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### **JEL codes:**

H71, H72, R50, R51

# Local Taxation and Tax Base Mobility: Evidence from a business tax reform in France

Tidiane Ly\*      Sonia Paty†

March, 2018

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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-Differences 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.

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## 1. Introduction

Most federal and unitary countries have experienced a substantial increase in the mobility of capital and population among their local jurisdictions. Tax base mobility has also many implications on public decisions made by local governments. As studied by a large literature on the efficiency problems associated with tax competition by independent governments, there is a tendency for taxes and public expenditures to be set inefficiently low in equilibrium since tax rates are negatively related to the degree of tax base mobility as initially showed by [Zodrow and Mieszkowski \(1986\)](#) and [Wilson \(1986\)](#).<sup>1</sup>

Starting with [Brueckner and Saavedra \(2001\)](#), the related empirical literature on tax competition has often focused on the estimation of fiscal reaction functions, where the optimal tax rate in a jurisdiction depends on the tax rates in nearby jurisdictions ([Brueckner and Kim, 2003](#); [Revelli, 2005](#)). However, to our knowledge, there is no existing empirical literature on the extent to which the presence of a mobile tax base would lead to a downward pressure on local tax rates.

To fill in this gap, the goal of the present paper is to analyze the impact of tax base mobility on local taxation. 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 ([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". Inefficiencies occur whenever one of the above tax instruments is unavailable or replaced by a distortive tax ([Wellisch and Hulshorst, 2000](#)).

Most papers consider mobile individuals who work where they reside and, consequently, treat wage as a jurisdiction-specific variable.<sup>2</sup> This makes the above models well-suited to study tax competition between large jurisdictions such as regions or states but not to examine what happens within a metropolitan area. Indeed, once they have decided on a residential location within a metropolitan area, households commute to work

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<sup>1</sup>See [Wilson \(1999\)](#) and [Wellisch \(2006\)](#) for comprehensive reviews of this literature.

<sup>2</sup>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 economics activities location.

anywhere in the metropolis, which equalizes wages across jurisdictions. [Braid \(1996\)](#) studies sub-metropolitan jurisdictions, which compete for mobile capital and workers, but residents are assumed immobile.

To test the impact of tax base mobility on tax rates within a metropolitan area, we first develop a theoretical model in line with [Wilson \(1995\)](#) and [Richter and Wellisch \(1996\)](#) but, in order to better account for sub-metropolitan features, we here consider households who do not necessarily work where they reside as in [Ly \(2018\)](#). Within this framework, we examine the efficiency properties of local public goods provision when firms and households are mobile across local jurisdictions within a metropolitan area. We then derive the impact of tax base mobility on local business property taxation. We find that decreasing capital intensity in the tax base increases the business property tax rates unambiguously.

To test this theoretical prediction, we use a French reform, which changes the composition of the main local business tax base in 2010. The reform indeed removed the capital investment, which was around 80% from the local business tax base (of the so-called '*Taxe professionnelle*'). More precisely, while their tax base mainly consisted in the capital investments made by firms (machinery and equipment) and property (buildings), French 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?

To address this question, we build a data set on local taxation and socio-economic characteristics for more than 12,000 French urban jurisdictions in 2009 (before reform) and 2011 (after reform). To control for the tax base mobility, we use a proxy, i.e. the capital share in the business property tax base in 2009. Using Difference-in-Differences, we consider this continuous variable - the capital share in the tax base - as our treatment effect. Increase in the business tax rates may be the result of the loss of the related tax revenues and the need for a compensation. To control for this possible budget effect, we consider the tax decisions made the year just after the reform (2011) since a complete financial compensation mechanism was allocated by the state to the municipalities.<sup>3</sup>

Estimations using Difference-in-Differences show that a drastic cut in the amount

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<sup>3</sup>A state grant was allocated to each municipality for the exact amount of their business tax revenues before the reform. This mechanism was ensured the years after although was based on the tax revenues level of 2010.

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. Since a perfect financial compensation was allocated to French municipalities, which have borne the consequences of a loss in tax revenues due the reform, we find that this increase was motivated by a less mobile tax base and not by a budget effect. We also find that housing tax rates were not affected by the reform. This paper contributes to the existing empirical literature on tax competition, since we provide empirical evidence that there is a negative relationship between local business taxation and the degree of tax base mobility.

In terms of public policy implications, we show that the composition of the local tax base has a clear impact on the related tax decisions. While exact compensations were given to municipalities after reform, local governments have taken the opportunity to increase their tax rates on a far less mobile tax base. However, it seems that they did not shift the tax burden on households. Finally, since we do not know whether local business tax rates were initially lower or higher than the optimal level, we cannot conclude on the efficiency of the reform. A similar reform is discussed in France since the most mobile part (based on capital) of the solidarity tax base on wealth (ISF) would be removed in a near future. We can expect a higher tax rate on the immobile property tax base of the new ISF.

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 to examine the connection between local business taxation and tax base mobility within a metropolitan area.<sup>4</sup>

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 good  $G_i$  and one unit of land paying the land rent  $\rho_i$ .<sup>5</sup> 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

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<sup>4</sup>The model is in line with tax competition models with both households and firms mobility (e.g. Wilson, 1995; Richter and Wellisch, 1996; Brueckner, 2000). In order to better account for features of the municipal level, by allowing household to consume land and to reside and work in separate municipalities, the present framework relies more on Ly (2018).

<sup>5</sup>The one-unit land consumption could alternatively be replaced by an exogenous value  $l_i$ .

in the jurisdiction's population  $R_i$  due to congestion. Since households are assumed to be perfectly mobile across jurisdictions, we have:

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

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.<sup>6</sup> 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.<sup>7</sup>

The local government  $i$  collects a head tax  $\tau_i^R$  on its residents.<sup>8</sup> The budget constraint of a representative resident of jurisdiction  $i$  can be written as

$$x_i + \rho_i = y - \tau_i^R \quad (2.2)$$

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  $\tau_i^P$  is the business property tax rate, and  $\theta \in \{0; 1\}$  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:

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

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

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

$$\mathcal{L}_i = R_i + L_i. \quad (2.5)$$

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<sup>6</sup>But the results derived in this section would be strictly identical when introducing mobile labor (Ly, 2018).

<sup>7</sup>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 (2018) consider only mobile households and assume that land is uniformly distributed among them.

<sup>8</sup>Because individuals consume a single unit of land,  $\tau_i^R$  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:

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

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).<sup>9</sup> Let us consider that the local government freely chooses  $\tau_i^R$  and  $G_i$ , while adjusting  $\tau_i^P$  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:<sup>10</sup>

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

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

$$G_i^0 = \alpha R_i^0, \quad (2.7)$$

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  $f_i$ ,  $\mathcal{L}_i$ ,  $\alpha$ ,  $y$ ,  $u$  and  $r$ . The optimal taxation rule (TR<sup>0</sup>) 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  $\tau_i^R$  tax revenues (left-hand side of (TR<sup>0</sup>)) but she entails three marginal costs for the jurisdictions (right-hand side of (TR<sup>0</sup>)): a congestion cost,  $R_i |\partial v^i / \partial R_i| = \alpha$ , since she decreases the utility of all other residents; a fiscal cost  $\tau_i^P$  due to the crowd-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<sup>0</sup>) simply states that  $\tau_i^P$  allows to satisfy the budget constraint (2.6). Condition (2.7) is the Samuelson rule which shows that the public good is provided efficiently.<sup>11</sup>

<sup>9</sup>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, 2018). 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.

<sup>10</sup>See the appendix for more details about the derivations of the first-order conditions.

<sup>11</sup>Indeed, condition (BC<sup>0</sup>) 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).



