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TAX DIFFERENTIALS AND AGGLOMERATION ECONOMIES IN INTRAREGIONAL FIRM LOCATION

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TAX DIFFERENTIALS AND AGGLOMERATION ECONOMIES IN INTRAREGIONAL FIRM LOCATION[a,b]

Jordi Jofre-Monseny, Albert Solé-Ollé[c]

Abstract: This paper analyses empirically how differences in local taxes affect the intraregional location of new manufacturing plants. These effects are examined within the random profit maximization framework while accounting for the presence of different types of agglomeration economies (localization/ urbanization/ Jacobs' economies) at the municipal level. We look at the location decision of more than 10,000 establishments locating between 1996 and 2003 across more than 400 municipalities in Catalonia, a Spanish region. It is necessary to restrict the choice set to the local labor market and, above all, to control for agglomeration economies so as to identify the effects of taxes on the location of new establishments.

Keywords: Local taxes, agglomeration economies, firm location.
JEL Codes: R3, H32.

Resumen: Este artículo analiza a nivel empírico el papel de los impuestos locales en la localización intra-regional de nuevos establecimientos manufactureros. Estos efectos son analizados en un modelo de maximización aleatoria de beneficios "*random profit maximization*", teniendo en cuenta la presencia de distintas economías de aglomeración (localización/ urbanización/ Jacobs) a nivel municipal. En concreto, estudiamos la decisión de localización de más de 10.000 nuevos establecimientos manufactureros, que se establecen en más 400 municipios de la región española de Cataluña. Para identificar el efecto de los impuestos locales en la localización de los nuevos establecimientos es preciso restringir el conjunto de elección al mercado de trabajo local y, sobretodo, controlar la presencia de economías de aglomeración.

Palabras clave: Impuestos locales, economías de aglomeración, , localización de empresas.
Clasificación JEL: R3, H32.

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1. Introduction

The effect of taxation on the location of economic activity is an issue that has interested scholars and policy makers alike. Knowing the extent to which firms respond to tax differentials is an issue of major concern for tax setting governments. In particular, governments may want to foresee the outflow of firms following a tax increase in order to assess how tax revenues and local employment are affected by changes in tax rates. A high degree of sensitivity to tax differentials on the part of firms can, thus, erode the tax autonomy of governments that may be engaged in tax competition processes[1].

Although initial attempts at quantifying empirically the impact of taxes on the location of economic activities date back some decades the question is far from being resolved. Studies carried out during the sixties and seventies, mainly in the U.S., reached the conclusion that regional and local tax bills did not play a significant role in firms' location decisions. It was argued that as these taxes were so small, tax differentials were offset by other location factors. Yet, during the eighties a number of studies, again conducted in the U.S., reported a significant role being played by taxes in the location of economic activities[2]. Analyses of this type have not flourished to the same degree in Europe. Houdebine and Schneider (1997) and Buettner (2003) find that local taxes affect the location of economic activities to some extent in France and Germany, respectively. Duranton *et al.* (2006) conclude that local taxes in the UK have a negative impact on employment but no effect on firm entry. For Spain, Solé-Ollé and Viladecans-Marsal (2003) examine local employment growth within the metropolitan area of Barcelona and report an elasticity of around -0.5 for local business and property tax rates, the main local taxes levied in Spain.

Analyzing empirically the extent to which taxes affect firms' location decisions is by no means straightforward given the range of other factors underlying this particular decision. Moreover, tax rates may be endogenous in the sense that tax setting governments may look at the same attributes that firms take into consideration at the time of locating. This possibility has been stressed in the literature concerned with the study of tax competition in the presence of agglomeration economies[3]. Agglomeration economies lead firms to concentrate in space resulting in economic activities that have been described as "lumpy". In this setting, firms may

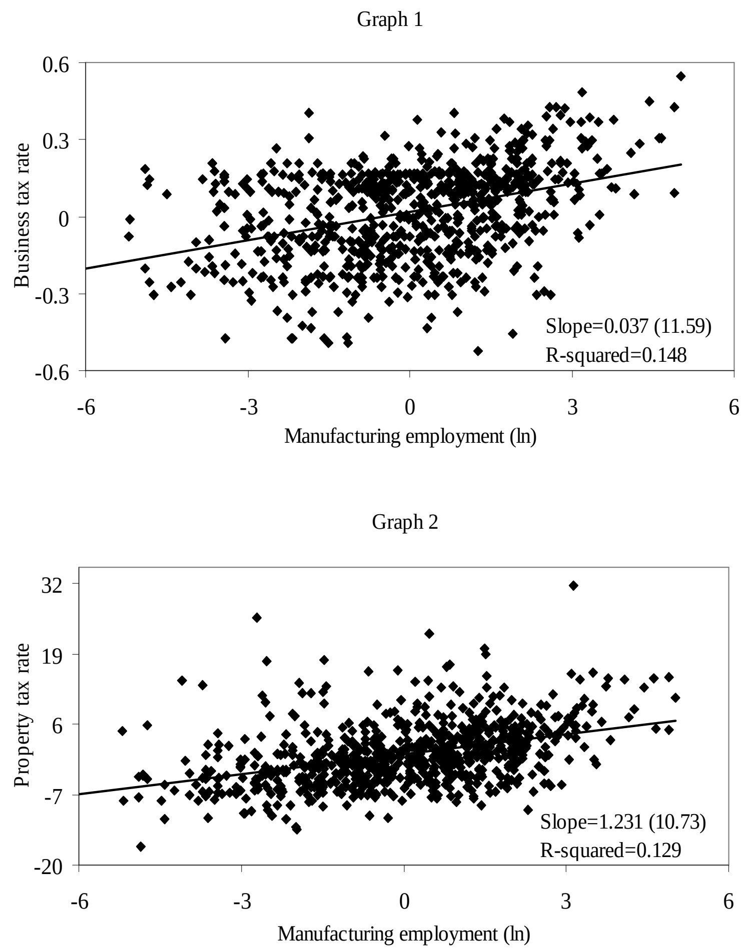
[1] See Wilson (1999) for a review of the tax competition literature.

[2] This literature is reviewed in Bartik (1991a) and Herzog and Schlottmann (1991).

[3] The seminal papers are Ludema and Wooton (2000) and Kind *et al.* (2000). A review of this literature can be found in Baldwin *et al.* (2003), chapters 15 and 16.

indeed be willing to pay a higher tax bill in order to locate close to other firms. This means that some governments may be able to set a high tax rate while hosting large amounts of economic activity. In Figure 1 (Graphs 1 and 2), the partial correlations between tax rates (business and property tax) and manufacturing employment for municipalities in Catalonia, a Spanish region, are depicted[4]. These correlations are positive and large (in the 30-40% range), which is consistent with the intuition that agglomeration economies enable those municipalities where economic activities are found to set higher tax rates. While this does not constitute a test of the relationship between the tax level and agglomeration economies, it does suggest that accurate measures of the benefits firms obtain when they co-locate in space may be necessary to identify the effect of tax rates on the location of economic activities.

Figure 1. Correlations between tax rates and manufacturing employment.



Notes: Data are referred to year 2000 and variables are expressed in deviations from the local labor market mean.

[4] See Sections 3.1 and 3.2 for a description of data and variables. Since we focus on firm location within local labor markets, variables are expressed in deviations from the local labor market mean.

The term agglomeration economies can be used to denote any mechanism that causes economic activities to cluster in specific locations. At the intraregional level, the type of agglomeration economies we have in mind are technological externalities. Marshall (1890) identifies labor market pooling, input sharing and knowledge spillovers as the main sources of such technological externalities. However, regardless of the particular source that is operating, external effects mean that a firm's productivity comes to depend on the economic scale and composition of its economic environment (Rosenthal and Strange, 2004). Fortunately, a large number of empirical studies have undertaken to quantify agglomeration economies of this type and conclude that the productivity of a firm depends on the amount of economic activities being carried out within the same industry (localization economies), the amount of economic activities being carried out within other industries (urbanization economies) and the sectoral diversity of the local economy (diversity effects). It has also been reported that these agglomeration economies have a very limited geographical scope (Rosenthal and Strange, 2004). For Spain, Viladecans-Marsal (2004) finds little evidence of agglomeration economies spilling over the country's municipal borders. This makes Spain a good setting for the analysis we propose to undertake as there is a close equivalence between the size of tax setting jurisdictions and the scope of agglomeration economies[5].

