share in the business property κ	0.83	(0.14)	0.00	1.00	12488
Single business tax	0.60	(0.49)	0.00	1.00	12655
Tax rates					
Rate of the tax on firms	0.14	(0.05)	0.00	0.46	12655
Rate of the housing tax	0.12	(0.04)	0.00	0.45	12655
Rate of the tax on constructed land	0.17	(0.06)	0.01	0.54	12655
Rate of the tax on unconstructed land	0.51	(0.25)	0.00	2.20	12655
Tax bases (100K€)					
Base of the tax on firms	67.81	(610.84)	0.00	59376.87	12532
Base of the housing tax	45.52	(469.05)	0.00	48805.37	12651
Base of the tax on constructed land	44.62	(612.11)	0.07	65554.49	12644
Base of the tax on unconstructed land	0.58	(0.92)	0.00	50.86	12649
Tax revenues (100K€)					
Revenue from the tax on firms	11.22	(90.31)	0.00	7992.16	12655
Revenue from the housing tax	7.05	(55.89)	0.00	4680.46	12652
Revenue from the tax on constructed land	8.60	(60.93)	0.00	5080.48	12648
Revenue from the tax on unconstructed land	0.27	(0.39)	0.00	12.50	12649
Expenditure (100K€)					
Total expenditure	237.72	(522.87)	20.02	10993.36	2093
Current expenditure	179.15	(390.57)	12.85	8869.07	2093
Investment expenditure	58.56	(162.97)	0.67	5076.72	2093
Socio-demographic					
Population (1000 inhabitants)	3.73	(24.72)	0.00	2234.11	12655
Median income (10K€)	3.31	(0.68)	1.43	7.80	12344
Work outside mun. of residence (%)	0.82	(0.10)	0.00	1.00	12654
Share of young residents	0.36	(0.05)	0.00	0.66	12654
Density (dummies)					
Very low density	0.12	(0.33)	0.00	1.00	12655
Low density	0.64	(0.48)	0.00	1.00	12655
Intermediate density	0.19	(0.39)	0.00	1.00	12655
High density	0.05	(0.21)	0.00	1.00	12655
Firms					
Number of firms	208.64	(3171.18)	0.00	340203.00	12655
Industrial sector (%)	0.09	(0.07)	0.00	1.00	12604
Construction sector (%)	0.22	(0.12)	0.00	1.00	12604
Tertiary sector (%)	0.60	(0.13)	0.00	1.00	12604
Public sector (%)	0.09	(0.08)	0.00	1.00	12604

Graph 3 depicts the evolution of the four main tax rates: the business tax, the housing tax, the tax on constructed land and the tax on unconstructed land. The higher categories have higher capital intensity $K_i/(K_i + L_i)$, so that category 1 has the lowest one. The ordering of the curves suggests that $\beta_2 < 0$ as expected. Graph 3 shows reveals a significant increase in the business property tax rate in 2010, the year of the

reform which coincides with the theoretical predictions of section 2. However, while the housing tax remains constant between 2009 and 2010, it significantly increases in 2011. An important part of this increase could certainly be explained by the institutional transfer of the business property tax rates of the departments towards the municipalities that occurred in 2011. A similar reason could explained the rise in the tax rate on unconstructed land since in 2011, the tax rates of departments and regions have been transferred to municipalities. Finally, one can observe that the tax rates on constructed land have not been significantly affected by the reform.

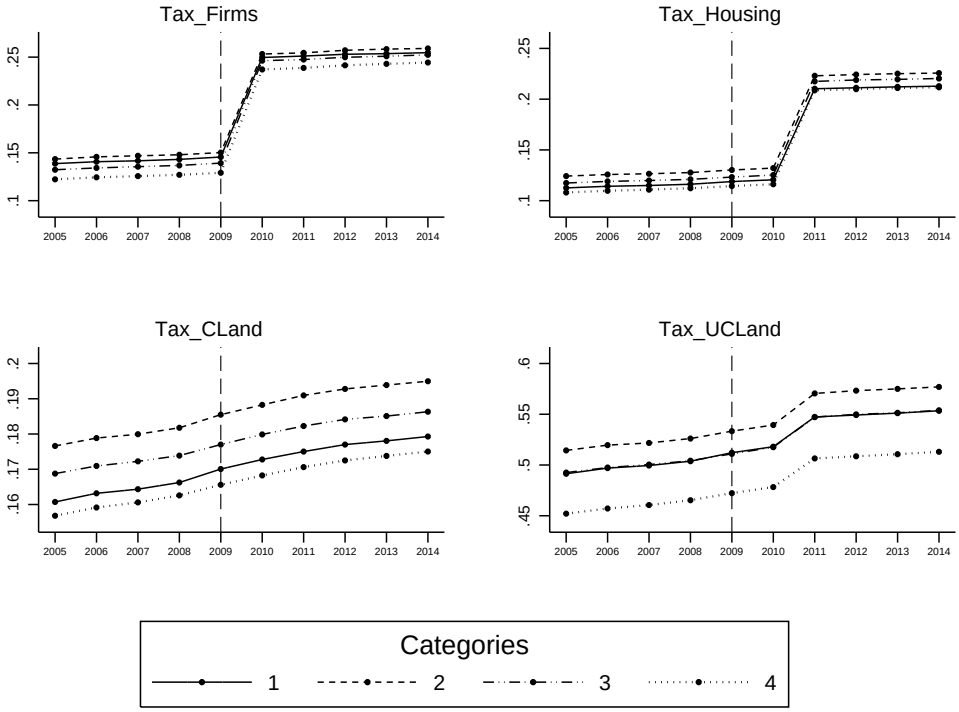


Figure 3. Evolution of the tax rates

6. Results

6.1. Estimation results on local business property tax

We use the years 2009 (pre-treatment) and 2011 (post-treatment) to estimate the regression equation (4.1). In the Table 4 shows that the three predictions from the theory are verified in the data. First, the coefficient of the time-dummy variable *Post* is positive which indicates that business property tax rates have increased between 2009 and 2010. Second, the treatment variable *Ratio* which is the capital share in the business property that municipalities had in 2009 (i.e. κ_{2009}) has a negative coefficient. This confirms the theoretical prediction: business property tax rates where lower in municipalities with highly capital-intensive firms. Third and most importantly, Table 4 reveals that the ATE is positive (coefficient β_3 in (4.1)). This is an evidence in favor of the existence

of a convergence of business property tax rates over time. The results also show that the effect of the removal of the tax capital tax base is concentrated in municipalities which belong to the urban centre. The ATE is not significantly different from zero for municipalities in the urban ring.[24]

Some additional results worth be noticed. According to Table 4, density has a positive impact on business property taxation. This is consistent with the literature on agglomeration economies according to which tax rates are higher in the presence of agglomeration economies (e.g. Charlot and Paty, 2010; Fréret and Maguain, 2017).[25] The share of residents younger than 25 increases business property tax rates in the centre of urban areas but has no significant impact in the urban ring. This is certainly explained by the existence of higher expenditure (e.g. education, sport and transport) in municipalities with younger population. These expenses are generally noticeably less important in peripheral municipalities which certainly explains their non-significant impact in the urban ring. Table 4 also indicates that the removal of the ability of regions (variable $Post \times RTRF$) and departments (variable $Post \times DTRF$) to tax the business property has a highly positive effect on municipal business property tax rates. This effect is consistent with what could be expected from a drastic shrink in vertical tax competition between municipalities and upper government layers for mobile firms. Since competition has been dampened municipalities can charge higher tax rates on firms.