When  $\theta = 1$  - which can be interpreted as the post-reform situation - the optimal behavioral rules of the local authorities are:

$$\tau_i^{R1} = \alpha + \tau_i^{P1} \quad (\text{TR}^1)$$

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

$$G_i^1 = \alpha R_i^1, \quad (2.8)$$

where the superscript 1 stands for the equilibrium value of the variables when  $\theta = 1$ . Similarly to (BC<sup>0</sup>), (BC<sup>1</sup>) states that  $\tau_i^P$  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<sup>1</sup>). Compared to (TR<sup>0</sup>), 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<sup>0</sup>),(TR<sup>1</sup>),(BC<sup>0</sup>) and (BC<sup>1</sup>), we can derive the reduced form of the tax on resident and the business property tax before and after the institutional change:

$$\tau_i^{R0} = \alpha + \frac{f_i}{\mathcal{L}_i}, \quad (2.9a) \quad \tau_i^{R1} = \alpha + \frac{f_i}{\mathcal{L}_i}, \quad (2.9b)$$

$$\tau_i^{P0} = (1 - \kappa_i^0) \frac{f_i}{\mathcal{L}_i}, \quad (2.9c) \quad \tau_i^{P1} = \frac{f_i}{\mathcal{L}_i}. \quad (2.9d)$$

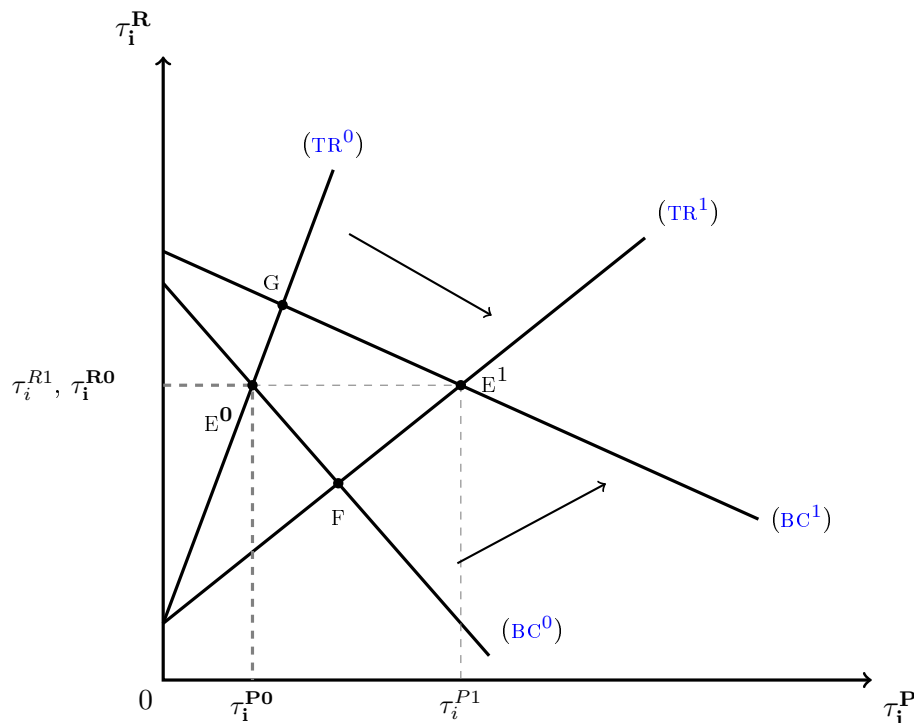
where  $\kappa_i^0 \equiv K_i^0 / (K_i^0 + L_i^0)$ . Expressions (2.9a) and (2.9b) show that the tax on residents  $\tau_i^R$  does not directly depend on the share of the taxable capital base,  $\theta$ . In other words, the tax reform should not have had a significant impact on  $\tau_i^R$ . However,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

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

Municipalities with higher capital intensity before the reform - that is a higher value of  $\kappa_i^0$  - 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  $\tau_i^P$  than in less capital-intensive jurisdictions.

To provide further understanding of this key result, equations (TR<sup>0</sup>),(TR<sup>1</sup>),(BC<sup>0</sup>) and (BC<sup>1</sup>) are drawn on Figure 1.<sup>12</sup>

<sup>12</sup>The graph on Figure 1 corresponds to the following values:  $R_i^0 = 3.5$ ,  $L_i^0 = 1.5$ ,  $K_i^0 = 3.5$ ,  $R_i^1 = 3.2$ ,  $L_i^1 = 1.8$ ,  $\alpha = .05$ ,  $f_i = 1.05$  and  $\mathcal{L}_i = 5$ .



**Figure 1.** Effect of a removal of the capital tax base  $K_i$  on  $\tau_i^R$  and  $\tau_i^P$ .

The taxation-rule curve ( $\text{TR}^0$ ) on Figure 1 depicts the positive relationship that links  $\tau_i^R$  to  $\tau_i^P$  in the pre-reform context: an increase in  $\tau_i^P$  implies a rise in the marginal fiscal cost of new residents. The budget-constraint curve ( $\text{BC}^0$ ) represents the negative relationship that links  $\tau_i^P$  to  $\tau_i^R$  in the pre-reform context: increasing  $\tau_i^R$  allows local authorities to alleviate the tax burden on firms by cutting  $\tau_i^P$ . Thus, point  $E^0$  which intersects ( $\text{TR}^0$ ) and ( $\text{BC}^0$ ), 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 ( $\text{BC}^0$ ) to ( $\text{BC}^1$ ) which shifts the equilibrium from from  $E^0$  to  $G$ .<sup>13</sup> The second effect due to capital mobility is characterized by a decrease in  $\tau_i^R$  and an increase in  $\tau_i^P$ . It is illustrated by the downward move of the taxation-rule curve from ( $\text{TR}^0$ ) to ( $\text{TR}^1$ ) and a shift of the equilibrium from  $E^0$  to  $F$ . Indeed, after the reform the local government does

<sup>13</sup>An increase in the fixed costs  $f_i$  would also imply a rightward shift of ( $\text{BC}^0$ ). 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.

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.

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.<sup>14</sup> But the reform should have affected  $\tau_i^R$  to a lesser extent.

Finally, [Figure 1](#) allows to see the effect of the removal of capital from the business property tax base in the presence of a perfect budgetary compensation,  $Comp_i^1 = \tau_i^{P0} K_i^0$ , provided by the central government to municipality  $i$  after the reform.<sup>15</sup> In the presence of this compensation, the budget-constraint curve only rotates around point  $E^0$  -  $(BC^0)$  becomes parallel to  $(BC^1)$ . Then, the points  $E^0$  and  $G$  coincide, which simply illustrates that the pure budgetary effect is controlled for by such a compensation.<sup>16</sup> Then, in this case, the shift of  $(TR^0)$  towards right allows to identify a pure capital-mobility effect.

### 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:<sup>17</sup> (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

<sup>14</sup>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  $\tau_i^R$ , 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.  $\tau_i^{R0} > \tau_i^{R1}$ ).

<sup>15</sup>As will be seen in section 3, this the French government has indeed provided such a compensation.

<sup>16</sup>It is easily shown formally that introducing  $Comp_i^1$  into the budgetary constraint when  $\theta = 1$  and solving for  $\tau_i^R$  and  $\tau_i^P$  using  $(TR^0)$ , one obtain  $\tau_i^{R0}$  and  $\tau_i^{P0}$ .

<sup>17</sup>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.

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 investments from the tax base of the business property tax, which was around 80 % of its tax base (see Table 1).<sup>18</sup> The former business property tax, called "Taxe professionnelle", based on firms' capital investment and personal/real property has been replaced by a tax on firms' personal/real property only, which is called "Cotisation foncière des entreprises". This deletion affected municipalities in a twofold way.

First, *ceteris paribus*, it has indeed shrunk municipalities' own resources. Indeed, 80% of the business property tax base, which constituted the first tax revenue of municipalities, were removed. However, a compensation mechanism was implemented to maintain the level of resources just after the reform (from 2011). Two state grants called "dotation de compensation de la réforme 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 DCRTP and the FNGIR have been designed such that each euro lost by each municipality in 2011 compared to its situation of 2009 was reimbursed.<sup>19</sup> Due to this budget compensation, no pure budgetary effect is expected on business property tax rates in 2011.

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

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<sup>18</sup>Removal of the capital investments base was the initial stated purpose of the reform. It aimed at boosting business investment capacity in France.

<sup>19</sup>Notice that the DCRTP and the FNGIR have been legally fixed to their amount of 2011. This implies that the compensation need not be perfect from 2012. This explains why we focus on the year 2011 to evaluate the impact of the reform.