In his review of the role played by taxes on the location of economic activities, Bartik (1991a) points out that empirical studies tend to draw different conclusions according to whether these analyses are conducted at the intra- or the intermetropolitan level. While the former have tended to conclude that tax increases discourage firms from moving in, the latter have failed to produce a definitive result as regards the extent to which taxes affect location. These findings may not be independent of the difficulties that such studies face when seeking to measure interregional variation in key location factors such as wage levels, business climate and transportation facilities. However, by looking at the location of economic activities among neighboring municipalities, we can do away with this problem, because these variables can be assumed to show little variation between neighboring locations. Between very close-lying municipalities, location decisions are assumed to be motivated by differences in building rents, taxes and agglomeration economies.

Most studies examining the role of taxes in the location of economic activities have focused on either employment levels or employment growth. However, as Bartik (1991b) points out, it might be preferable to study a particular location decision rather than to model employment levels and changes. By focusing on a particular decision, rather than modelling the aggregate

[5] We focus our analysis on the Spanish region of Catalonia.

result of the creation, closure, expansion and contraction of plant processes, it should be possible to impose greater structure on the analysis and, hence, yield more precise estimates of the effects that are of interest to us. In line with Carlton (1983), Bartik (1985) and a series of more recent papers by Guimaraes and co-authors (2000, 2002 and 2004), we adopt the random profit maximization framework to analyse the location decision of new establishments. This empirical strategy has at least two advantages. First, Schmenner's (1982) study reveals that managers will first decide whether or not to start-up a new establishment and only then will they take a decision regarding the location that best suits their needs. This means we can focus on an establishment's location decision in isolation of any consideration of the processes underlying the decision to start-up. Second, it enables us to consider the explanatory variables as being pre-determined and thus to avoid any endogeneity considerations as regards the regressors. In this paper we focus on the location of manufacturing establishments, which has the additional advantage that demand remains unchanged within the region as manufactured outputs are targeted at national or supranational markets (Erickson and Wasylenko, 1980; and Charney, 1983). Hence, we are able to abstract from any local demand considerations that may affect the location decision of firms.

The rest of this paper is organized as follows. In Section 2, following on from this introduction, we present a model that sets up the location problem of the firm in line with Carlton (1983). Then, an empirical application follows. We describe the dataset and variables in Section 3.1 and then introduce and explain the econometric specification in Section 3.2. In Section 3.3, we discuss the results obtained. In Section 4, we present a summary and the main conclusions of this paper.

2. The model

The aim of a competitive firm belonging to industry *s* is to choose simultaneously a location and a level of inputs that yield the highest level of profits. There are *J* jurisdictions each firm can choose to locate in and, conditional on locating in *j*, the problem of the firm *i* is to choose the level of machinery (*K*), labor (*L*) and buildings (*N*) that maximize the following profit function:

$$\overline{P} \cdot Y_i - w_l \cdot L_i - \overline{r} \cdot K_i - R_j \cdot N_i - T_{sj}(L_i, K_i, N_i) \tag{1}$$

The price of a manufactured output ($\overline{P}$) is assumed to be common for all firms in the region. The prices of the three inputs used by firms are expected to vary at different geographic levels due to different degrees of mobility. The rental price of machinery ($\overline{r}$) is assumed to show no variation within the region. Wages are assumed to vary across local labor markets (w_l), whereas the rent of industrial buildings (R_j) may differ from one location to another. The local tax bill (T_{sj}) depends on the level of all the inputs considered and the industry of the firm, *s*. Output is denoted by Y which is assumed to be obtained by the following decreasing returns to scale homogeneous production function of the Cobb-Douglas form:

$$Y_{ij} = A_{sj} \cdot (L_i^{\alpha_1} \cdot K_i^{\alpha_2} \cdot N_i^{\alpha_3}) \cdot \exp(\mu_i) \cdot (\exp(\varepsilon_{ij}))^{\delta} \tag{2}$$

where $k \equiv \alpha_1 + \alpha_2 + \alpha_3 < 1$ denotes the returns to scale of the production function; A_{sj} is a Hicks' neutral productivity shifter capturing the agglomeration economies of site *j* for firms whose activity falls into industry *s*; μ_i pins down the managerial ability of the firm in the terms defined in Mundlak (1978); ε_{ij} stands for an identically and independently distributed (*iid*) zero mean Weibull random variable that changes over firms and locations; and δ is a positive constant.

The problem of simultaneously choosing a location and the optimal level of inputs can be reduced through the restricted profit function to one in which firms choose the location where the level of profits is the highest when inputs are chosen optimally. This is equivalent to choosing the location where the log of the restricted profit function, scaled by $(1-k)/\delta$, takes its highest value:

$$\begin{aligned} \ln \Pi_{isj} \cdot (1-k)/\delta \equiv \pi_{isj} = \varphi_0 + 1/\delta \cdot \ln \bar{P} + 1/\delta \cdot \ln A_{sj} \\ + \alpha_1/\delta \cdot \ln(w_l + \partial T_{sj}/\partial L) + \alpha_2/\delta \cdot \ln(\bar{r} + \partial T_{sj}/\partial K) \\ + \alpha_3/\delta \cdot \ln(R_j + \partial T_{sj}/\partial N) + 1/\delta \cdot \mu_i + \varepsilon_{ij} \end{aligned} \tag{3}$$

where Π is the restricted profit function and φ_0 stands for a constant term. To accommodate expression (3) into the random profit maximization framework, the following normalizations are carried out. Notice that the units of machinery can be set in such a way that the price is unity (i.e., $\bar{r} = 1$). Given that $\ln(1+\lambda) \approx \lambda$ for low values of λ, it must be that for low tax rates, as is the case here, $\ln(\bar{r} + \partial T_{sj}/\partial K)$ approaches $\partial T_{sj}/\partial K$ if *K* is set at the appropriate scale. We assume that within a region, wages do show variation but within certain limits. Hence, by choosing the appropriate scale for the units of labor, the wage can be redefined as one plus a wage premium ($w_l = 1 + \tilde{w}_l$). The same reasoning can be applied to the rents of buildings ($R_j = 1 + \tilde{R}_j$). After these normalizations, expression (3) can be expressed as:

$$\begin{aligned} \pi_{isj} \approx \varphi_0 + 1/\delta \cdot \ln \overline{P} + 1/\delta \cdot \ln A_{sj} + \alpha_1/\delta \cdot w_l + \alpha_3/\delta \cdot R_j \\ \alpha_1/\delta \cdot (\partial T_{sj}/\partial L) + \alpha_2/\delta \cdot (\partial T_{sj}/\partial K) + \alpha_3/\delta \cdot (\partial T_{sj}/\partial N) + 1/\delta \cdot \mu_i + \varepsilon_{ij} \end{aligned} \tag{4}$$

where $\varphi_1 = \varphi_0 - 2$. Expression (4) is a conditional logit model whose parameters can be estimated, up to a $1/\delta$ scale, by maximum likelihood. As Bartik (1985) points out, it makes sense that the estimates are up to some scale since doubling the profits at all sites leaves the selection probabilities unchanged. McFadden (1974) shows that given the assumption regarding ε_{ij} , the probability that firm *i* locates in *j* is given by:

$$p_{ij} = exp(\pi_{isj} - \varepsilon_{isj}) / \sum_j exp(\pi_{isj} - \varepsilon_{isj}) \tag{5}$$

where the variables that do not show variation across locations (i.e. $\varphi_1, \overline{P}, \mu_i$) drop out of the analysis.