[24] These results are identical with a fixed effects specification. As noticed in Jordahl and Liang (2010), either specification provides the same point estimate for the ATE coefficient since all municipality specific heterogeneity affects the interaction term through the group-specific heterogeneity term. Only standard errors differ.

[25] Notice that the variable *Single business tax* which indicates municipalities having delegated the power to vote their business property tax rates to the inter-municipal level is positively correlated with the density. Thus, its coefficient becomes significantly positive if one remove density from the control variables.

Table 4. DiD OLS - Estimation results on business property taxation

	(1) (a) All	(2) (b) All	(3) (a) Centre	(4) (b) Centre	(5) (a) Ring	(6) (b) Ring
Post	0.0993***	0.0259***	0.0824***	0.0071	0.1030***	0.0315***
	(0.0037)	(0.0036)	(0.0091)	(0.0052)	(0.0033)	(0.0032)
Ratio	-0.0243***	-0.0238***	-0.0401**	-0.0329**	-0.0171**	-0.0210***
	(0.0056)	(0.0048)	(0.0139)	(0.0099)	(0.0051)	(0.0049)
Post x Ratio	0.0075*	0.0046*	0.0226*	0.0132**	0.0049	0.0022
	(0.0033)	(0.0018)	(0.0097)	(0.0046)	(0.0031)	(0.0018)
Single business tax		-0.0028		-0.0086		-0.0024
		(0.0026)		(0.0046)		(0.0028)
Median income (10K€)		-0.0018		-0.0018		0.0001
		(0.0015)		(0.0020)		(0.0020)
Share of young residents		0.0255		0.1449***		-0.0041
		(0.0181)		(0.0182)		(0.0218)
Density		0.0193***		0.0144***		0.0112***
		(0.0014)		(0.0021)		(0.0014)
Industrial sector		-0.0751***		-0.1317***		-0.0606***
		(0.0122)		(0.0257)		(0.0116)
Tertiary sector		-0.0470***		-0.0563**		-0.0433***
		(0.0090)		(0.0206)		(0.0085)
Construction sector		-0.0594***		-0.0612**		-0.0508***
		(0.0093)		(0.0218)		(0.0094)
Departmental tax rate on firms (DTRF) in 2009		0.3839**		0.2811		0.4089**
		(0.1186)		(0.1483)		(0.1238)
Regional tax rate on firms (RTRF) in 2009		1.4939***		1.7422***		1.4230**
		(0.3898)		(0.4554)		(0.4193)
Post x DTRF		0.6656***		0.6992***		0.6709***
		(0.0433)		(0.0579)		(0.0396)
Post x RTRF		0.4898**		0.5999**		0.4088**
		(0.1525)		(0.1859)		(0.1324)
Constant	0.1612***	0.0855***	0.2005***	0.0907***	0.1465***	0.0942***
	(0.0063)	(0.0157)	(0.0120)	(0.0252)	(0.0059)	(0.0179)
Observations	24974	24601	6246	6237	18728	18364
r2	0.5064	0.6751	0.5078	0.6792	0.5302	0.6672
F	950.5634	2188.3878	532.8492	928.1996	1002.1727	2981.6355
pvalue	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
ll	38315.5733	42938.4853	9882.0965	11203.4072	29366.9239	32004.9552

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.2. Estimation results on housing tax

Equation (4.1) is now estimated using the housing tax as the dependent variable. Table 5 shows that there has been no significant convergence of these tax rates due to the

removal of capital from the business property tax base. Indeed, the treatment effect (i.e. the coefficient of variable $Post \times Ratio$) is not significantly different from zero. This confirms the prediction of section 2 and it seems rather likely that the budgetary effect offsets the capital-mobility effect. That is, even if municipalities raise their housing tax rate in order to compensate the cut in tax revenue due to the loss of an important tax base, they also have incentives to reduce the housing tax since it is now less costly to tax firms relative to residents.

Table 5. DiD OLS - Estimation results on housing taxation

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) All	(b) All	(a) Centre	(b) Centre	(a) Ring	(b) Ring
Post	0.0015*	0.0026***	0.0014*	0.0027***	0.0018*	0.0026**
	(0.0006)	(0.0007)	(0.0006)	(0.0006)	(0.0008)	(0.0009)
Ratio	0.0086*	0.0154***	-0.0215	0.0156	0.0152***	0.0159***
	(0.0042)	(0.0036)	(0.0113)	(0.0081)	(0.0041)	(0.0038)
Post x Ratio	0.0006	0.0006	-0.0004	-0.0004	0.0007	0.0007
	(0.0005)	(0.0005)	(0.0007)	(0.0007)	(0.0005)	(0.0006)
Departmental tax rate on Housing (DTRH) in 2009	0.6429**	0.6616***	0.9540*	0.9333**	0.5648***	0.5660***
	(0.2053)	(0.1613)	(0.3849)	(0.3077)	(0.1443)	(0.1256)
Post x DTRH	-0.0020	-0.0056	0.0088	0.0038	-0.0062	-0.0088
	(0.0092)	(0.0091)	(0.0060)	(0.0066)	(0.0128)	(0.0124)
Median income (10K€)		-0.0070***		-0.0079***		-0.0048
		(0.0016)		(0.0018)		(0.0025)
Share of young residents		0.1664***		0.2491***		0.1273***
		(0.0305)		(0.0530)		(0.0312)
Density		0.0172***		0.0158***		0.0136***
		(0.0024)		(0.0022)		(0.0026)
Industrial sector		-0.1170***		-0.2252***		-0.0955***
		(0.0141)		(0.0264)		(0.0133)
Tertiary sector		-0.0735***		-0.0953***		-0.0660***
		(0.0082)		(0.0218)		(0.0075)
Construction sector		-0.0933***		-0.1516***		-0.0779***
		(0.0108)		(0.0211)		(0.0089)
Constant	0.0624***	0.0573**	0.0805**	0.0454	0.0572***	0.0678***
	(0.0156)	(0.0216)	(0.0269)	(0.0543)	(0.0131)	(0.0164)
Observations	24974	24601	6246	6237	18728	18364
r2	0.0580	0.2433	0.0996	0.3492	0.0567	0.1366
F	82.2929	38.0888	57.4201	62.9141	60.8683	27.2111
pvalue	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000
ll	43310.9462	45392.4712	9917.8307	10920.1201	34607.3637	34800.0484

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.3. Robustness checks

We need to check if our main result, i.e. a negative relationship between tax base mobility and business property tax rate, is not due to a tax competition effect. In a theoretical model, Lee (1997) indeed shows the effects on interjurisdictional tax competition of the imperfect mobility of capital. He finds that capital tax rates are negatively related to the degree of capital mobility in a tax competition framework. In the empirical literature, many papers provide estimates of the degree of interdependence in capital tax rates among local governments (Brett and Pinkse, 2000; Allers and Elhorst, 2005; Charlot and Paty, 2007; Hauptmeier et al., 2012; **?**) but, to our knowledge, there is no existing empirical literature on the extent to which the presence of a mobile tax base - such as capital - would lead to a downward pressure on local tax rates.[26]

To detect any potential spatial correlation, we run the appropriate non robust and robust Lagrange Multiplier tests. The robust version (RLM-ERR and RLM-LAG) tests are not significant. Therefore, there is no spatial correlation among the municipalities when they set their level of business property tax rate on our period of study. The main reason may be that the same business property tax rate is applied within the interjurisdictional communities ("EPCI"), which have chosen to set a single business tax rate after the reform of 1999. Let us precise that we have selected municipalities in urban areas where many communities have chosen the most integrated form of cooperation among municipalities in terms of taxation and spending.