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
$\tau_{pre}^P$	$K_{pre}$ : capital $L_{pre}$ : business land use	$\tau_{post}^P$	- $L_{post}$
$\tau_{pre}^R$	$R_{pre}$ : residents' housing	$\tau_{post}^R$	$R_{post}$
$\tau_{pre}^{\mathcal{L}^C}$	$\mathcal{L}_{pre}^C$ : constructed land property	$\tau_{post}^{\mathcal{L}^C}$	$\mathcal{L}_{post}^C$
$\tau_{pre}^{\mathcal{L}^U}$	$\mathcal{L}_{pre}^U$ : unconstructed land property	$\tau_{post}^{\mathcal{L}^U}$	$\mathcal{L}_{post}^U$

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 fixed value of 1.5%.<sup>20</sup>

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.<sup>21</sup>

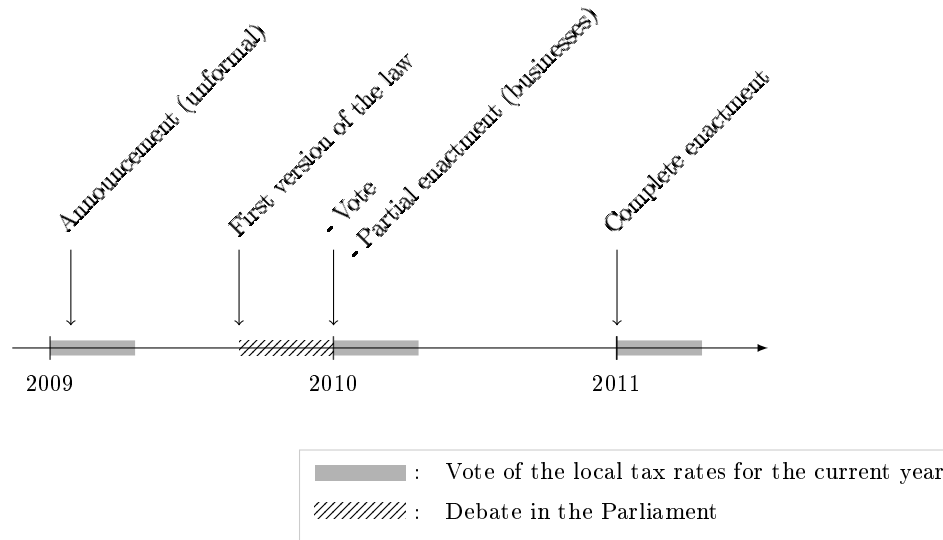
Third, the municipal level has been transferred shares of direct taxes revenue previously allocated to upper sub-government layers. Municipalities now benefit from the departments' housing tax share and from the departments' and regions' portions of the tax on unconstructed land property.

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.

<sup>20</sup>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.

<sup>21</sup>An additional flat-rate tax on basic nuclear installations has also been introduced.

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).



**Figure 2.** Timing of the Reform.

The French business property tax reform was implemented according to a temporal process represented in Figure 2. The outlines of the reform were announced by the President of the Republic on 5 February 2009. A first version of the law was tabled by the French Parliament on 30 September 2009. Then, during four months of debates in the Parliament, numerous amendments were included. This period has been perceived as strongly uncertain from a legal perspective by municipalities (Guené, 2012); very few anticipation about the concrete implementation of the reform could be made. The final version of the reform was voted on 30 December 2009 and was enacted on 1 January 2010. The timing of the reform shows that it had a very fast implementation (less than a year). Moreover it was not possible for municipalities to anticipate the reform by altering their tax rates of 2009 since the annual voting period of the local tax rates - between January 1st and April 15th - was closed when the very first version of the law was introduced.

The timeline in Figure 2 also shows that the reform has been implemented in two separate steps. The first step, in January 2010, maintained the institutional context of the previous years ( $\leq 2009$ ) but allowed municipalities to vote the tax rate of the new business tax which excludes capital investments from its tax base (CFE). However, the revenue of this new tax was given to the central government. Hence, 2010 was a “neutral”

year for municipalities, while firms paid the new business tax (CFE).<sup>22</sup> Then, in January 2011, the second step of the reform consisted in a full enactment of the reform.

## 4. Estimation strategy

### 4.1. Difference-in-differences approach

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:<sup>23</sup>

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

where  $\tau_{it}^P$  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,  $\kappa_i$  the capital share in the total business property in 2009 (treatment intensity). Assume that the treatment intensity is exogenous:  $E[\varepsilon_{it} | Post_t, \kappa_i] = 0$ .<sup>24</sup> The time effect for an individual  $i$  with treatment level  $\bar{\kappa}$  is:

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

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

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

Subtracting the time effect of the individual receiving  $\bar{\kappa}$ , (4.2), 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  $\bar{\kappa}$ :

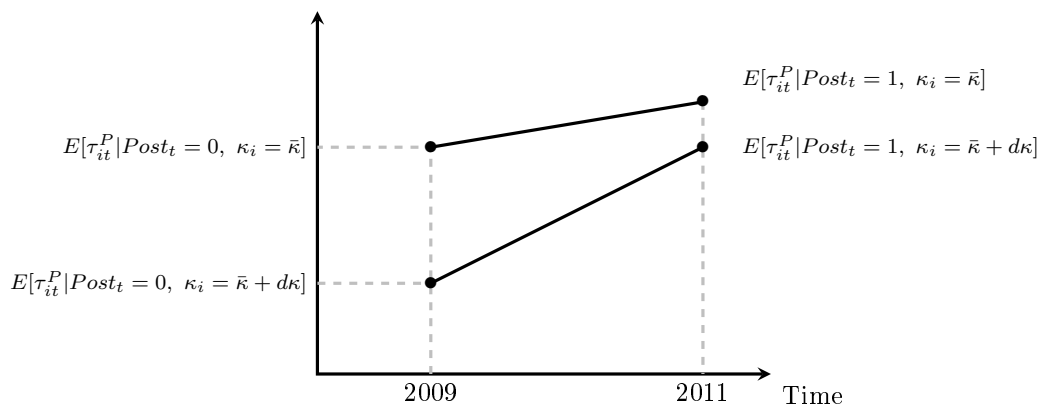
$$\frac{\partial}{\partial \kappa} \{E[\tau_{it}^P | Post_t = 1, \kappa_i = \kappa] - E[\tau_{it}^P | Post_t = 0, \kappa_i = \kappa]\}_{\kappa=\bar{\kappa}} = \beta_3 \quad (4.4)$$

In other words, the ATE  $\beta_3$  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  $\kappa$ .

<sup>22</sup>The proposition of a neutral year for local jurisdictions in the first year of the reform had been developed in several reports (e.g. [Fouquet, 2004](#)).

<sup>23</sup>The regression equation is a difference-in-differences method with continuous treatment intensity, as in e.g. [Card \(1992\)](#) and [Jordahl and Liang \(2010\)](#).

<sup>24</sup>This assumption is consistent with our theoretical model since in the optimal decision rule (2.9c) only depends on exogenous parameters.



**Figure 3.** Graphical representation of the ATE

In the case of the business property tax, the ATE  $\beta_3$  will thus be the increase in the average tax rate  $\tau_i^P$  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  $\kappa_i$  in 2009 should relatively have lower business property taxes  $\tau_i^P$ . Finally,  $\beta_1$  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.<sup>25</sup> 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:<sup>26</sup> the capital share in the business property in 2009. Economic and socio-demographic

<sup>25</sup>It is entitled the *Recensement des éléments d'impositions*.

<sup>26</sup>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.



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.<sup>27</sup> 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.<sup>28</sup> We consider only municipalities in large urban centre - with more than 10,000 jobs - and their rings.<sup>29</sup> 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 also notice that the business property tax was the most important source of local tax revenue in 2009.

<sup>27</sup>The main results presented in this paper also hold when integrating the years 2012 to 2014.

<sup>28</sup>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).

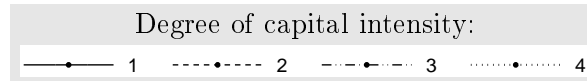
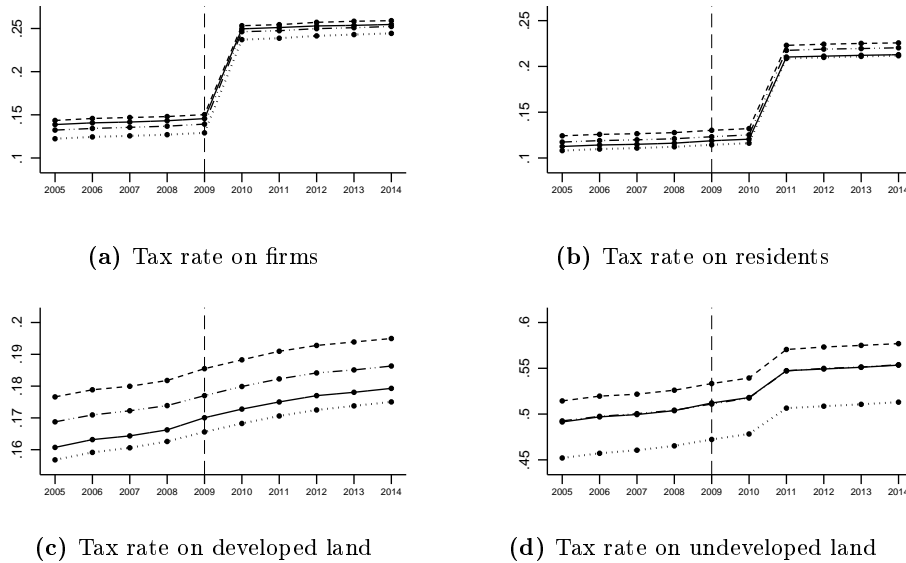
<sup>29</sup>The INSEE separates urban centre in three categories: large (more than 10 000 jobs), medium (between 5 000 and 10 000 jobs) and small (between 5 000 and 1 500) ones.

