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Legal and political barriers to entry in the Spanish retail market: a frontier approach.

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Legal and political barriers to entry in the Spanish retail market: a frontier approach

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Abstract

Recent studies have shown that barriers to entry for large retail establishments in Spain have been increased in the last decade. We exploit a unique dataset derived from an extensive analysis of the location of each large retail establishments in Spain to test whether the entry of large retail establishments was effectively limited by regional regulation and whether it depends on the approval policy of both municipal and regional authorities. To achieve this aim we merge the literatures on stochastic production frontiers and on barriers to entry by estimating a frontier entry model, which allows us to get market-specific estimates of entry costs. We have found that entry costs have decreased the number of large establishments in a 27%. A 17% of this inefficiency is explained by regional legislation (in particular, taxes and outright bans) and the entry deterrence though the approval policy of both municipal and regional authorities. The existence of significant differences among local markets discourages using regional data to analyze entry cost and barriers to entry in the Spanish retail industry.

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1. **Introduction**

A study carried out recently by the Spanish Central Bank (see Matea and Mora, 2009) showed that barriers to entry for large retail establishments promoted by Spain's autonomous regions have been increased over the last decade. From 1985 to 1993 the retail sector in Spain was liberalized. In 1993 all regional authorities were given jurisdiction to set restrictions on the opening hours and other conditions of competition. In 1996, Law 7/1996 de Ordenación del Comercio Minorista, January 15.was passed, since then, in addition to a municipal license, entry of large retail stores requires approval (i.e. a second license) of the regional authorities. The stringency of entry deterrence though the approval of this second license divers from region to region because regions have set more (different) restrictive definitions of large establishments,[1] and the approval policy is likely related to both regional and municipal electoral results. Many regions have also established the requirement of a special license for discount stores or of a financial viability plan, or have established taxes and outright bans for/on large retail establishments.

Using the simple sum of the number of barriers identified by the Spanish Competition Authority in their 2003 report, we show the level of entry barriers in each region in Table 1.[2] The dispersion of barriers to entry across Spain's autonomous regions is high, reflecting the high degree of regional autonomy in raising barriers to entry. Although all barriers have been employed by Spain's regions, the two most commonly used are those defining a large firm based on its location and outright bans. Both have been present in more than half of the regions during the sample period, 1996–2005. The definition of large retail establishments has varied across regions and has changed over time. A number of regions—including Aragón, Castile-León, Catalonia, Galicia, La Rioja, Navarra, and Valencia Community—have employed location-based restrictions since the mid-1990s; these have remained in place through to the end of 2005. Most of the autonomous regions have at some point established outright bans that forbid opening large retail establishments in a particular region during a period of time. With the exception of The Balearic Islands and Catalonia, however, outright bans are a more recent phenomenon, mostly being introduced since 2001. Nowadays, only the Canary Islands and The Balearic Islands maintain outright bans for large establishments. Idiosyncratic license licensing requirements for discount stores have also been used in a number of regions since the late 1990s.

[Insert Table 1 here]

Matea and Mora (2009) have constructed synthetic indicators of retail market regulation using factorial analysis incorporating, among others, all the legal restrictions highlighted by the Spanish Competition Authority in their 2003 report. In Table 2 we

[1] The Law 7/1996 established the requirement of a second (regional) licence for large establishments with a selling area higher than 2500 m^2. However, regions have defined a large retail firm based on its location, i.e. as a function of the size of the town, which in practice imply extending the second license for establishments with less than 2500 m^2. In addition, some regions have also established multiple criteria to determine whether a firm is large or have defined a firm to be large when at least 25 percent is owned by a large firm.

[2] Following Djankov et al. (2002), Hoffmaister (2006) used this approach to construct an ordinal measure of the barriers to retail trade in the Spanish regions.

reproduce their second figure, which includes the calculated values of the synthetic indictor of retail regulation for each autonomous region.