7. Conclusion

This paper has examined the relationship between tax base mobility and local taxation through theoretical and empirical analyses. The theoretical model derives a local tax setting equation, which shows that decreasing capital intensity in the tax base increases the business property tax rates unambiguously. We then test this result using a French reform in 2010, which changes the composition of the main local business tax base, which now rely on a far less mobile tax base. Results from the empirical analysis are consistent with findings from the theoretical reasoning, suggesting that the reduction in the mobility of the tax base indeed results in higher business property tax rates. We also show that this result is not due to a tax competition effect. Finally, housing tax rates were not affected by the reform.

[26] In an empirical study of the tax mix of Flemish municipalities, Geys and Revelli (2011) show that whatever the tax base considered, a wider tax base is associated with an increasing reliance tax relying on it. According to Hettich and Winer (1988), a wider tax base allows the government to save political and administrative costs when raising taxes from this tax base, which leads them to raise the related tax rates.

References

Allers, M. A. and J. P. Elhorst (2005). Tax mimicking and yardstick competition among local governments in the netherlands. *International tax and public finance 12*(4), 493–513.

Braid, R. M. (1996). Symmetric Tax Competition with Multiple Jurisdictions in Each Metropolitan Area. *American Economic Review 86*(5), 1279–90.

Brett, C. and J. Pinkse (2000). The determinants of municipal tax rates in british columbia. *Canadian Journal of Economics/Revue canadienne d'économique 33*(3), 695–714.

Brueckner, J. K. (2000). A Tiebout/tax-competition model. *Journal of Public Economics 77*(2), 285–306.

Card, D. (1992). Using regional variation in wages to measure the effects of the federal minimum wage. *Industrial & Labor Relations Review 46*(1), 22–37.

Charlot, S. and S. Paty (2007). Market access effect and local tax setting: evidence from french panel data. *Journal of Economic Geography*.

Charlot, S. and S. Paty (2010). Do agglomeration forces strengthen tax interactions? *Urban Studies*.

Fréret, S. and D. Maguain (2017). The effects of agglomeration on tax competition: evidence from a two-regime spatial panel model on french data. *International Tax and Public Finance*, 1–41.

Geys, B. and F. Revelli (2011). Economic and political foundations of local tax structures: an empirical investigation of the tax mix of flemish municipalities. *Environment and Planning C: Government and Policy 29*(3), 410–427.

Hauptmeier, S., F. Mittermaier, and J. Rincke (2012). Fiscal competition over taxes and public inputs. *Regional science and urban economics 42*(3), 407–419.

Hettich, W. and S. L. Winer (1988). Economic and political foundations of tax structure. *The American Economic Review*, 701–712.

Hoyt, W. H. (1991). Competitive jurisdictions, congestion, and the Henry George Theorem : When should property be taxed instead of land? *Regional Science and Urban Economics 21*(3), 351–370.

Jordahl, H. and C.-Y. Liang (2010). Merged municipalities, higher debt: on free-riding and the common pool problem in politics. *Public Choice 143*(1-2), 157–172.

Krelove, R. (1993). The persistence and inefficiency of property tax finance of local public expenditures. *Journal of Public Economics 51*(3), 415–435.

Lee, K. (1997). Tax competition with imperfectly mobile capital. *Journal of Urban Economics 42*(2), 222–242.

Ly, T. (2016). Sub-metropolitan tax competition with household and capital mobility. *GATE Working Paper series, WP 1624*.

Lyytikäinen, T. (2012). Tax competition among local governments: Evidence from a property tax reform in finland. *Journal of Public Economics 96*(7), 584–595.

Richter, W. F. and D. Wellisch (1996). The provision of local public goods and factors in the presence of firm and household mobility. *Journal of Public Economics 60*(1), 73–93.

Wellisch, D. (2006). *Theory of Public Finance in a Federal State*. Number 9780521026871 in Cambridge Books. Cambridge University Press.

Wellisch, D. and J. Hulshorst (2000). A Second-Best Theory of Local Government Policy. *International Tax and Public Finance 7*(1), 5–22.

Wilson, J. D. (1995). Mobile Labor, Multiple Tax Instruments, and Tax Competition. *Journal of Urban Economics 38*(3), 333–356.

Wilson, J. D. (1997). Property taxation, congestion, and local public goods. *Journal of Public Economics 64*(2), 207–217.

Appendix A Derivation of the taxation rules

Pre-reform optimal rules

Before the reform, it can be proved that the optimal behavioral rules are:[27]

$$\tau_i^R = R_i|U_R^i| + \left(1 + \frac{K_i}{L_i}\right)\tau_i^P, \tag{A.1}$$

$$\tau_i^P = \left(1 - \frac{K_i}{K_i + L_i}\right)\frac{R_i}{\mathcal{L}_i}\left(\frac{G_i + f_i}{R_i} - R_i|U_R^i|\right), \tag{A.2}$$

$$R_i U_g^i = 1. \tag{A.3}$$

From the specification of U^i:

$$\begin{aligned} U(x_i, g_i, R_i) &= x_i + \alpha \log(G_i/R_i) \\ &= x_i + \alpha \log G_i - \alpha \log R_i \end{aligned} \tag{A.4}$$

It follows that $R_i|U_R^i| = \alpha$ and (A.3) is equivalent to $G_i = \alpha R_i$. Then, the above conditions can be written as:

$$\tau_i^R = \alpha + \frac{f_i}{\mathcal{L}_i}, \tag{A.5}$$

$$\tau_i^P = (1 - \kappa_i)\frac{f_i}{\mathcal{L}_i}, \tag{A.6}$$

$$G_i = \alpha R_i. \tag{A.7}$$

Post-reform optimal rules

After the reform, it can be proved that the optimal behavioral rules are:

$$\tau_i^R = R_i|U_R^i| + \tau_i^L, \tag{A.8}$$

$$\tau_i^L = \frac{R_i}{\mathcal{L}_i}\left(\frac{G_i + f_i}{R_i} - R_i|U_R^i|\right), \tag{A.9}$$

$$R_i U_g^i = 1, \tag{A.10}$$

$$\tag{A.11}$$

which can be written as:

$$\tau_i^R = \alpha + \frac{f_i}{\mathcal{L}_i}, \tag{A.12}$$

$$\tau_i^L = \frac{f_i}{\mathcal{L}_i}, \tag{A.13}$$

$$G_i = \alpha R_i. \tag{A.14}$$

$$\tag{A.15}$$

[27] See Ly (2016).