**Table 3.** Descriptive statistics (2009)

	mean	sd	min	max
Capital share $K_i/(K_i + L_i)$	0.80	(0.20)	0.00	1.00
Single business tax regime (dummy)	0.46	(0.50)	0.00	1.00
<i>Tax rates</i>				
Business property tax	0.15	(0.06)	0.00	0.77
Housing tax	0.09	(0.04)	0.00	0.45
Tax on developed property	0.14	(0.06)	0.00	0.62
Tax on undeveloped property	0.43	(0.27)	0.00	3.41
<i>Tax bases (100K€)</i>				
Business property tax	29.56	(364.58)	0.00	59376.87
Housing tax	20.03	(278.56)	0.00	48805.37
Tax on developed property	19.11	(362.76)	0.00	65554.49
Tax on undeveloped property	0.49	(0.68)	0.00	50.86
<i>Tax revenues (100K€)</i>				
Business property tax	4.68	(53.83)	0.00	7992.16
Housing tax	2.97	(33.27)	0.00	4680.46
Tax on developed property	3.65	(36.31)	0.00	5080.48
Tax on undeveloped property	0.22	(0.30)	0.00	12.50
<i>Socio-demographic</i>				
Population	1.72	(14.72)	0.00	2234.11
Median income	2.92	(0.68)	1.01	7.91
Share of commuters	0.76	(0.14)	0.00	1.00
Share of young	0.33	(0.06)	0.00	0.71
<i>Density (dummies)</i>				
Low	0.35	(0.48)	0.00	1.00
Intermediate	0.55	(0.50)	0.00	1.00
High	0.08	(0.27)	0.00	1.00
Very high	0.02	(0.13)	0.00	1.00
<i>Firms</i>				
Total	92.71	(1877.70)	0.00	340203.00
Share in industrial sector	0.10	(0.12)	0.00	1.00
Share in building sector	0.23	(0.17)	0.00	1.00
Share in tertiary sector	0.59	(0.19)	0.00	1.00
Share in public sector	0.07	(0.09)	0.00	1.00

Figure 4 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 4 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 4.** Evolution of the tax rates

Finally, Figure 4 shows that aside from the period of the reform, the evolution of each tax rate is quite stable. This is mainly explain by the institutional context which constrains through several rules the evolution of the tax rates. However, in 2010 and 2011, these rules were temporarily abandoned so that municipalities can have sufficient leeway to respond to the institutional changes. This strong stability of the tax rates before the reform explains why the common trend assumption is satisfied.<sup>30</sup>

<sup>30</sup>Placebo tests are available from the author upon request.

## 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.  $\kappa_{2009}$ ) has a negative coefficient. This confirms the theoretical prediction: business property tax rates were lower in municipalities with highly capital-intensive firms. Third and most importantly, Table 4 reveals that the ATE is positive (coefficient  $\beta_3$  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.<sup>31</sup>

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).<sup>32</sup> 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

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<sup>31</sup>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.

<sup>32</sup>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.

competition has been dampened municipalities can charge higher tax rates on firms.

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

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) All	(b) All	(a) Centre	(b) Centre	(a) Ring	(b) Ring
Post	0.0993*** (0.0037)	0.0259*** (0.0036)	0.0824*** (0.0091)	0.0071 (0.0052)	0.1030*** (0.0033)	0.0315*** (0.0032)
Ratio	-0.0243*** (0.0056)	-0.0238*** (0.0048)	-0.0401** (0.0139)	-0.0329** (0.0099)	-0.0171** (0.0051)	-0.0210*** (0.0049)
Post x Ratio	0.0075* (0.0033)	0.0046* (0.0018)	0.0226* (0.0097)	0.0132** (0.0046)	0.0049 (0.0031)	0.0022 (0.0018)
Single business tax		-0.0028 (0.0026)		-0.0086 (0.0046)		-0.0024 (0.0028)
Median income (10K€)		-0.0018 (0.0015)		-0.0018 (0.0020)		0.0001 (0.0020)
Share of young residents		0.0255 (0.0181)		0.1449*** (0.0182)		-0.0041 (0.0218)
Density		0.0193*** (0.0014)		0.0144*** (0.0021)		0.0112*** (0.0014)
Industrial sector		-0.0751*** (0.0122)		-0.1317*** (0.0257)		-0.0606*** (0.0116)
Tertiary sector		-0.0470*** (0.0090)		-0.0563** (0.0206)		-0.0433*** (0.0085)
Construction sector		-0.0594*** (0.0093)		-0.0612** (0.0218)		-0.0508*** (0.0094)
Departmental tax rate on firms (DTRF) in 2009		0.3839** (0.1186)		0.2811 (0.1483)		0.4089** (0.1238)
Regional tax rate on firms (RTRF) in 2009		1.4939*** (0.3898)		1.7422*** (0.4554)		1.4230** (0.4193)
Post x DTRF		0.6656*** (0.0433)		0.6992*** (0.0579)		0.6709*** (0.0396)
Post x RTRF		0.4898** (0.1525)		0.5999** (0.1859)		0.4088** (0.1324)
Constant	0.1612*** (0.0063)	0.0855*** (0.0157)	0.2005*** (0.0120)	0.0907*** (0.0252)	0.1465*** (0.0059)	0.0942*** (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	0.0009 (0.0024)	0.0022 (0.0021)	0.0000 (0.0075)	0.0079 (0.0070)	0.0011 (0.0027)	0.0014 (0.0025)
Ratio	805.1131 (412.0472)	1032.0164* (396.2962)	-3203.3085 (1668.9868)	1198.4029 (1035.3252)	1148.1896** (419.1301)	1091.9252* (415.4631)
Post x Ratio	0.0029 (0.0018)	0.0025 (0.0019)	0.0061 (0.0091)	-0.0026 (0.0083)	0.0027 (0.0018)	0.0028 (0.0019)
Departmental tax rate on Housing (DTRH) in 2009	0.4127** (0.1349)	0.4712*** (0.1321)	0.4876* (0.2004)	0.6510*** (0.1675)	0.4412** (0.1580)	0.4511** (0.1419)
Post x DTRH	-0.0002 (0.0003)	-0.0002 (0.0002)	-0.0004 (0.0006)	-0.0003 (0.0005)	-0.0002 (0.0003)	-0.0002 (0.0003)
Median income (10K€)		-0.0053* (0.0026)		-0.0079*** (0.0020)		-0.0039 (0.0033)
Share of young residents		0.1158*** (0.0252)		0.2154*** (0.0468)		0.0946*** (0.0269)
Density		0.0139*** (0.0020)		0.0127*** (0.0025)		0.0124*** (0.0029)
Industrial sector (%)		-0.0833*** (0.0174)		-0.1920*** (0.0426)		-0.0722*** (0.0163)
Tertiary sector (%)		-0.0609*** (0.0073)		-0.0956** (0.0306)		-0.0567*** (0.0068)
Construction sector (%)		-0.0707*** (0.0078)		-0.1342*** (0.0305)		-0.0635*** (0.0075)
Constant	0.0755*** (0.0122)	0.0784*** (0.0189)	0.1167*** (0.0220)	0.0808* (0.0369)	0.0677*** (0.0148)	0.0799*** (0.0200)
Observations	11401	11136	1715	1714	9686	9422
r2	0.0313	0.1425	0.0379	0.2821	0.0384	0.0971
F	10.5174	22.3446	6.2486	39.7058	10.5002	16.8558
pvalue	0.0072	0.0000	0.0236	0.0000	0.0073	0.0000
ll	20987.2919	21214.6382	2984.4153	3234.6681	18189.3481	18029.7308

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ 

## 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.

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## Appendix A Robustness check: spatial regressions

The following table shows that the main result derived in the paper remain when controlling for spatial autocorrelation. Note that the depend variable is here the logarithm of the tax rate of firm  $\log \tau_{it}^P$  instead of the tax rate  $\tau_{it}^P$  in order to correct the skewness of gaussian errors in the maximum-likelihood estimations.