[Insert Table 2 here]

Using this indicator they found that, in contrast to international developments, retail trade has become increasingly regulated in Spain. Indeed, most Spanish regions have imposed at least one barrier since 1996. The rising trend in regional barriers to retail competition contradicts the falling trend in international trade barriers among European countries. The differences in retail regulation among autonomous regions have also increased, i.e. regions that were relatively friendly to retail trade at the outset, such as Asturias or Extremadura, have caught up with the more restrictive practices in other regions. Hence, there are important differences in the temporal evolution of the retail regulation among autonomous regions.

This picture contrasts with the European Single Market Program initiative that was launched more than two decades ago to deregulate markets and lower trade barriers (Nicoletti and Scarpetta, 2003; Chen, 2004) and with the European Union's Services Directive (Directive 2006/123/EC) that aims to facilitate the provision of cross-border services in the Internal Market.[3] Why have regions decided to create entry barriers against large retail establishments? Why have they then imposed additional barriers to the initial ones? As pointed out by the Spanish Competition Authority in a 1995 report, "the objective of the [Spanish law that regulates the retail sector] is to protect traditional shops with the aim of slowing down the continuous decline in their market share […]. In addition, slowing down the creation of large retail establishments will reinforce the incumbents' market power, as they will not compete with new rivals. In contrast, if the entry of large retail establishments was not limited, retail competition would increase, and supply would thus be higher, with more variety and better prices".

Using an asymmetric model of oligopoly, Hoffmaister (2006) has shown that forcing (low-cost) large retail establishments out of the market changes the composition of the retail industry in favor of traditional shops. In the absence of barriers, (low-cost) large retailers drive prices below the traditional retailers' long-run break-even point thereby forcing the latter out of the market. To the extent that these shops are locally owned and operated, regional governments may thus be seeking to protect and enhance employment in these businesses as well as to shore up electoral constituencies.

In the present paper we try to test whether the entry of large retail establishments was effectively limited by regional regulation, and whether the approval policy is related to electoral results, i.e. the percentage of votes obtained by each party in both regional and municipal electoral constituencies. Our hypothesis is that nationalist parties tend to protect traditional stores as a way to shore up electoral constituencies. Left and social-democrat parties also tend to protect traditional stores as a way to enhance employment in these businesses. On the other hand, national center-right parties usually represent the interests of not only small private employers but also large employers and hence they try to abolish any restriction on any private business.

To achieve these objectives, we estimate a *frontier entry model* where the number of retail establishments in a particular local market is modeled as a function of a measure of regional barriers to entry as well as demand and cost drivers. The equation

[3] Completion of the internal market in services is viewed as a major building block and contributor to higher growth and employment in the European Union, as services account for 60-70 % of economic activity in the EU Member States and about the same percentage of jobs.

to be estimated relies on a theoretical model where entry is thought of as a two-stage process: a firm incurs an entry cost, which includes the cost of barriers to entry, and then competes for business (see, for instance, Manuszak and Moul, 2008). Since entry costs always reduce the number of firms in all theoretical models of entry and the nature of barriers to entry is quite different to that of other unobserved demand and cost variables, we assume that the effect of entry costs on market structure can be modeled as a non-positive random term, which in turn may depend on some measure of regional barriers to entry and the approval policy. This allows us to apply the stochastic frontier techniques developed in the production literature (Kumbhakar and Lovell, 2000).

The contributions of the paper are the following. To our knowledge this is the first time the literature on stochastic production frontiers has been applied to measure entry costs and barriers to entry. Bresnahan and Reiss (1991) and subsequent papers have estimated the *probability* that a local market is supplied by a particular number of firms.[4] Instead we directly estimate a simple equation where the number of retail establishments is modeled as a function of regional barriers to entry and demand and cost drivers. In the present paper we do not estimate a model *a-lá* Bresnahan and Reiss because the number of retail establishments in our local markets is large compared to the number of competitors in previous papers. While previous papers focused on average entry cost (barriers to entry), the main advantage of the frontier approach proposed in the present paper is that we can get time-varying market-specific estimates of entry cost. The approach followed by Bresnahan and Reiss and others papers allows entry cost to vary with the number of firms but imposes a common entry cost structure for all markets, i.e. two markets supplied by the same number of firms face the same barriers to entry, and hence only an average entry cost can be estimated for all markets.