Appendix B Fixed-effects specification

B.1 Business property tax regression

Table 6. DiD FE - Estimation results on business property taxation

	(1) (a) All	(2) (b) All	(3) (a) Centre	(4) (b) Centre	(5) (a) Ring	(6) (b) Ring
Post	0.0993***	0.0256***	0.0824***	0.0058	0.1030***	0.0318***
	(0.0037)	(0.0036)	(0.0091)	(0.0054)	(0.0033)	(0.0032)
Post x Ratio	0.0075*	0.0047*	0.0226*	0.0132**	0.0049	0.0023
	(0.0033)	(0.0018)	(0.0097)	(0.0046)	(0.0031)	(0.0018)
Single business tax		-0.0080		-0.0102		-0.0074
		(0.0053)		(0.0065)		(0.0059)
Median income (10K€)		0.0037		0.0169**		-0.0007
		(0.0021)		(0.0054)		(0.0022)
Share of young residents		0.0370*		0.0412		0.0294
		(0.0170)		(0.0424)		(0.0194)
Post x DTRF		0.6669***		0.7045***		0.6709***
		(0.0427)		(0.0587)		(0.0393)
Post x RTRF		0.4823**		0.5881**		0.4043**
		(0.1512)		(0.1899)		(0.1317)
Constant	0.1411***	0.1211***	0.1677***	0.1058***	0.1322***	0.1284***
	(0.0010)	(0.0098)	(0.0013)	(0.0285)	(0.0010)	(0.0111)
Observations	24974	24601	6246	6237	18728	18364
r2	0.9343	0.9592	0.9235	0.9559	0.9383	0.9615
F	1423.3462	4047.6272	799.2565	1332.5956	1497.8671	5543.9111
pvalue	0.0211	0.0000	0.0281	0.0000	0.0206	0.0000
ll	71178.4766	75996.8919	17569.6480	19261.1611	53743.8216	57038.9378

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.2 Housing tax regression

Table 7. DiD FE - Estimation results on housing taxation

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) All	(b) All	(a) Centre	(b) Centre	(a) Ring	(b) Ring
Post	0.0015*	0.0015**	0.0014*	0.0016*	0.0018*	0.0018*
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0008)	(0.0008)
Post x Ratio	0.0006	0.0005	-0.0004	-0.0004	0.0007	0.0006
	(0.0005)	(0.0005)	(0.0007)	(0.0007)	(0.0005)	(0.0006)
Post x DTRH	-0.0020	-0.0019	0.0088	0.0081	-0.0062	-0.0060
	(0.0092)	(0.0086)	(0.0060)	(0.0061)	(0.0128)	(0.0119)
Median income (10K€)		0.0002		-0.0016		0.0004
		(0.0003)		(0.0011)		(0.0004)
Share of young residents		0.0009		0.0147		-0.0012
		(0.0044)		(0.0107)		(0.0055)
Constant	0.1217***	0.1210***	0.1392***	0.1393***	0.1158***	0.1152***
	(0.0001)	(0.0022)	(0.0001)	(0.0052)	(0.0001)	(0.0026)
Observations	24974	24601	6246	6237	18728	18364
r2	0.1317	0.1347	0.1345	0.1356	0.1316	0.1355
F	133.6650	83.8393	93.6142	56.0200	91.0438	61.3230
pvalue	0.0075	0.0003	0.0106	0.0006	0.0109	0.0005
ll	1.153e+05	1.139e+05	29115.3724	29073.3834	86254.1846	84820.3476

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix C Evolution of the fiscal variables

C.1 Evolution of the main fiscal variables

Figure 4. Tax rates of the municipalities (*bloc communaux*)