**Table 6.** Robustness check: spatial regressions of the business property tax rate.

	(1)	(2)	(3)
	FE	SAR	SEM
Post	0.2392*** (0.0617)	0.1669* (0.0664)	0.3418*** (0.0675)
PostxRatio	0.4365*** (0.0748)	0.3798*** (0.0796)	0.2988*** (0.0819)
Density	-46.4865*** (13.7955)	-41.1913*** (10.0479)	-20.9251* (9.9358)
Constant	-1.9098*** (0.0856)		
Spatial			
rho		0.2339*** (0.0182)	
lambda			0.3557*** (0.0249)
sigma2_e		0.0149*** (0.0009)	0.0142*** (0.0009)
r2	0.8430	0.0014	0.0554
F	3291.8166		
ll	2328.0149	2497.8329	2534.5225

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Appendix B Derivation of the taxation rules

### Pre-reform optimal rules

Before the reform, it can be proved that the optimal behavioral rules are:<sup>33</sup>

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

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

$$R_i U_g^i = 1. \quad (\text{B.3})$$

From the specification of  $U^i$ :

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

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

$$\tau_i^R = \alpha + \frac{f_i}{\mathcal{L}_i}, \quad (\text{B.5})$$

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

$$G_i = \alpha R_i. \quad (\text{B.7})$$

### Post-reform optimal rules

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

$$\tau_i^R = R_i|U_R^i| + \tau_i^L, \quad (\text{B.8})$$

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

$$R_i U_g^i = 1, \quad (\text{B.10})$$

$$(\text{B.11})$$

which can be written as:

$$\tau_i^R = \alpha + \frac{f_i}{\mathcal{L}_i}, \quad (\text{B.12})$$

$$\tau_i^L = \frac{f_i}{\mathcal{L}_i}, \quad (\text{B.13})$$

$$G_i = \alpha R_i. \quad (\text{B.14})$$

$$(\text{B.15})$$

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<sup>33</sup>See Ly (2018).

## Appendix C Fixed-effects specification

### C.1 Business property tax regression

**Table 7.** DiD FE - Estimation results on business property taxation

	(1)	(2)	(3)	(4)	(5)	(6)
	(a) All	(b) All	(a) Centre	(b) Centre	(a) Ring	(b) Ring
Post	0.0993*** (0.0037)	0.0256*** (0.0036)	0.0824*** (0.0091)	0.0058 (0.0054)	0.1030*** (0.0033)	0.0318*** (0.0032)
Post x Ratio	0.0075* (0.0033)	0.0047* (0.0018)	0.0226* (0.0097)	0.0132** (0.0046)	0.0049 (0.0031)	0.0023 (0.0018)
Single business tax		-0.0080 (0.0053)		-0.0102 (0.0065)		-0.0074 (0.0059)
Median income (10K€)		0.0037 (0.0021)		0.0169** (0.0054)		-0.0007 (0.0022)
Share of young residents		0.0370* (0.0170)		0.0412 (0.0424)		0.0294 (0.0194)
Post x DTRF		0.6669*** (0.0427)		0.7045*** (0.0587)		0.6709*** (0.0393)
Post x RTRF		0.4823** (0.1512)		0.5881** (0.1899)		0.4043** (0.1317)
Constant	0.1411*** (0.0010)	0.1211*** (0.0098)	0.1677*** (0.0013)	0.1058*** (0.0285)	0.1322*** (0.0010)	0.1284*** (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

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## C.2 Housing tax regression

**Table 8.** 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* (0.0006)	0.0015** (0.0006)	0.0014* (0.0006)	0.0016* (0.0006)	0.0018* (0.0008)	0.0018* (0.0008)
Post x Ratio	0.0006 (0.0005)	0.0005 (0.0005)	-0.0004 (0.0007)	-0.0004 (0.0007)	0.0007 (0.0005)	0.0006 (0.0006)
Post x DTRH	-0.0020 (0.0092)	-0.0019 (0.0086)	0.0088 (0.0060)	0.0081 (0.0061)	-0.0062 (0.0128)	-0.0060 (0.0119)
Median income (10K€)		0.0002 (0.0003)		-0.0016 (0.0011)		0.0004 (0.0004)
Share of young residents		0.0009 (0.0044)		0.0147 (0.0107)		-0.0012 (0.0055)
Constant	0.1217*** (0.0001)	0.1210*** (0.0022)	0.1392*** (0.0001)	0.1393*** (0.0052)	0.1158*** (0.0001)	0.1152*** (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 D Evolution of the fiscal variables

### D.1 Evolution of the main fiscal variables

Figure 5. Tax rates of the municipalities (*bloc communaux*)