3. Empirical exercise

3.1. Data and variables

The empirical analysis is carried out using a rich dataset containing information on the universe of new and relocating manufacturing establishments settling in Catalonia, a Spanish region, between 1996 and 2003[6]. This dataset, the Industrial Establishments Registry, contains information on the establishments created including data concerning employment, location and activity. The level of sectoral disaggregation considered is the 2-digit industry classification yielding 18 manufacturing industries[7]. In Table 1, we report the number of establishment entries and the number of municipalities for which data are available. Roughly speaking, we are dealing

[6]Catalonia is a region of north-east Spain. In 1999, it had 6.2 million inhabitants living in 946 municipalities. The surface area is 32 thousand km^2.

[7] The Industrial Establishments Registry uses the 3-digit industry classification. However, data on local employment from the Social Security Register is only available at the 2-digit level. Therefore, the analysis is performed at this latter level of sectoral disaggregation.

with municipalities with more than 1,000 inhabitants hosting some type of industrial activity[8]. The municipal data sources, variable definitions and summary statistics are provided in Table 2.

Table 1. Number of new establishments and municipalities by year.

Variable	1996	1997	1998	1999	2000	2001	2002	2003
New establishments (all)	1319	1664	1733	1065	1175	926	1127	1163
New establishments (small)[1]	567	620	716	432	441	392	380	368
New establishments (large)[2]	751	1,032	1,009	626	734	524	731	765
Municipalities	259	396	414	412	410	636	631	631

Notes: 1. Small (1-3 workers). 2. Large ($\geq$ 4 workers). 2. Employment data is missing for those new establishments not included in either of the two categories.

Table 2. Definition of municipal variables. Data sources and descriptive statistics.

Variable	Definition	Data sources	1999 mean	1999 st. dev
Business tax rate; τ_j^b	Municipal coefficient to be applied to a presumed firm-specific level of profits	Ministry of economics municipal yearbooks (1995-1999) & data-base (2000-2002)	1.357	0.187
Nominal property tax rate; t_j^p	Nominal property tax rate	Property Assessment Office	0.567	0.154
Assessed value per unit of surface; v_j	Mean of the ratable value of buildings	Property Assessment office	20.898	14.388
Property tax rate; τ_j^p	$t_j^p \cdot v_j$	Property Assessment office	12.145	8.486
Manufacturing employment; m_j	ln of workers employed in manufacturing activities	Social Security Register	4.128	2.317
Non-manufacturing employment; se_j	ln of workers employed in non-manufacturing activities	Social Security Register	4.462	2.173
Diversity index; d_j	ln of the inverse of a *H-H* index of sectoral concentration	Social Security Register	4.890	2.957
Manufacturing ratio of labor to buildings surface; L_j/N_j	Manufacturing workers over square meters of industrial buildings	Catalan Institute of Statistics & Social Security Register	0.053	0.177

[8] There is a substantial increase in the number of municipalities for which data are available in year 2000. This is due to the fact that business tax rates are only available for those municipalities exceeding 1,000 inhabitants before this date.

Local taxes: Local governments in Spain are moderate in size (their expenditure represents 13% of total public expenditure), with only a third of local government budgets being funded by intergovernmental grants. More than half of their own revenues are raised by taxes, while the remainder consists of user charges. The property tax (*Impuesto sobre la propiedad immueble*) is the main source of collected tax revenue (half of all revenues), although it is small in comparison to the U.S. Whereas an average U.S. property owner is charged around 0.75% of the market value of their property[9], in Spain this falls to about 0.14%[10]. The local business tax (*Impuesto sobre actividades económicas*), the second largest source of revenue (18% of local tax revenue), is the largest local tax firms have to bear. To indicate the relative size of these two taxes we compute the average tax bills per unit of establishment surface for Catalonia. The business tax is equivalent to 4.5€/m^2, while this measure falls to 2.25€/m^2 in the case of the property tax[11]. Manufacturing establishments average 790 m^2 in our sample. For such an establishment, this yields bills of around 1,800 and 3,600€ for property and business taxes, respectively. Three other taxes complete the picture of local taxation: a tax on vehicles, a tax on building activities, and a tax on the sale of land and buildings[12]. Although the revenue raised by these three taxes is not negligible, it should be noted that only a share of them, presumably small, is borne by business activities.

When local taxes are considered as a whole, the burden that the business sector has to bear is significant. If we only consider business and property taxes, together they yield a local tax bill of around 0.45% of the market value of a firm's buildings (in the case of the remaining taxes, we are completely unaware of the share of revenue that the business sector has to bear). Although this level of local taxation is low in comparison to that of the U.S., the difference in the order of magnitude is not so great. Besides, municipal governments are given remarkable

[9] According to the U.S. Census of Communities 2005, the median home value in 2005 was 213,900 $ whereas the median real estate tax was 1,614 $.

[10] Data refer to 2003. The average home market value in Spain was 193,100 € while the average ratable value was 35,000 €. Data sources are the *Sociedad de Tasación*, a firm providing valuations of real estate properties, and the Property Assessment Office. The 0.14 percentage is obtained as (35,000/193,100)*0.0077, where 0.0077 is the mean (population weighted) of the nominal property tax rate.

[11] The business tax equivalent is the result of dividing total business tax revenue by the sum of the surface of all business establishments. To obtain an idea of the property tax bill per unit of surface is not so straightforward as the share of this tax revenue paid by business is unknown. We have aggregated the surface of residential and business properties to compute a measure of the property tax per unit of surface (assuming that businesses pay as much as home owners per unit of surface). On average, we obtain a property tax bill of 2.25€/m^2. Sources are the Catalan Institute of Statistics and the Ministry of Economics.

[12] Municipalities are under no obligation to levy the latter two taxes.

tax autonomy. Statutory tax rates can vary by a two to three-fold factor across municipalities. Bearing in mind that we are analyzing the location of firms in neighboring municipalities, we expect local tax differentials to be large enough to influence the location of new establishments. In this analysis we focus solely on the property and business taxes, the main local taxes paid by business[13]. Therefore, we can characterize the local tax liability of firm *i* of the s^{th} industry in municipality *j* as $T_{isj} \approx T_{isj}^{b} + T_{isj}^{p}$ where *b* and *p* stand for the business and property taxes, respectively. The business tax bill depends on all the inputs used by the firm whereas the property tax bill is only increasing in the usage of buildings. Therefore, we can write $\partial T_{sj} / \partial L$ as $\partial T_{sj}^{b} / \partial L$ and $\partial T_{sj} / \partial K$ as $\partial T_{sj}^{b} / \partial K$ while $\partial T_{sj} / \partial N$ decomposes as $\partial T_{sj}^{b} / \partial N + \partial T_{sj}^{p} / \partial N$.

The local business tax liability of each firm (T_{isj}^{b}) is based on a presumed level of profits that is established in accordance with the observed level of input usages and the economic sector of each firm[14]. This presumed level of profits is determined by national tax laws that do not make any distinction as regards location. This industry specific level of tax liability $(\phi_s^L \cdot L_i + \phi_s^K \cdot K_i + \phi_s^N \cdot N_i)$ is then modified at the municipal level by being multiplied by a coefficient set by local governments (τ_j^b)[15]. Hence, we can characterize the tax bill for a firm *i* belonging to industry *s* in municipality *j* as $T_{isj}^{b} \equiv \tau_j^b \cdot (\phi_s^L \cdot L_i + \phi_s^K \cdot K_i + \phi_s^N \cdot N_i)$ where ϕ_s^L, ϕ_s^K and ϕ_s^N measure the way in which national tax laws assess how profits in industry *s* increase differently with an extra unit of labor, machinery and buildings, respectively. Hence, it is possible to decompose $\alpha_1 / \delta \cdot \partial T_{sj}^{b} / \partial L + \alpha_2 / \delta \cdot \partial T_{sj}^{b} / \partial K + \alpha_3 / \delta \cdot \partial T_{sj}^{b} / \partial N$ into two terms, an industry-specific constant (i.e. $\alpha_1 / \delta \cdot \phi_s^L + \alpha_2 / \delta \cdot \phi_s^K + \alpha_3 / \delta \cdot \phi_s^N$) times the municipal business tax rate, τ_j^b. Moreover, this constant captures the percentage squeeze on profit levels when the municipal business tax rate increases by one unit. If this share is similar

[13] In the results section (3.3), we address the role of the remaining local taxes. However, these are found to be statistically insignificant and their exclusion does not affect our results. Therefore, we focus solely on the business and property taxes.