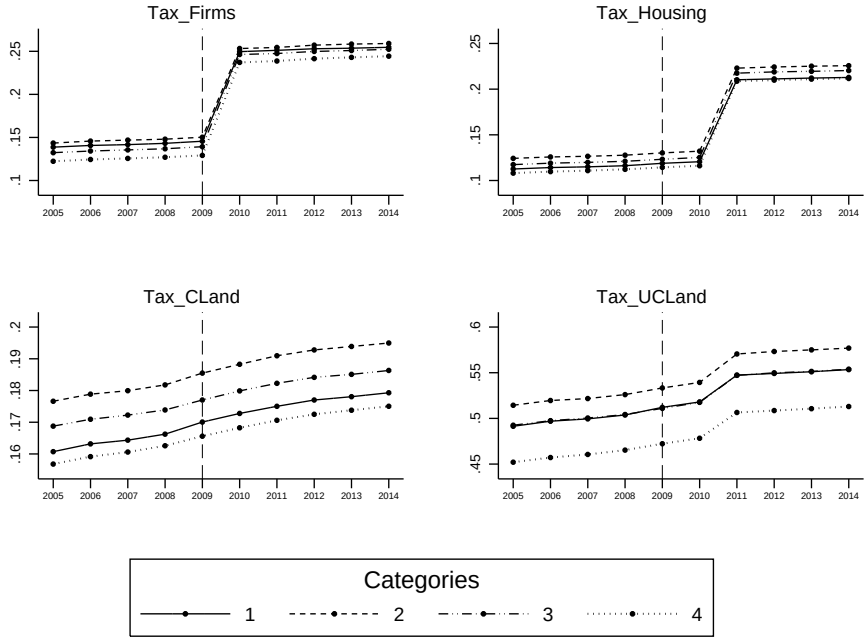


Figure 5. Tax bases of the municipalities

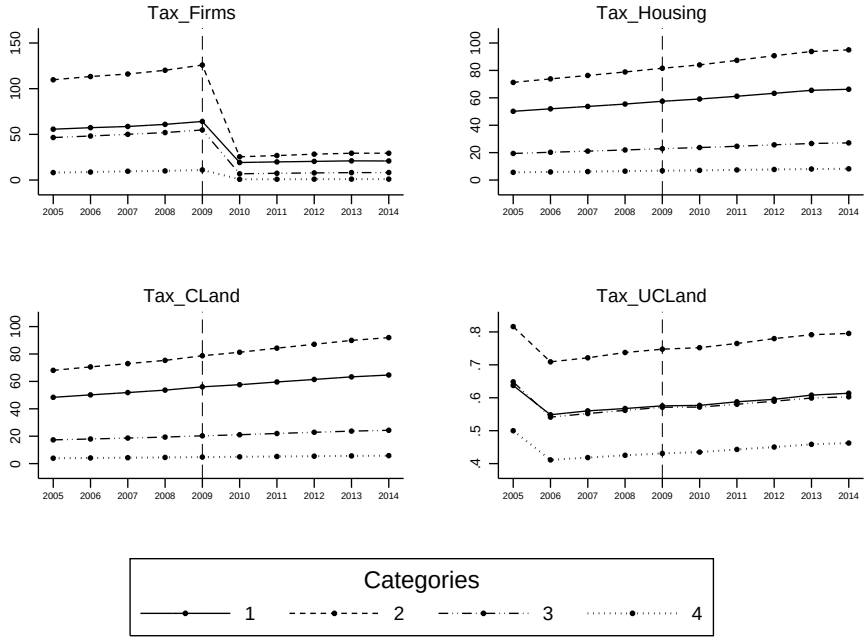


Figure 6. Fiscal revenue of the municipalities

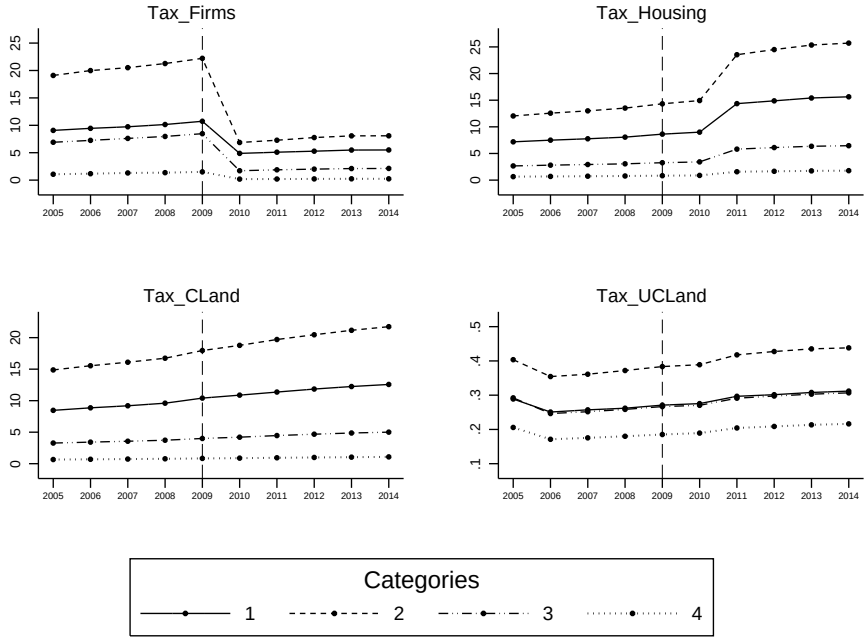
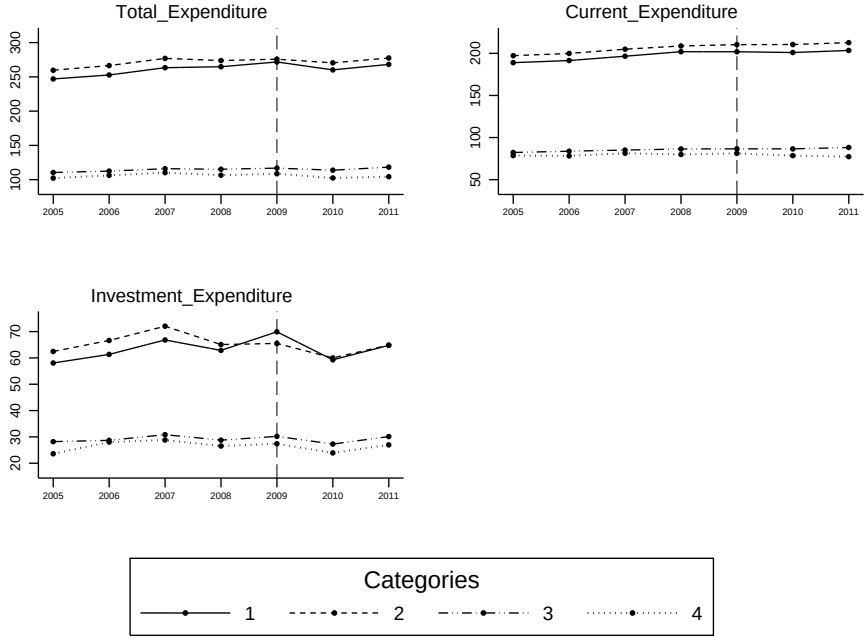


Figure 7. Expenditure of the municipalities (*bloc communaux*)