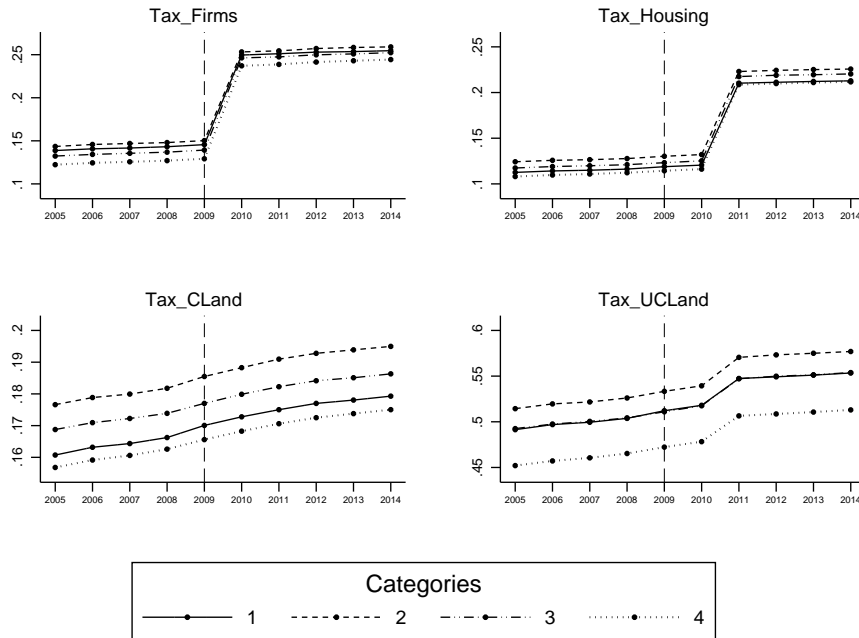


Figure 6. Tax bases of the municipalities

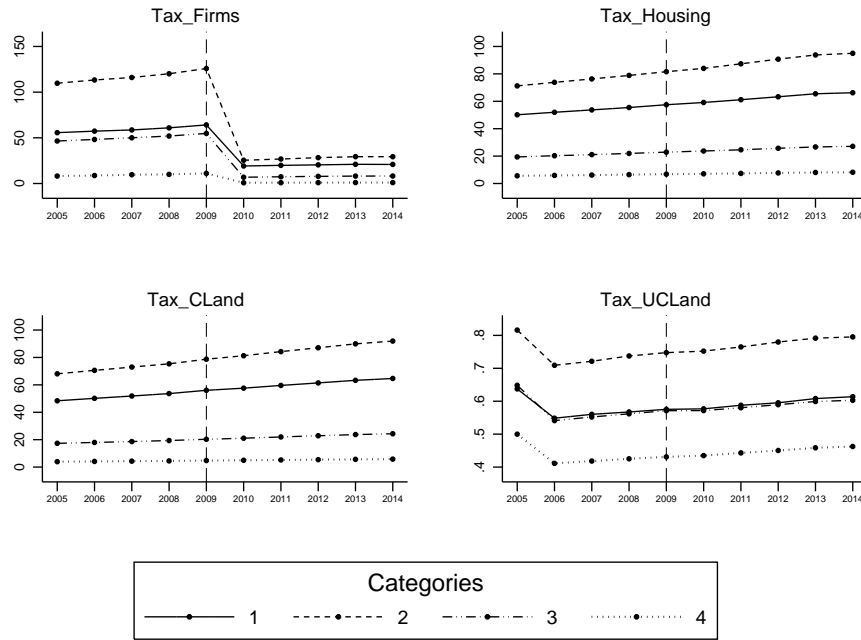
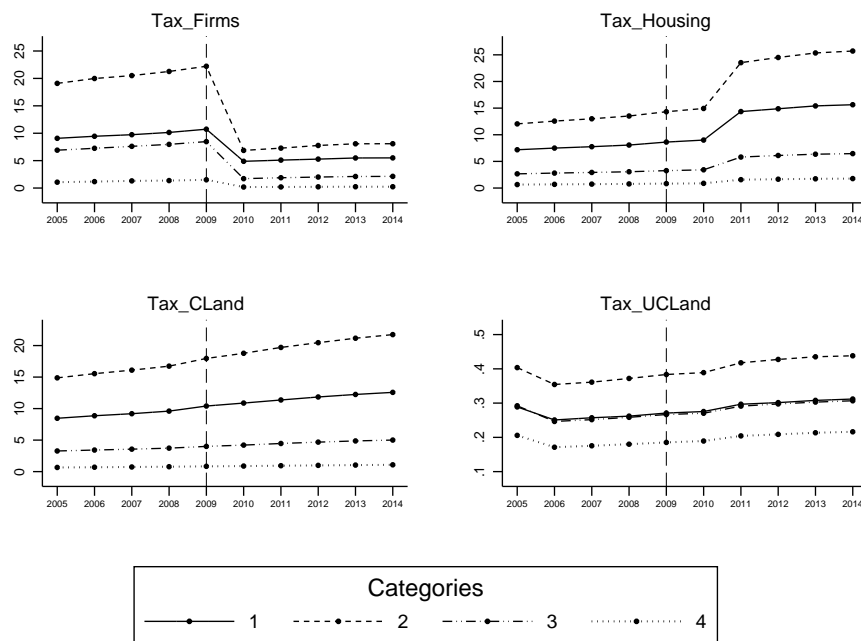
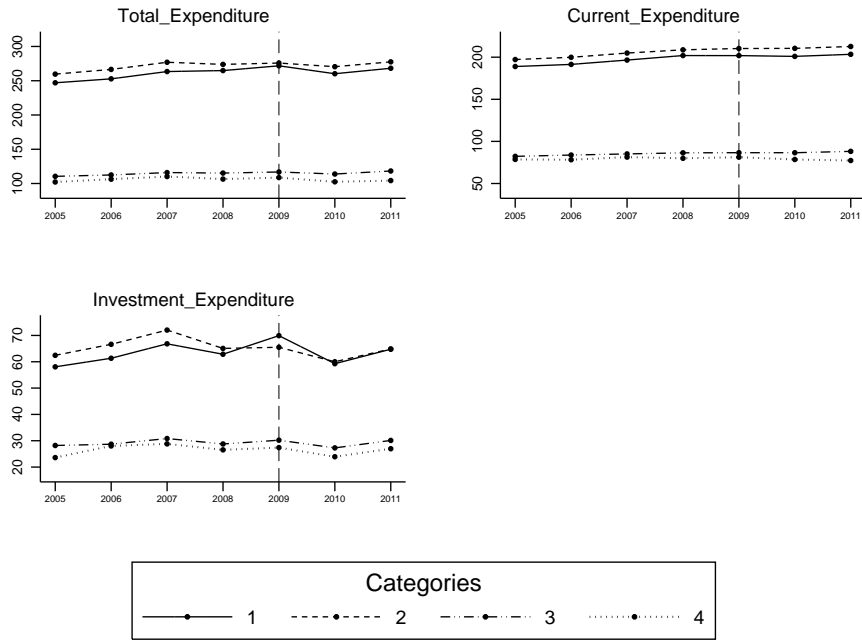