[14] The business tax code proxies labor with the number of workers, machinery with power capacity and building surface area with m^2 of establishments.

[15] This municipal tax rate can be raised or cut depending on the location of the firm within the municipality. Each local government can sort streets into a small number of categories. Then, a specific business tax rate is applied to the firms located in each of these street categories. Municipalities are also entitled to offer tax cuts to benefit new establishments during their first years of trading. However, municipal data on the business tax code other than the municipal tax rate are poor and not very informative. Therefore, we summarize the business tax burden in location *j* by means of the municipal business tax rate, τ_j^b.

across sectors (after all, the business tax is levied on a presumed level of profits for all industries), then this coefficient can be expected to be roughly the same for all sectors. The business tax rate can range from 0.8 to 1.9. There exists substantial cross-section variation in this variable. In 1999, a quarter of municipalities set a business tax rate below 1.1 whereas another quarter chose a rate that was above 1.4 (see Table 2 for descriptive statistics).

The local business tax was reformed by a law passed in 2002. From 2003 onwards, all self-employed and very small firms, with sales below 1 million €, became exempt from this tax. At the same time, the tax burden was partly shifted towards larger firms, for whom the tax burden increased by 30% on average[16]. Thus, the reform is expected to decrease the sensitivity of small firms to tax differentials and to increase the effect of taxes on the location of larger firms. We design two subsets of firms that we consider would be affected by the reform in a different manner: on the one hand, an establishment with 1, 2 or 3 registered employees is considered small, while an establishment with 4 or more workers is considered large[17]. The number of entries falling into these two categories are reported in the second and third rows of Table 1.

The property tax is charged to the owners of land and building structures and no distinction is drawn between industrial and residential usages. The property tax bill (T_{ij}^{p}) of firm *i* if located in municipality *j* results from the product of the property nominal tax rate (t_j^p) and the ratable value per unit of surface (v_j) times the surface of buildings used, i.e. $T_{ij}^{p} = t_j^p \cdot v_j \cdot N_i$. We are interested in measuring how the property tax bill increases when we increase the surface of buildings in one unit ($\partial T_{sj}^{p} / \partial N$). Therefore, in this analysis, the relevant measure of the property tax rate is obtained as the nominal tax rate times the ratable value per unit of surface of industrial buildings, i.e. $\tau_j^p \equiv t_j^p \cdot v_j$. Hence, we need a proxy of the ratable value of a representative unit of an industrial building. Unfortunately, this information is not available and, instead, we use the mean of the ratable value of all properties found in location *j*. Governments are free to choose a nominal tax rate between 0.4 and 1.1%. That is, property owners are asked to pay a share (between 0.4 and 1.1%) of the ratable value of their properties. There exists a great deal of heterogeneity across locations although low tax rates are generally preferred. For instance in 1999, a quarter of municipal governments set a property tax rate below 0.45 whereas

[16] Tax rates vary according to sales' intervals.

[17] The effects of the reform differ with establishment sales rather than with employment. However, our knowledge of new establishment size is limited to the number of employees reported at the time of registering the establishment. We expect this measure to be highly correlated with sales. The threshold of 4 workers was set after testing various levels.

another quarter chose a tax rate above 0.7. Differences in the average ratable value of properties across municipalities are great and further increase property tax bill differentials (See Table 2 for descriptive statistics).

Agglomeration economies: Agglomeration economies for a firm of the s^{th} industry found in location *j*, A_{sj}, are expected to be summarized by the following expression:

$$A_{sj} \equiv K_0 \cdot O_{sj}^{\psi_1} \cdot M_{sj}^{\psi_2} \cdot SE_j^{\psi_3} \cdot D_j^{\psi_4} \tag{6}$$

where K_0 stands for a constant. O_{sj} denotes the s^{th} manufacture employment in location *j* whereas M_{sj} captures the remaining manufacturing employment found in municipality *j*. This distinction is made in order to take into account the fact that the benefits for two firms from co-localizing in space may be larger between same industry firms than between two firms that belong to distinct activities. The non-manufacturing employment level, SE_{sj}, is introduced in order to capture the advantages manufacturing firms derive from locally provided services. The productivity gains derived from one's own manufacturing employment levels (O_{sj}) are known in the literature as localization economies. The benefits stemming from the remaining levels of employment ($M_{sj} + SE_{sj}$) are often called urbanization economies in a distinction that dates back to Hoover (1936). Jacobs (1969) sustains that diverse economic environments favor the productivity of firms through the cross-fertilization of ideas. To test this last hypothesis we introduce the variable D_j, which accounts for the diversity of the productive environment and which amounts to the inverse of a Hirschman-Herfindahl index that can be defined as follows:

$$D_j = 1/\sum_s share_{sj}^2 \tag{7}$$

where $share_{sj}$ denotes the share of the overall employment in location j that is devoted to activity s (including both manufacturing and non-manufacturing activities). The larger the value of the index, the more diverse the described economic environment is. Equations (4) and (5) suggest that agglomeration economies should be considered in logs. We use *o*, *m*, *se* and *d* to denote the natural logarithm of *O*, *M*, *SE* and *D*.

As discussed above, agglomeration economies of the type we are looking at have been found to be of very limited geographical scope. Rosenthal and Strange (2003) analyze the scope of agglomeration economies by estimating external effects between firms localized at various distances. These authors find that such external effects fall sharply after the first 1.6 km. In our dataset, the urban area of the municipalities averages 1.3 km^2 whereas the mean total surface is 34 km^2. Therefore, one can expect that external effects do not spill over municipal borders to a very large extent. In fact, Viladecans-Marsal (2004) finds that, for most industries, there is no evidence of external effects taking place between neighbouring Spanish municipalities. In unreported regressions we have included spatial lags of the variables of agglomeration economies, but the coefficients were found to be statistically insignificant.

The rent of buildings: Unfortunately, we lack data on the rents of industrial buildings for the Spanish municipalities[18]. We circumvent this problem by looking at how pre-established firms use labor in relation to buildings. Since wages are assumed to be constant across a local labor market, the aggregate municipal ratio of buildings with respect to labor should provide us with information about the variation in the rent of buildings within local labor markets. However, we need to take into account the fact that different aggregate ratios of labor to square meters of buildings may not only be the result of differences in relative prices but could also respond to variations in the sectoral composition of municipalities[19]. If we measure the rent of buildings using the aggregate ratio of labor to buildings we may overstate its variation within a local labor market. The reason for this is that firms needing particularly large buildings will tend to gather in locations where buildings are relatively cheap. Therefore, we need to account for the aggregate ratio of labor to buildings while controlling for the sectoral composition of municipalities. That is:

$$R_j = \frac{1}{N_j} \cdot \left(\sum_s \kappa_s \cdot L_{sj}\right) \tag{8}$$

where N_j is the surface occupied by manufactures in municipality j, L_{sj} is employment of the s^{th} manufacture in j and the κ_s's are 18 parameters to be estimated. These should be high for sectors using large buildings intensively (high α_3/α_1 ratios) and low for sectors that have lower space requirements (low α_3/α_1 ratios). This can be seen at a more formal level in Annex 1.

[18] Nor can the ratable value of the property tax be used as a proxy given that reassessments are not carried out simultaneously in all municipalities

[19] This acknowledges the point stressed by Gyourko (1987) in his analysis of the between-cities variation in the aggregate ratio of labor to capital between cities. This author breaks the variation down into two phenomena: the economic sector composition of the city and the within industry factor intensity variation.