C.2 Evolution of the tax rates of the upper government layers

Figure 8. Tax rates of the departments

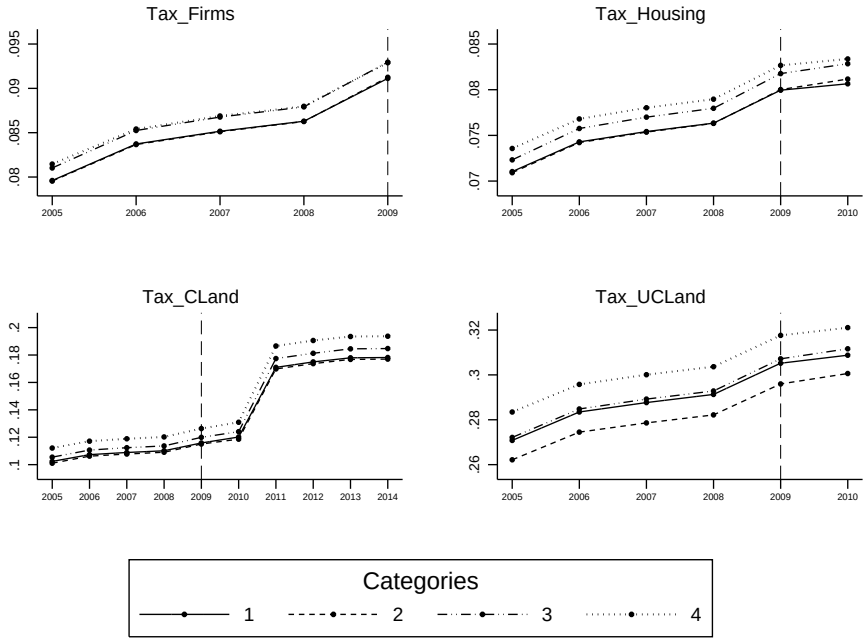


Figure 9. Combined tax rates of the municipalities and the departments

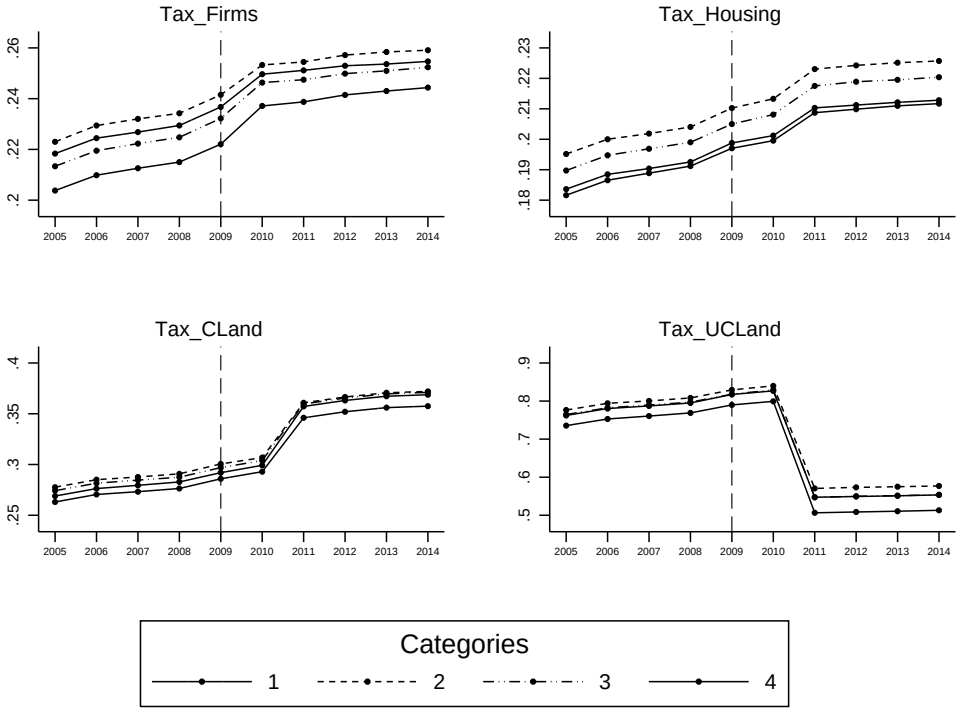


Figure 10. Tax rates of the regions

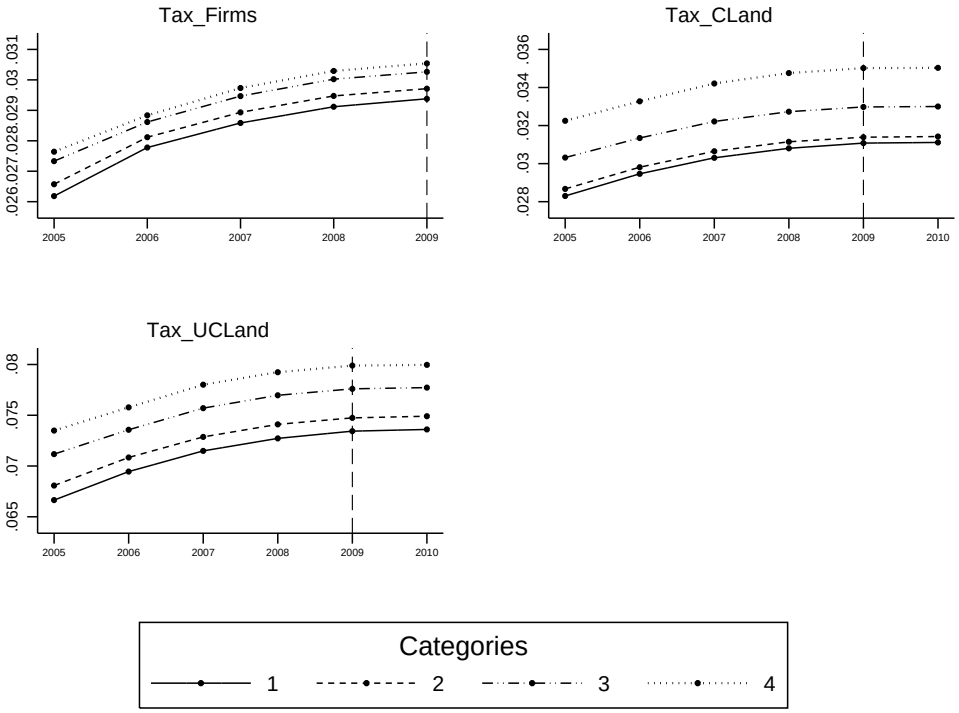
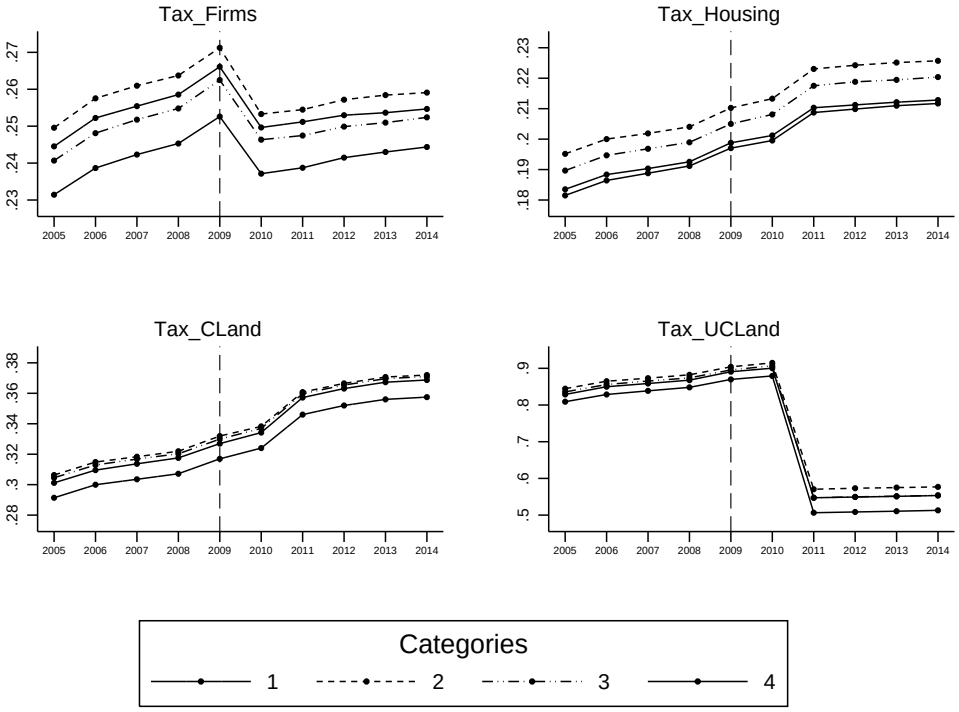