Figure 7. Fiscal revenue of the municipalities



**Figure 8.** Expenditure of the municipalities (*bloc communaux*)



*D.2 Evolution of the tax rates of the upper government layers*

**Figure 9.** Tax rates of the departments

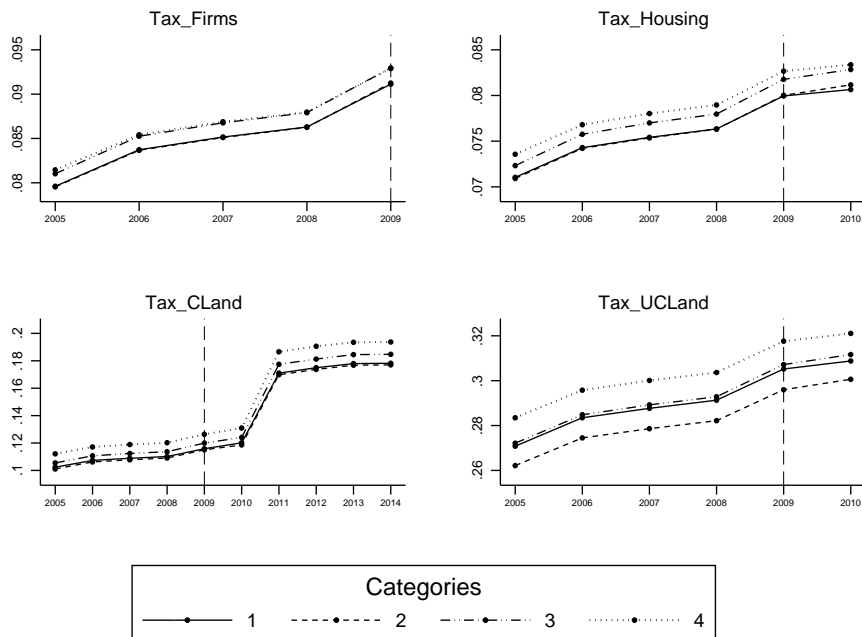




Figure 10. Combined tax rates of the municipalities and the departments

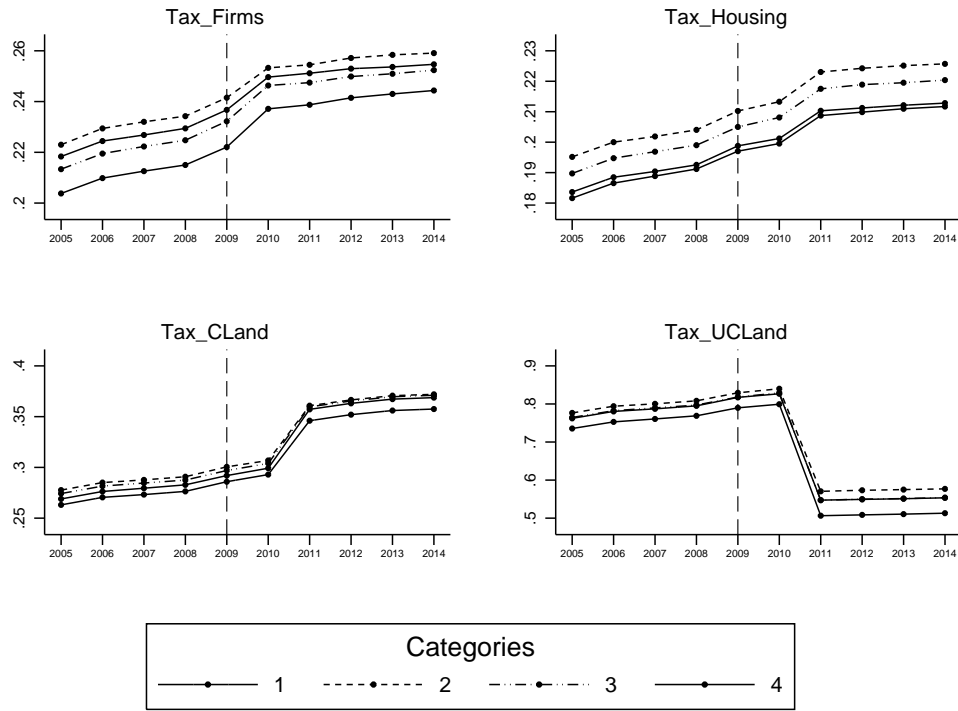


Figure 11. Tax rates of the regions

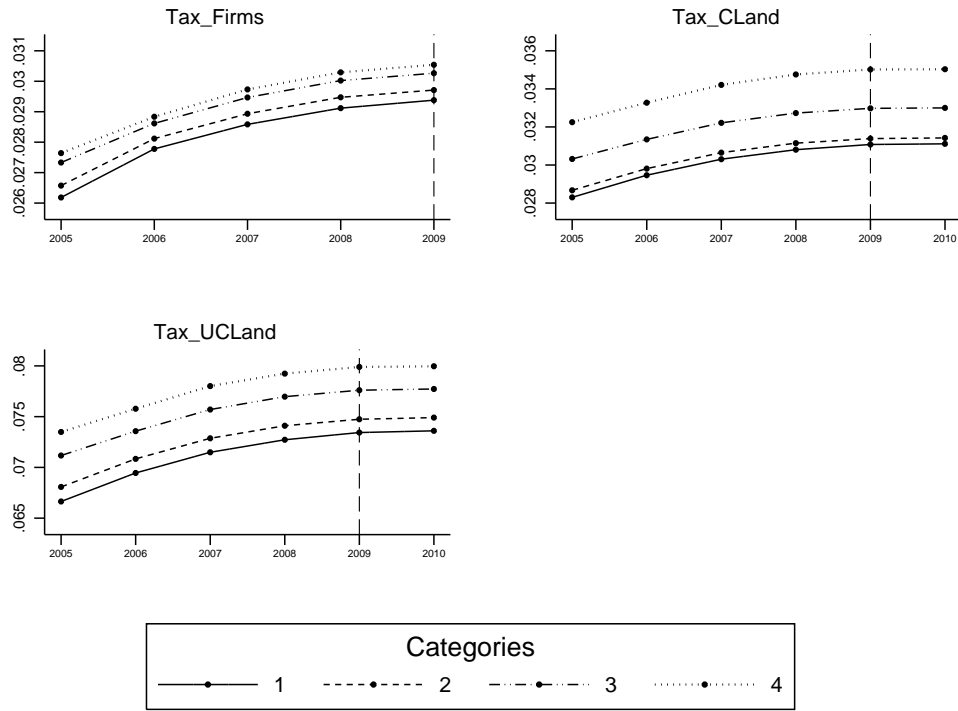
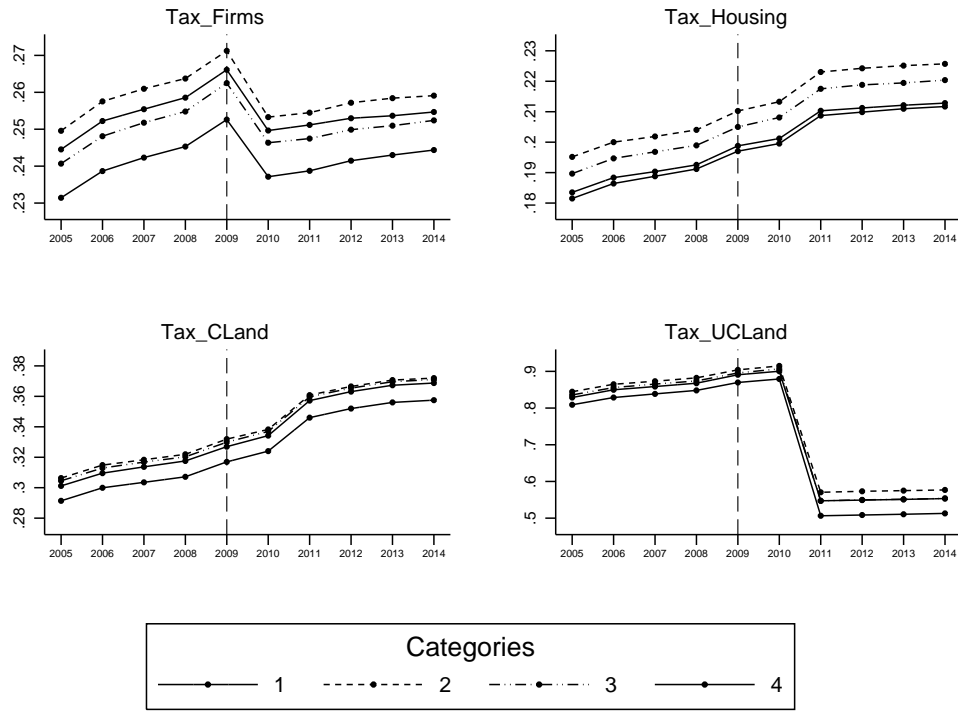