3.2. Econometric specification

As yet, we have made no mention of how we capture wage differentials between local labor markets. However, there is no information on wage levels at this geographical scale. The way we proceed involves conditioning the choice set to be the local labor market in which we finally observe the establishment settles. The local labor markets we use are built on the basis of labor mobility considerations[20]. Thus, they reflect groups of municipalities which show high levels of interaction. Hence, by looking at the location of establishments within a local labor market we are not only controlling for wage differentials but also for unobserved location attributes that may show up at precisely this geographical level. These attributes may include the business climate, transportation facilities or access to markets.

The dataset we use includes information on firms that belong to different manufactures entering the market at different points in time. We are interested in looking at how an establishment manager belonging to industry *s* decides in which municipality to settle in period *t*, conditionally on investing in a particular local labor market. Hence, we need to condition the choice of jurisdiction *j* on the sector, time period and local labor market that we eventually observe the investment to be taking place in. In line with Rosenthal and Strange (2003), we assume that there exists a one-year time lag between a new establishment decides where to locate and we observe the establishment settles in this location. Hence, we are interested in location probabilities of the following type:

$$p_{ij/s,j\in l,t+1} = \frac{\exp(\beta_1 \cdot o_{sjt} + \beta_2 \cdot m_{sjt} + \beta_3 \cdot se_{jt} + \beta_4 \cdot d_{jt} + \beta_5 \cdot \tau^b_{jt} + \beta_6 \cdot \tau^p_{jt} + \sum_s \beta_s \cdot (L_{sjt}/N_{jt}))}{\sum_{j=1}^{J_l} \exp(\beta_1 \cdot o_{sjt} + \beta_2 \cdot m_{sjt} + \beta_3 \cdot se_{jt} + \beta_4 \cdot d_{jt} + \beta_5 \cdot \tau^b_{jt} + \beta_6 \cdot \tau^p_{jt} + \sum_s \beta_s \cdot (L_{sjt}/N_{jt}))} \tag{9}$$

where $\beta_k \equiv 1/\delta \cdot \psi_k$, for k = 1, 2, 3 and 4.; $\beta_5 \equiv \alpha_1/\delta \cdot \phi^L_s + \alpha_2/\delta \cdot \phi^K_s + \alpha_3/\delta \cdot \phi^N_s$; $\beta_6 \equiv \alpha_3/\delta$; and $\beta_s \equiv \alpha_3/\delta \cdot \kappa_s, \forall s$.

This resembles a nested logit model which is often seen as a conditional logit where decisions are made sequentially. In this particular case, firm managers would first choose the local labor

[20] The local labor markets to which we refer have been computed by Roca and Moix (2004). Municipalities are aggregated in groups according to commuting considerations. Broadly speaking, each local labor market is built to ensure people live and work within its boundaries. This methodology differs from the British Local Labor markets in that a municipality cannot in itself constitute a local labor market. We consider the 945 municipalities to make up 41 local labor markets. With this level of aggregation, approximately 75% of the people live and work in the same local labor market.

market in which to locate and would then choose the municipality that they like best within the local labor market. It turns out that the estimates to be obtained by the estimation of expression (9) are precisely the same as those that would be obtained by estimating a nested logit model. At this juncture, we should make two comments in this respect. First, the approach we take enables us to control for what Carlton (1983) calls the “birth potential” of an area. In other words, people are tied to a particular area and, hence, when an entrepreneur is looking where to locate a start-up, the additional advantages offered by a distant municipality may be offset by a personal preference for locations that are located more close at hand. Thus, not all jurisdictions are equal substitutes for each other. Given the fact that there are more entrepreneurs in large cities with more agglomeration economies and higher tax rates, this statistical control may be important. In the second place, it might be that in the case of large and very mobile firms (e.g. multinational plants) the choice set considered does not correspond to the actual choice set. Even if this were to be true, the consistency of our estimates does not rely on assuming that we are specifying the choice set correctly, since to obtain consistent estimates of the parameters of interest all that we require is that the independence of irrelevant alternative assumptions holds between each pair of alternatives being considered in our estimation.

The log-likelihood of the model is given by:

$$\sum_t \sum_s \sum_l \sum_{j=1}^{J_l} n_{sjt+1} \ln p_{j/s,j\in l,t+1} \tag{10}$$

Guimaraes *et al.* (2003) shows that this log-likelihood function differs in a constant from the log-likelihood function of a Poisson model with exponential mean function whose mean and variance are given by the following expression:

$$\begin{aligned} E(n_{sjt+1}) = Var(n_{sjt+1}) = \exp(&\alpha_{stl} + \beta_1 \cdot o_{sjt} + \beta_2 \cdot m_{sjt} + \beta_3 \cdot se_{jt} + \beta_4 \cdot d_{jt} \\ &+ \beta_5 \cdot \tau_{jt}^{b} + \beta_6 \cdot \tau_{jt}^{p} + \sum_s \beta_s \cdot (L_{sjt} / N_{jt})) \end{aligned} \tag{11}$$

where n_{sjt+1} accounts for the number of firms of the s^{th} industry that locate in jurisdiction j during period $t+1$ and α_{stl} denotes a time-sectoral-Local Labor Market specific constant term[21]. The exponential mean Poisson regression model does not suffer from the incidental parameters problem that generally affects non-linear models (Cameron and Trivedi, 1998). This implies

[21] α_{stl} cannot be computed if, for industry s in time period $t+1$, there are no firms locating in any location within local labor market l. Hence, the number of observations changes over the specifications.

that the consistency of the slope parameters does not hinge on the number of constant terms that needs to be fitted.

3.3. Results

Main results: The maximum likelihood Poisson estimates of the location determinants of new and relocating establishments are presented in Table 3. In the first column of Table 3, we present the preferred specification, specification [1], that corresponds to that of the location of manufacturing establishments outlined in expressions (10) and (11). Auxiliary results are provided in specifications [2] and [3].

Table 3.-Location determinants. Poisson Maximum Likelihood estimates. Dep.Variable is the count of new establishments of industry *s* in municipality *j* and time period *t+1* (n_{sjt+1}).

Variable	[1]	[2]	[3]
(i) Local tax rates			
Business tax rate: τ^{b}_{jt}	-0.387 (-4.67)***	-0.249 (-3.24)***	2.643 (36.39)***
Property tax rate: τ^{p}_{jt}	-0.011 (-4.90)***	-0.009 -(2.55)***	-0.012 (6.09)***
(ii) Agglomeration economies			
Own manufacture employment: o_{sjt}	0.403 (34.89)***	0.416 (41.06)***	-.- -.-
Manufacturing employment: m_{sjt}	0.248 (12.04)***	0.190 (11.09)***	-.- -.-
Non-manufacturing employment: se_{jt}	0.124 (7.29)***	0.135 (9.53)***	-.- -.-
Diversity index: d_{jt}	0.224 (5.36)***	0.261 (6.67)***	-.- -.-
Rent of buildings: $L_{sjt} / N_{jt}, \forall s$	Yes	Yes	Yes
Local Labor Market Dummies	Yes	No	Yes
No. Dummies $(s \times t \times l)$	1,520	142	1,520
Log-likelihood	-13,564	-14,585	-16,538
No. Observations	21,914	21,914	21,914

Notes: 1. Figures in parenthesis are *z*-statistics. 2.*, **, ***: statistically significant at the 90%, 95% and 99%, respectively.

The high number of statistically significant variables reported in specification [1] suggests that the model fits the data satisfactorily. A likelihood ratio test has been computed indicating that the model is statistically significant at any reasonable level. Moreover, the variables take the sign that theory predicts. That is, local taxes and the proxies used to capture the rent of buildings seem to discourage the arrival of firms, whereas agglomeration economies are an attribute that firms value at the time of looking for a location[22].