Figure 11. Combined tax rates of the all governments layers



Appendix D Maps

Figure 12. Capital intensity $K/(K+L)$ in 2009

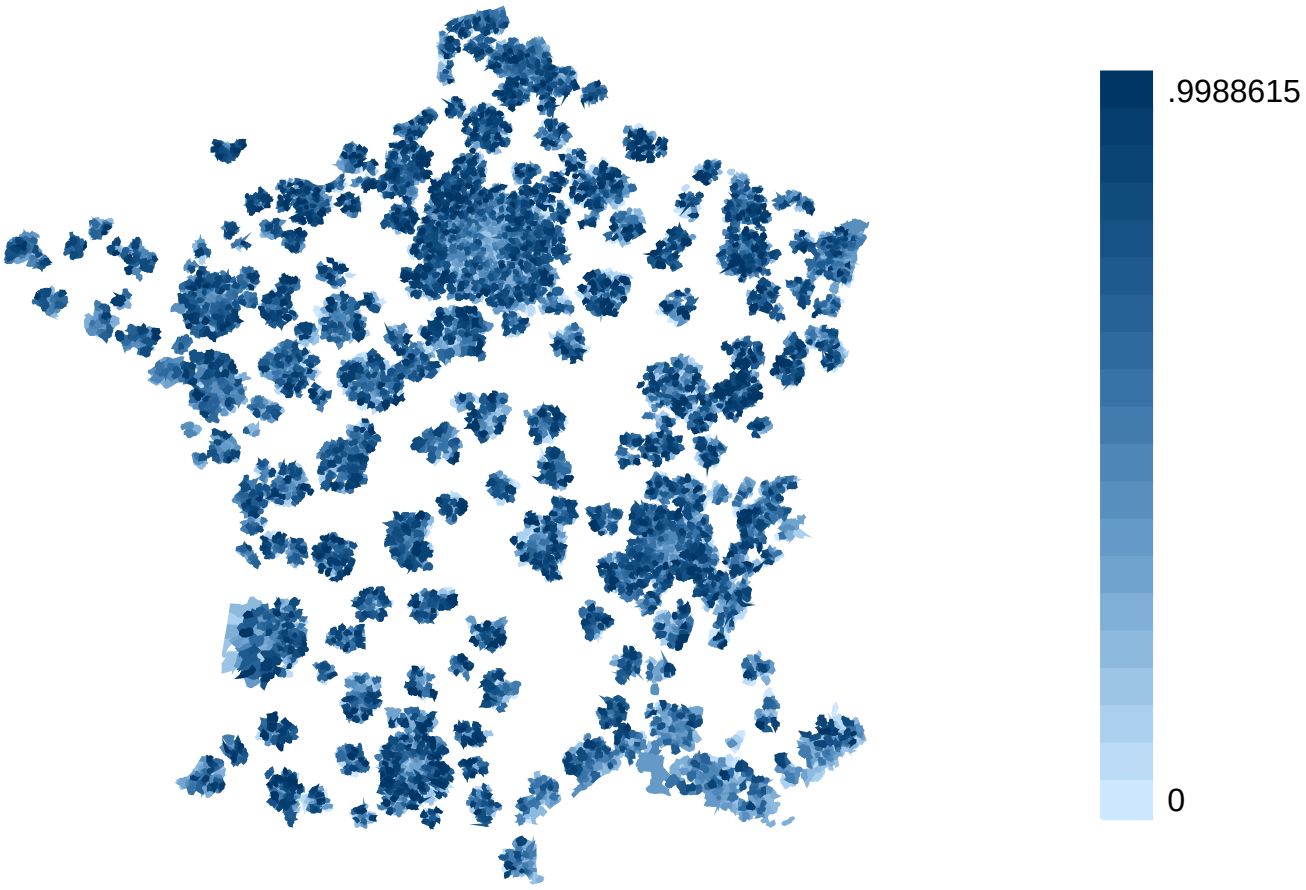


Figure 13. Tax rate on firms in 2009

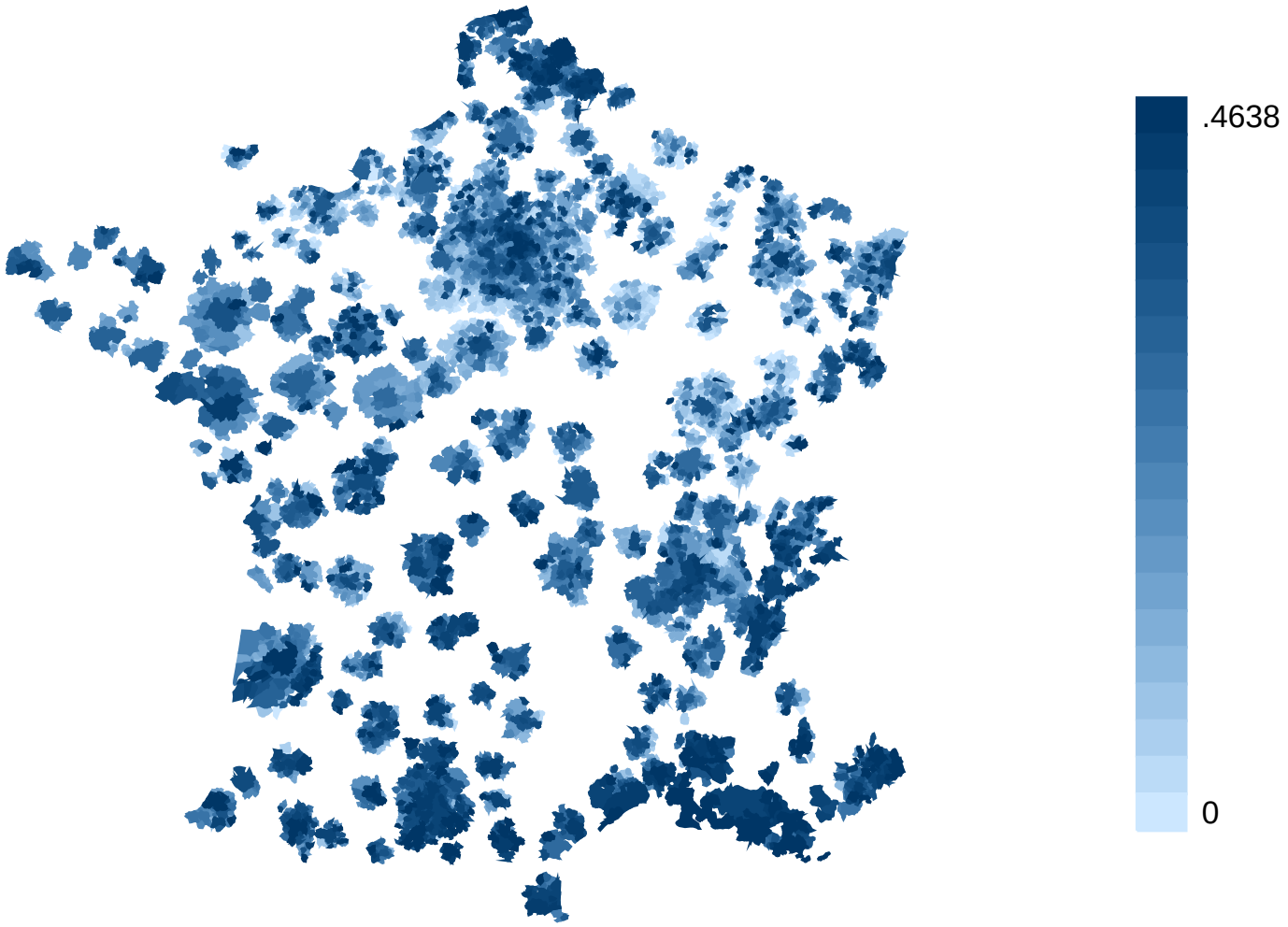
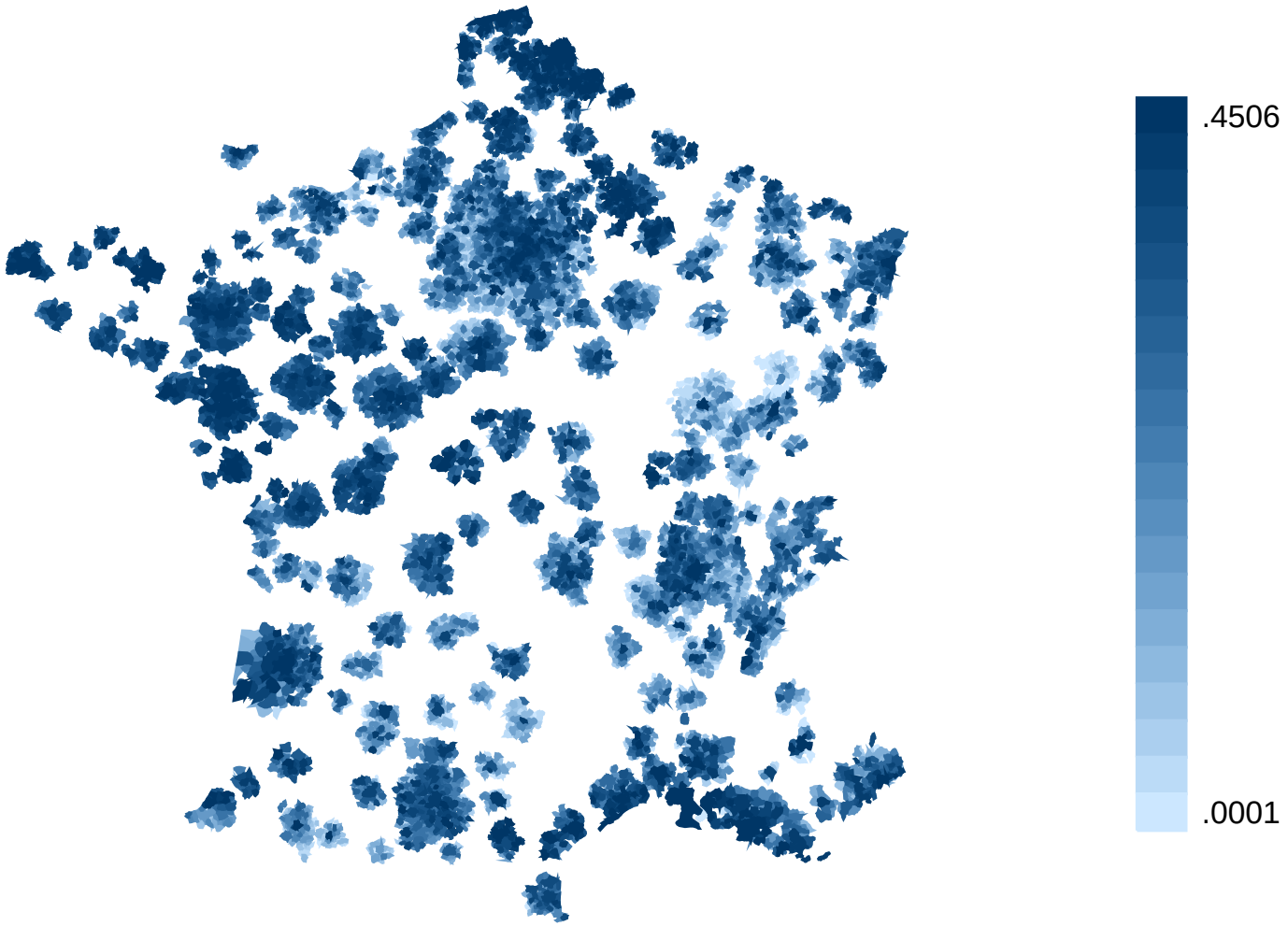