Figure 12. Combined tax rates of the all governments layers





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## Appendix E Maps

Figure 13. Capital intensity  $K/(K + L)$  in 2009

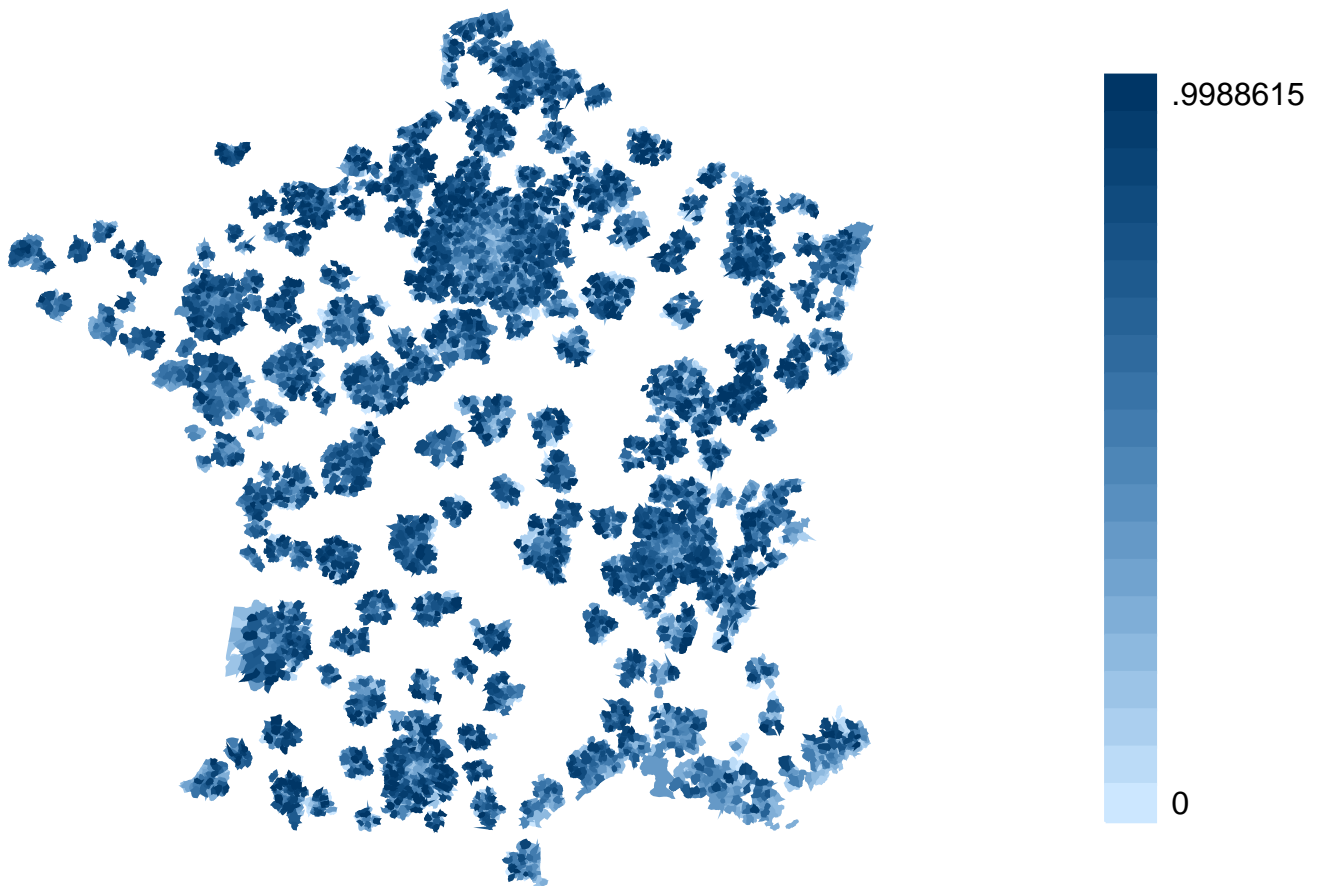


Figure 14. Tax rate on firms in 2009

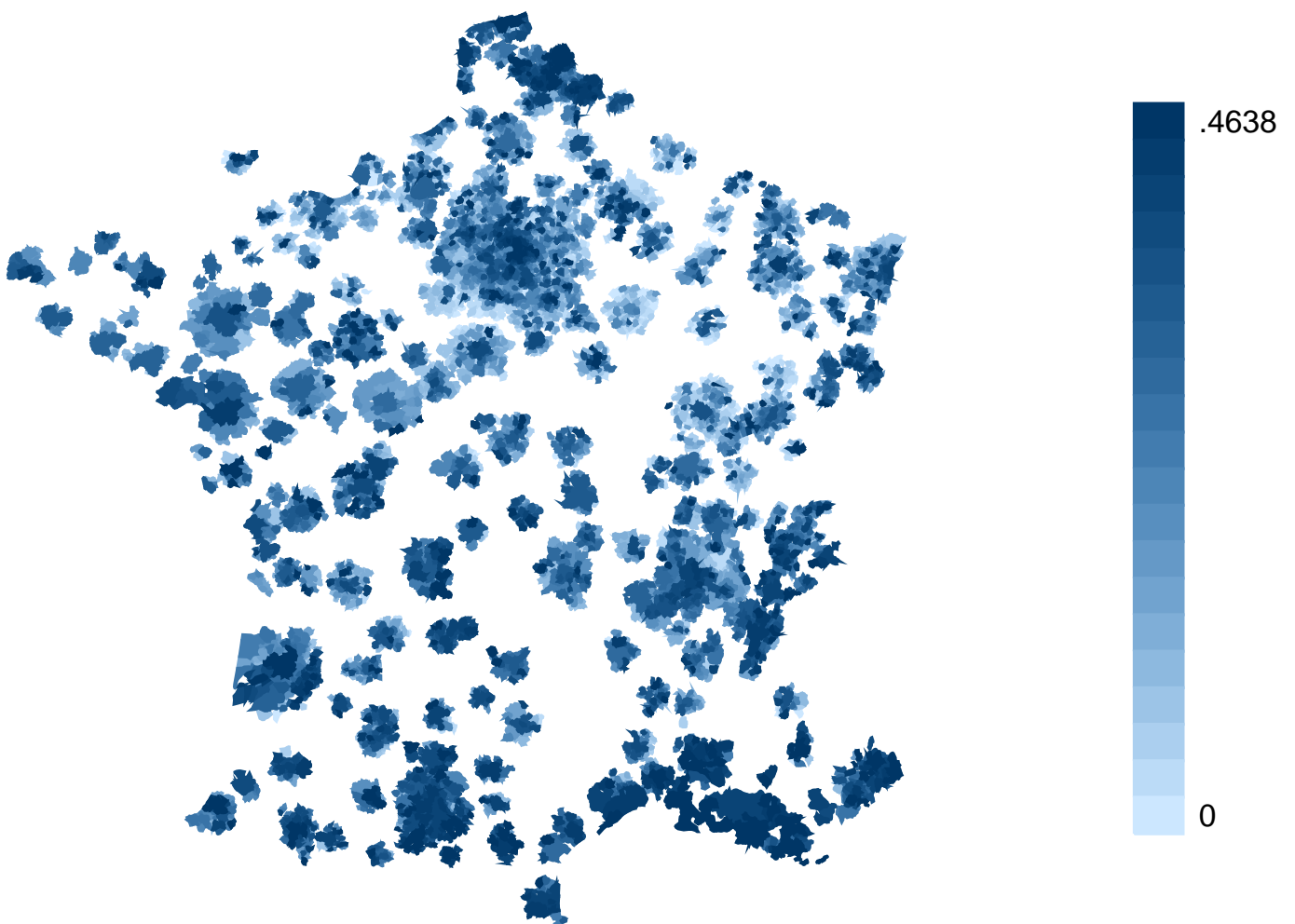
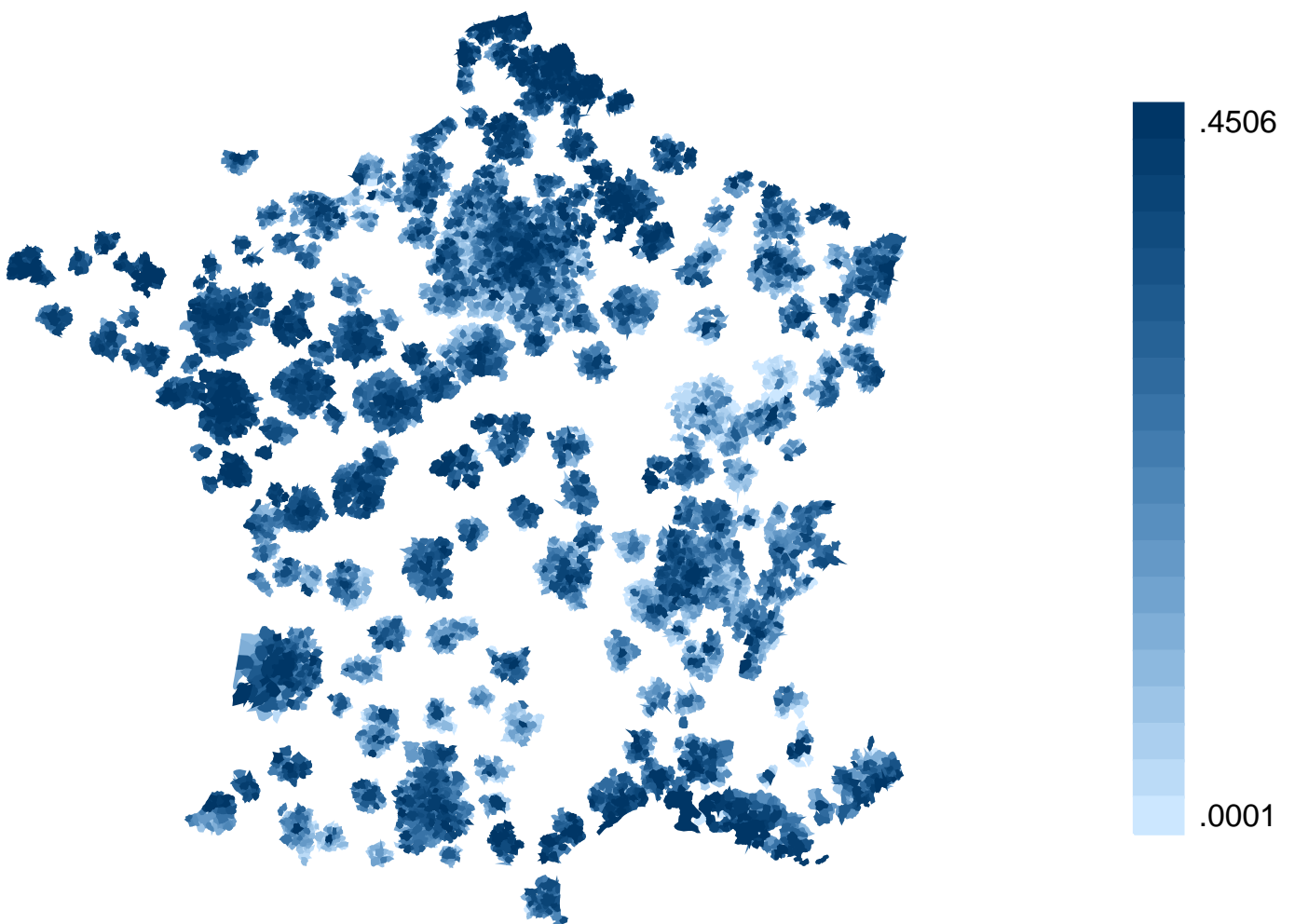


Figure 15. Tax rate on housing in 2009



## Appendix F Descriptive statistics for French municipalities (2009)

### *Municipalities and Single business tax (SBT) regime*

**Table 9.** SBT versus no SBT: fiscal and sociodemographic variables (All municipalities, 2009)

	SBT	No SBT
<i>Tax rates</i>		
Capital share in the business property $\kappa$	0.83	0.82
Business capital (K)	48.70	22.41
Business land (L)	10.10	5.50
<i>Fiscal</i>		
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
<i>Socio-demographic</i>		
Population (1000 inhabitants)	2.53	1.01
Share of young residents	0.34	0.32
Median income (10K€)	2.97	2.87
<i>Density (%)</i>		
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
<i>Firms</i>		
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 10.** SBT versus No SBT: categories of municipalities (all municipalities, 2009)

	SBT		No SBT	
	Count	%	Count	%
<i>Tax option of the PICE</i>				
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
<i>Juridic status of the PICE</i>				
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
<i>Urban areas (UA)</i>				
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
<i>Size of the UA</i>				
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.