The two local taxes - the local business tax and the property tax - seem to be relevant determinants of the location of new manufacturing establishments. Both the business tax and the property tax coefficients are negative and statistically significant at the 1% level (β_5 , $\beta_6 < 0$). Given that these variables do not enter the model in logs, the estimated coefficients do not tell us much about the dimensions of these effects[23]. Hence, we have computed the average elasticity for these two taxes. The estimated elasticity of the business tax rate is -0.52 whereas the elasticity of the property tax rate is -0.13. As mentioned, the list of papers we can compare our results with is extremely limited. Since the paper by Solé-Ollé and Viladecans-Marsal (2003) focuses on employment growth, it is difficult to assess the degree to which these results are comparable. Our elasticities are in general smaller than those that they report, above all in relation to property tax. Nevertheless, the results we report are in the same range as those found by these authors. In particular, the elasticity we obtain for the business tax rate is close to the figure they report for the overall employment growth equation (-0.5) and, similarly, we found an elasticity for the property tax rate that is close to the one they provide for the growth in services employment (-0.18). These elasticities are also small in comparison to the average result found in the U.S., which Bartik (1991a) quantifies at -2. However, our results do resemble those found in U.S. studies of the conditional logit type, for example Bartik (1985) and Guimaraes *et al.* (2004). These studies report negative elasticities that do not exceed -0.5 in general. If, in addition, we take into account the size of the taxes considered in this analysis, we deem our elasticities plausible.

The results also suggest that agglomeration economies play an important role as firm location determinants since all the coefficients of the variables of agglomeration economies are found to be positive and statistically significant at the 1% level. Since all these variables are measured in logs, the coefficients have an elasticity interpretation. The variable pinning down the localization economies (*o*) seems to play an important role in the firm's location decision,

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[22]The coefficients associated with the variables that proxy the rent of buildings have been omitted to save space given the difficulty in interpreting them.

[23] When a variable is interpreted in terms of its impact on the expected number of firms locating (n_{sjt+1}) its coefficient has an elasticity interpretation if the variable is measured in logs. If it is measured in levels, the average elasticity can be obtained by multiplying the coefficient by the sample mean of the regressor, $\beta \cdot \bar{x}_{sjt}$.

presenting an elasticity of around 0.40. The variables capturing the urbanization economies (*m* and *se*) have elasticities of 0.25 and 0.12, respectively. This suggests that localization economies outweigh the advantages resulting from the presence of employment in distant economic activities. The diversity of the economic environment also shifts the productivity of firms, becoming a valuable attribute for firms in search of a location. The elasticity lies around 0.22 supporting Jacobs' hypothesis. The results obtained for the relative importance of these location determinants are in line with the results reported in the literature[24]. We have also computed the average marginal effects that are implicit in our agglomeration estimates in order to contextualize our results more closely with other studies[25]. Our localization economies' estimate implies that 100 extra workers in a particular industry will increase the expected number of start-ups in the same industry by 0.097. In the case of urbanization economies, a 100-worker increase outside the industry increases the number of start-ups by 0.04 if these are manufacturing workers and 0.01, otherwise. These estimates are in the upper limit of the results reported by Rosenthal and Strange (2003). One possible explanation is that, unlike these authors, we hold rents and taxes at a fixed level.

In the second column of Table 3, we report the results obtained when we do not restrict the choice set to the local labor market level. When the choice set is considered to be the entire region of Catalonia, some coefficient estimates do change, if not always dramatically. In particular, the coefficients (and the elasticities) of the business tax rate and the property tax rate drop by 55 and 22%, respectively. This suggests that the independence of irrelevant alternatives assumption does not hold at the regional level. This can also be tested statistically. The second row from the bottom in Table 3 reports the log-likelihood functions of the different specifications. Since specification [2] is obtained by keeping the sector-year-local labor market dummy variables equal regardless of the local-labor market of the municipality, a likelihood ratio test can be performed. The value this test takes is over 2,000 which clearly exceeds the critical value of a Chi-Square distribution with 1,378 degrees of freedom at the 1% level. Hence, our data seem to indicate that there are important location factors that show up in the local labor market or/and, for some entrepreneurs, not all municipalities are equal substitutes for each other. This supports our empirical strategy of restricting the choice set to nearby locations.

Specification [3], whose results are reported in the third column of Table 3, omits the agglomeration economies' variables. The point of running such a regression is to assess the

[24] See Rosenthal and Strange (2004) for a review of this literature.

[25] If the variable x_{sjt} is expressed in logs, the average marginal effect can be obtained as $\beta \cdot (\bar{n}_{sjt} / \bar{x}_{sjt})$ where $\bar{n}_{sjt}$ is the sample mean of the dependent variable.

consequences of failing to account for the benefits firms obtain from the economic scale and composition of different locations. The property tax estimate remains unchanged. In contrast, the business tax effect switches sign becoming positive (and statistically significant at the 1% level). Moreover, the implied elasticity is very large (exceeding 3). The fact that municipalities hosting large amounts of economic activities can set higher tax rates and still be preferred by new locating establishments may explain this large bias. This finding shows the importance of controlling for agglomeration economies when estimating the effects of taxes on the location of economic activities.

Robustness checks and additional results: In this subsection we first explore whether the estimates are sensitive to the empirical strategy we adopt to control for the rent of buildings. The implications of omitting the level of some particular public expenditure programmes are then addressed. We then proffer some comments regarding the inclusion of some other local taxes, before extending the analysis in two directions. First, we consider small and large firms, separately (Table 4). The main point of this exercise is to confirm that the reform passed in 2002 has affected small and large firms in a very asymmetric manner. Second, we explore the role of taxes on the location of service activities.

Since, to the best of our knowledge, there are no papers that control for the rent of buildings by looking at how pre-established firms use labor with respect to buildings' surface, we estimate specification [1] using the density of the population as a proxy of building rents. This approach has been used in Bartik (1985) and Guimaraes *et al.* (2004), the rationale being that population and manufactures compete for the use of land. Density takes the correct sign if higher densities are to pick up higher building rents. Although some coefficient estimates experience non-negligible changes, the sign and order of magnitude of the estimates remain unchanged, providing our analysis with consistency.

Bartik (1991a) points out that controlling for the level of some local public expenditures can be relevant for identification purposes (i.e. higher tax bills may be financing better services which are valued by firms). Unfortunately, we lack data on current expenditures in which we can identify the programmes that firms may be particularly interested in. Hence, we are not able to address this question, empirically. However, we feel that this is not a major issue in our analysis as, in Spain, inter-municipal differences in per capita tax revenue do not stem so much from differences in municipal tax efforts. Rather, they arise from differences in fiscal capacity and in the volume of unconditional grants received from upper-level governments[26]. As a robustness check, we have included the natural log of overall public expenditure per capita in specification [1]. Although the expenditure per capita coefficient is positive, its elasticity is very small and statistically insignificant and, moreover, produces no significant changes in the parameters of interest. The inclusion of the remaining local taxes, namely the vehicle tax, the building activities tax and the tax on sales of land and buildings has also been considered. These taxes have been found to be statistically insignificant and to have no effect on our estimates of interest. This may be due to the fact that these taxes represent very light burdens.

As discussed in Section 3.2, from 2003 onwards, all self-employed and very small firms have become tax exempt, while the tax burden on larger firms has been increased. As such the reform is expected to decrease the sensitivity of small firms to tax differentials and increase the effect of taxes on the location of larger firms. We, therefore, estimate the model for small and large firms separately while specifying two different slopes for the business tax[27]. One slope is for firms entering the market in the time period spanning 1996-2002 when the pre-reform business tax law applied. The second slope is for establishments locating in 2003 when we expect most managers would have considered the new tax code, the final details of which were made known in October 2002. The results obtained for small and large firms are reported in the first two columns of Table 4 (specifications [4] and [5]).

[26] The correlation between overall expenditure per capita and the tax rates is around 16% and 24% for the business and the property taxes, respectively.

[27] See Section 3.1 for a definition of small and large firms.

Table 4.-Location determinants for small and large establishments.
Poisson Maximum Likelihood estimates. Dep. Variable is the count of new establishments of industry *s* in municipality *j* and time period *t+1* (n_{sjt+1}).