Figure 14. Tax rate on housing in 2009



Appendix E Descriptive statistics for French municipalities (2009)

Municipalities and Single business tax (SBT) regime

Table 8. SBT versus no SBT: fiscal and sociodemographic variables (All municipalities, 2009)

	SBT	**No SBT**
Tax rates		
Capital share in the business property κ	0.83	0.82
Business capital (K)	48.70	22.41
Business land (L)	10.10	5.50
Fiscal		
Rate of the tax on firms	0.14	0.12
Rate of the housing tax	0.12	0.11
Rate of the tax on constructed land	0.17	0.16
Rate of the tax on unconstructed land	0.52	0.48
Revenue from the tax on firms	7.24	2.46
Revenue from the housing tax	4.58	1.56
Revenue from the tax on constructed land	5.64	1.91
Revenue from the tax on unconstructed land	0.27	0.18
Socio-demographic		
Population (1000 inhabitants)	2.53	1.01
Share of young residents	0.34	0.32
Median income (10K€)	2.97	2.87
Density (%)		
Very low density	0.24	0.45
Low density	0.59	0.51
Intermediate density	0.13	0.04
High density	0.03	0.01
Firms		
Number of firms	128.28	61.81
Industrial sector (%)	0.10	0.11
Construction sector (%)	0.22	0.24
Tertiary sector (%)	0.60	0.59
Public sector (%)	0.08	0.06

Note: The table contains mean values. The sample contains all the 36 300 French municipalities

Table 9. SBT versus No SBT: categories of municipalities (all municipalities, 2009)

	SBT		**No SBT**	
	Count	%	Count	%
Tax option of the PICE				
Single	12625	0.75	0	0.00
Mixed	4208	0.25	0	0.00
Additional	0	0.00	8619	0.44
Zone	0	0.00	8423	0.43
No PICE	0	0.00	2425	0.12
Juridic status of the PICE				
Community of communes	13497	0.80	17009	0.87
Agglomeration community	2960	0.18	0	0.00
Urban community	376	0.02	33	0.00
Metropolis	0	0.00	0	0.00
No PICE	0	0.00	2425	0.12
Uraban areas (UA)				
Large Pole (LP)	2549	0.15	651	0.03
Ring of LP	6173	0.37	5991	0.31
Multipolar of LP	1909	0.11	2056	0.11
Medium Pole (MP)	259	0.02	180	0.01
Ring of MP	334	0.02	465	0.02
Small Pole (SP)	435	0.03	415	0.02
Ring of SP	159	0.01	398	0.02
Other Multipolar	2654	0.16	4313	0.22
Isolated	2342	0.14	4886	0.25
Size of the UA				
Isolated municipalities	6905	0.41	11255	0.58
less than 15 000 inhabitants	778	0.05	976	0.05
15 000 to 19 999 inhabitants	218	0.01	276	0.01
20 000 to 24 999 inhabitants	185	0.01	167	0.01
25 000 to 34 999 inhabitants	448	0.03	326	0.02
35 000 to 49 999 inhabitants	471	0.03	351	0.02
50 000 to 99 999 inhabitants	1241	0.07	1198	0.06
100 000 to 199 999 inhabitants	1396	0.08	1140	0.06
200 000 to 499 999 inhabitants	2222	0.13	1725	0.09
500 000 to 9 999 999 inhabitants	2220	0.13	877	0.05
Urban area of Paris	730	0.04	1064	0.05

Note: The sample contains all the 36 300 French municipalities. PICE: Public inter-municipality cooperation establishments.