Variable	*Small* [4]	*Large* [5]	*Small* [6]	*Large* [7]
(i) Local tax rates				
Business tax rate: τ^{b}_{jt}				
Business pre-reform (1996-2002)	-0.559 (-4.08)***	-0.237 (-2.13)**	-.-	-.-
Pre-election (1996-2000)	-.-	-.-	-0.599 (-4.06)***	-0.134 (-1.15)
Post-election (2001-2002)	-.-	-.-	-0.426 (-1.86)*	-0.562 (-3.12)**
Business post-reform (2003)	-0.332 (-1.02)	-0.607 (-2.82)***	-0.329 (-1.01)	-0.612 (-2.84)***
Property tax rate: τ^{p}_{jt}	-0.012 (-3.14)***	-0.012 (-4.16)***	-0.011 (-3.10)***	-0.012 (-4.25)***
(ii) Agglomeration economies				
Own manufacture employment: o_{sjt}	0.342 (17.93)***	0.437 (29.84)***	0.342 (17.93)***	0.437 (29.84)***
Manufacturing employment: m_{sjt}	0.146 (4.63)***	0.315 (11.51)***	0.146 (4.63)***	0.315 (11.52)***
Non-manufacturing employment: se_{jt}	0.245 (9.06)***	0.048 (2.14)*	0.244 (9.01)***	0.050 (2.22) **
Diversity index: d_{jt}	0.339 (4.95)***	0.165 (3.081)*	0.340 (4.96)***	0.164 (3.07)*
Rent of buildings: $(L_{sjt} / N_{jt}, \forall s)$	Yes	Yes	Yes	Yes
Local Labor Market dummies	Yes	Yes	Yes	Yes
No. Dummies $(s \times t \times l)$	1,022	1,140	1,022	1,140
Log-likelihood	-6,898	-9,693	-6,898	-9,691
No. Observations	18,010	19,558	18,010	19,558

Notes: 1. Figures in parenthesis are *z*-statistics. 2.*, **, ***: statistically significant at the 90%, 95% and 99%, respectively.

Our results suggest that small firms were more sensitive to business tax rate differentials than their larger counterparts during the pre-reform period. While the average elasticity implied by the coefficients for large firms approaches -0.32, the elasticity found for small firms stands at around -0.75. This suggests that, during this period, the business tax liability for a small firm represented a larger share of its profits than was the case for a larger firm. By contrast, the elasticity of the property tax rate appears to be equal for small and large firms, -0.14. As expected, our results suggest that the reform has reduced the sensitivity of small firms to tax differentials. In fact, the estimated coefficient for the post-reform period is not statistically different from zero. Results in the opposite direction are found for the subset of large firms. The reform has increased their sensitivity to business tax differentials. The elasticity of interest rises remarkably, from -0.32 to -0.82. Notice that this set of results corroborates the nature of the effects of the business tax and, therefore, enhances the consistency of this analysis.

Although the reform was passed in 2002, it constituted a cornerstone of the electoral campaign run by the conservative party that won the national election by a wide margin in March 2000. This means that establishments locating in 2001 and 2002 might have partly anticipated the effects of the reform. To determine whether this was the case, we split the pre-reform business tax slope into two different coefficients - one for firms entering the market in the time period spanning 1996-2000 (pre-election), and the other for new establishments in search of a location in 2001 and 2002 when managers might have anticipated the effects of the reform (post-election). Our results are shown in the third and fourth columns of Table 4 (specifications [6] and [7]). The estimates of the business tax for firms locating in 2001 and 2002 have been found to lie between the pre-election and post-reform period estimates for both small and large firms. This supports the idea that, during 2001 and 2002, the reform was partly anticipated.

In the case of agglomeration economies, there are relevant differences in how small and large firms value the characteristics of the economic environment of locations. Employment in services (se_j) and the diversity of the economic environment (d_j) seem to be two attributes small firms place considerable weight on (the elasticities are 0.24 and 0.34, respectively). By contrast, large firms seem to care less about these location features (the coefficients are, respectively, 5 and 2 times smaller). A possible interpretation of these results is that large firms are less dependent on external services and on tacit knowledge than small firms. Large firms seem to be fonder of manufacture employment than their smaller counterparts. This holds both for own industry (o_j) and other manufacturing employment (m_j). For the variable reflecting localization economies (o_j) the estimated elasticities are 0.43 and 0.34, respectively. In the case of other manufacturing employment (m_j), the elasticities are 0.31 and 0.15.

Although this analysis has focused on manufactures for the reasons outlined above, we have also explored the role of taxes on the location of services. We choose to do so because first services account for more than half of the total employment, second because a growing number of services do not need to be consumed locally and, finally, because it enables us to contextualize the results more effectively. In order to take into account the fact that demand for services may show variation at the local level, we include the population and a measure of the local income level in the regression, in line with Erickson and Wasylenko (1980). The estimated tax elasticities are of the same order of magnitude as those obtained for manufactures although the business tax rate estimate is found to be statistically insignificant. These elasticities are -0.28 and -0.18 for the business and the property tax, respectively. This finding is at odds with the results reported by Solé-Ollé and Viladecans-Marsal (2003) which differed significantly between a very large impact of taxes on manufactures and a much more moderate effect on the services side of the economy. Higher levels of manufacturing and non-manufacturing employment as well as diversified economic environments seem to attract new service establishments. This is consistent with both an external economies and a local demand explanation. By contrast, the variables included to capture differences in demand at the municipal level (population and income) are statistically not different from zero. As recognized by Newman and Sullivan (1983), even though some activities may not export their output beyond the local level, mobility among nearby jurisdictions ensures that both demand and the cost of factors, aside from the rent of buildings, can be assumed to show little cross-sectional variation at this geographical level.

4. Conclusions

In this study we have focused on the role of local taxes in determining the location of new manufacturing establishments in neighboring municipalities, while accounting for the presence of agglomeration economies. The empirical application we carry out, using Spanish municipalities' data, has two main advantages. First, in light of the results reported by Rosenthal and Strange (2003) and Viladecans-Marsal (2004), the Spanish case represents a setting in which there is probably a good match between the size of the tax setting jurisdiction and the geographic scope of agglomeration economies. Second, it sheds some extra light on a topic that has not received a great deal of attention in the European context.

The estimated tax elasticity for the business tax is close to -0.52. Significantly lower is our estimated elasticity for the property tax, which is around -0.13. The size of these effects is in the lower bound of the results reported by Solé-Ollé and Viladecans-Marsal (2003) for Spain. Given the quantitative importance of these local taxes in Spain, we consider our estimates to be reasonable. A reform of the business tax that was implemented during our period of study shifted part of the tax burden from small to larger firms. Our results suggest that this reform has decreased the sensitivity of small firms to tax differentials, whereas the opposite is true for large firms. This enhances the consistency of our estimates.

Restricting the choice set to the local labor market and, above all, accounting for the presence of agglomeration economies is of paramount importance for identifying the role of local taxes in the location of economic activities. In particular, the omission of the variables of the agglomeration economies results in a severe underestimation of the negative effect of the business tax on the location of manufactures. This can be explained by the fact that municipalities choosing high tax rates are also hosting large amounts of economic activities and, due to the existence of agglomeration economies, these are the preferred alternatives for new locating establishments.

References

Baldwin, R.E., Martin, P., Ottaviano, G., Robert-Nicoud, F., Forslid, R. (2003), Economic geography and public policy, Princeton University Press, Princeton, NJ.

Bartik, T. (1985), “Business Location Decisions in the United States: Estimates of the effects of Unionization, taxes, and other characteristics of states”, Journal of Business & Economic Statistics, vol. 3, pp. 14-22.

Bartik, T. (1991A), Who benefits from State and local economic development policies? W.E. Upjhon Institute for Employment research. Kalamazoo, Michigan.

Bartik (1991b), “The effects of property taxes and other local public policies on the intrametropolitan pattern of business location” in Herzog, H. and Schlottmann, A. (eds.), Industry location and public policy, The University of Tennessee Press, Knoxville, pp. 57-80.

Buettner, T. (2003), “Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of German jurisdictions”, Journal of Urban Economics, vol. 54, pp. 110-128.

Cameron, A.C. and Trivedi, P.K. (1998), Regression analysis of count data, Econometric Society Monograph No. 30, Cambridge University Press, New York.

Carlton, D.W. (1983), “The location and Employment Choices of new firms: An Econometric Model with discrete and Continuous Endogenous Variables”, The Review of Economics and Statistics, vol 65, pp. 440-449.

Charney, A. (1983), “Intraurban manufacturing location decisions and the local tax differentials”, Journal of Urban Economics, vol. 14, pp. 184-205.

Duranton, G., Gobillon, L. and Overman, H. (2006), “Assessing the Effects of Local Taxation Using Microgeographic Data”, Discussion Papers 5856, CEPR.

Erickson R. and Wasylenko, M. (1980), “Relocation and site selection in suburban municipalities”, Journal of Urban Economics, vol. 8, pp. 69-85.

Figuereido, O., Guimaraes, P. and Woodward, D, (2002), “Home field advantage: Location decisions of Portuguese entrepreneurs”, Journal of Urban Economics, vol 52, pp. 341-361.

Guimaraes, P., Figuereido, O. and Woodward, D, (2000), “Agglomeration and the location of foreign direct investment in Portugal”, Journal of Urban Economics, vol 47, pp. 115-135.

Guimaraes, P., Woodward, D and Figuereido, O. (2003), "A tractable approach to the firm location decision", The Review of Economics and Statistics, vol 84, pp. 201-204.

Guimaraes, P., Figueiredo, O. and Woodward, D. (2004), "Industrial location modelling: extending the random utility framework", Journal of Regional Science, vol. 44, pp. 1-20.

Gyourko, J. (1987), "Effects of local tax structures on the factor intensity composition of manufacturing activity across cities", Journal of Urban Economics, vol. 22, pp. 151-164.

Herzog, H. and Schlottmann, A. (1991), Industry location and public policy, The University of Tennessee Press, Knoxville.

Hoover, E. (1936), Location Theory and the Shoe and Leather industries, Harvard University Press, Cambridge, MA.

Houdebine, M. and Schneider, J. (1997), "Mesurer l'influence de la fiscalité sur la localization des enterprises", Économie et Prévision, vol. 131, pp. 47-64.

Jacobs, J. (1969), The economy of cities, Vintage, New York.

Kind H., Knarvik K. and Schjelderup, G. (2000), "Competing for capital in a lumpy world", Journal of Public Economics, Vol. 78, pp. 253-274.

Ludema, R. and Wooton, I. (2000), "Economic geography and the fiscal effects of regional integration," Journal of International Economics, vol. 52, pp. 331-357.

Marshall, A. (1890), Principles of economics, MacMillan, New York.

McFadden, D. (1974), "Conditional logit analysis of qualitative choice behavior", in Zarembka, P (ed.), Frontiers in econometrics, Academic Press, New York, , pp. 105-142.

Mundlak, Y. (1978), "On the Pooling of Time Series and Cross Section Data," Econometrica, vol. 46, pp. 69-85.

Newman, R. and Sullivan, D. (1988), "Econometric analysis of business tax impacts on industrial location: What do we know and how do we know it?" Journal of Urban Economics, vol. 23, pp. 215-234.

Roca, J. and Moix, M. (2004), "Cap a una nova organització territorial de Catalunya", Centre de política del sòl i valoracions research paper No. 5, May 2004.

Rosenthal, S. and Strange,W. (2003), "Geography, Industrial Organization and Agglomeration", The Review of Economics and Statistics, vol. 85, pp.377-393.

Rosenthal, S. and Strange,W. (2004), "Evidence on the Nature and Sources of Agglomeration Economics" in Henderson, V. and J.-F. Thisse, (eds.), Handbook of Urban and Regional Economics, vol. 3, North-Holland, Amsterdam, pp. 1455-1495.

Schmenner, R. (1982), Making business location decisions, Prentice Hall, Englewood Cliffs, NJ.

Solé-Ollé, A. and Viladecans-Marsal, E. (2003), “Creación de empleo e impuestos municipales: Un estudio empírico sobre las externalidades fiscales", Investigaciones Económicas, vol. XXVII, pp. 97-123.

Viladecans-Marsal, E. (2004), “Agglomeration economies and industrial location: city-level evidence”, Journal of Economic Geography, vol. 4, pp. 565-582.

Wilson, J. D. (1999), “Theories of tax competition”, National tax journal, vol. 52, pp. 269-304.

Annex 1.

Hotelling's lemma and equation [3] allows us to equate the following expressions for labor and buildings, respectively:

$$\frac{\partial \Pi_{ij}}{\partial R_j} \cdot \frac{R_j}{\Pi_{ij}} = -\frac{\alpha_3}{(1-k)} \cdot \frac{R_j}{(R_j + \partial T_{sj}{}^{b} / \partial N + \partial T_{sj}{}^{p} / \partial N)} = \frac{-N_{ij} \cdot R_j}{\Pi_{ij}} \tag{A.1}$$

$$\frac{\partial \Pi_{ij}}{\partial w_l} \cdot \frac{w_l}{\Pi_{ij}} = -\frac{\alpha_3}{(1-k)} \cdot \frac{w_l}{(w_l + \partial T_{sj}{}^{b} / \partial N)} = \frac{-L_{ij} \cdot w_l}{\Pi_{ij}} \tag{A.2}$$

Solving for Π_{ij} in equations (A.1) and (A.2) and equating them yields an expression for the before-tax building bill of firm *i*. To account for the fact that different sectors may use inputs with different intensities we introduced industry subscripts in the shares of inputs in output.

$$N_{isj} \cdot R_j = L_{isj} \cdot w_l \cdot \left(\frac{\alpha_3}{\alpha_1}\right)_s \cdot \left[\frac{\dfrac{R_j}{(R_j + \partial T_{sj}^{b} / \partial N + \partial T_{sj}^{p} / \partial N)}}{\dfrac{w_l}{(w_l + \partial T_{sj}^{b} / \partial L)}}\right]_{sj} \tag{A.3}$$

Adding up for all the firms in location *j* that belong to activity *s* we obtained the aggregate before-tax building bill for industry *s*:

$$N_{sj} \cdot R_j = L_{sj} \cdot w_l \cdot \left(\frac{\alpha_3}{\alpha_1}\right)_s \cdot \left[\frac{\dfrac{R_j}{(R_j + \partial T_{sj}^{b} / \partial N + \partial T_{sj}^{p} / \partial N)}}{\dfrac{w_l}{(w_l + \partial T_{sj}^{b} / \partial L)}}\right]_{sj} \tag{A.4}$$

Aggregating for all industries we find that the rent of industrial buildings in location *j* can be written as:

$$R_j = \frac{1}{N_j} \cdot \sum_s \kappa_s \cdot L_{sj} \tag{A.5}$$

where $\kappa_s = \varsigma \cdot \left(\frac{\alpha_3}{\alpha_1} \right)_s \cdot \left[\frac{\frac{R_j}{(R_j + \partial T_{sj}^b / \partial N + \partial T_{sj}^b / \partial N)}}{\frac{w_l}{(w_l + \partial T_{sj}^b / \partial L)}} \right]_s$.

ς is a constant term that needs to be introduced to take into account that *L* and *N* have been set at a particular scale. It is important to notice that this particular method for measuring the rent of buildings relies on the fact that the last term of expression (A.4) does not show significant variation across locations. This will occur when local taxes do not affect, to a significant extent, the ratio between the marginal costs of buildings and labor. We expect this to be the case. According to our estimates the business tax outweighs the property tax by a three-fold factor in terms of its effects on the behavior of firms. But notice that a business tax increase raises the marginal cost of buildings as well as the marginal cost of labor. Hence, differences across locations in the last term of expression (A.4) will tend to be small.

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