Another advantage of the frontier approach proposed in the present paper is that it allows us to capture either observed and non-observed entry costs or barriers to entry. While the first is likely to be common to several markets due to regional regulation and electoral results, the second might vary within a particular region. Once the parameters are estimated, we in turn can estimate the (maximum) number of stores that would exit in case of no entry cost or entry barriers. Thus, dividing the observed number of stores by the estimated (maximum) number of stores, an entry efficiency index or a measure of the relative importance of entry cost and barriers to entry can be computed for each local market.

On the other hand, this is the first attempt to assess the impact of both restrictive regulation and approval policy on entry into the Spanish retail industry. In order to control for market heterogeneity and aggregation errors that might bias our empirical results, we use a *local market* approach. Indeed, Griffith and Harmgart (2008) found

[4] This approach was first used by Bresnahan and Reiss (1991) to model the market structure in five different service and retail industries using data on the number of firms and population for a cross-section of geographical markets. They found that there was a positive correlation between the number of firms and population per firm over the range of approximately one to three firms in the market. They also provided the insight that if entry of additional firms into a market compresses the average markup of all firms in operation, then the market size needed to support an additional firm will be larger than if this competitive effect was absent. Mazzeo (2002b) used this approach to model the number of motels located along U.S. interstate highways using data from a cross-section of local markets. In recent applications of the same model, Manuszak and Moul (2008) analyzed the market structure for office supply superstores in the US and Griffith and Harmgart (2008) did so for the UK grocery retail industry. The authors of the latter paper found that more restrictive planning regulation reduces the number of large retail establishments.

that the impact of planning regulation on the number of UK large retail establishments is overestimated if variation in demographic characteristics across markets (i.e. market heterogeneity) is not controlled for. Following Manuszak and Moul (2008), Gómez-Lobo and González (2007), and Ashenfelter *et. al.* (2004), our geographical markets are commercial areas, formed by the main Spanish cities and their surrounding municipalities. Previous studies and reports on the Spanish retail market used a *regional* approach where geographical markets were broadly defined as a whole administrative region (see, for instance, Matea and Mora, 2009). The local approach of the present paper allows us to examine whether there are significant differences within a particular region in entry cost and hence to determine whether a regional or local approach is more appropriate.

Finally, the empirical evidence in this study exploits the synthetic indictors of regional retail regulation recently constructed by Matea and Mora (2009) and a unique dataset derived from an extensive analysis of the location of each large retail establishment in Spain. This analysis allowed us to measure the distance between stores and to identify the stores which are competing directly with other stores in the same commercial area.

2. Theoretical background

We analyse barriers to entry within the Cournot-Nash framework of imperfect competition. Retail services are non-traded so that firms must open a store before generating sales in a specific market. We assume that each market consists of a number of identical establishments maximizing profits by choosing output given other firms' output.

The firm's problem in the m*th* market is given by

$$\max_{q_i} \quad \pi_m(q_i) = (P_m - c_m)q_i - f_m \tag{1}$$

where π, q, c, and f denote profits, output, and marginal and fixed costs for firm i. The fixed costs are taken to be the annual costs of operation associated with regulations in market m, including bureaucratic and accounting requirements. For notational ease we assume that marginal and fixed costs are common to all firms in a particular market. $P_m(Q_m)$ is the m*th* market's (inverse) demand function, and $Q_m = \Sigma_{i=1}^{N_m} q_i$ is the output supplied by all firms in the market.

The first-order profit-maximizing condition that expresses the equality of marginal revenue and marginal cost is the following:

$$P_m + \frac{\partial P}{\partial q_i} q_i = c_m \tag{2}$$

For concreteness, take $P_m = D_m - Q_m$ where D_m denotes the position of the m*th* market's (inverse) demand curve, and assume that all firms are identical. The symmetrical Cournot-Nash optimal output can thus be expressed as:

$$q^* = \frac{1}{1 + N_m}(D_m - c_m) \tag{3}$$

which depends on the endogenous number of firms, N_m, supplying the market. The zero-profit condition pins down the number of firms in the long run, and thus allows the long-run optimum level of output to be fully characterized. The long-run equilibrium number of establishments supplying the market is therefore:

$$N_m^*(D_m, c_m, f_m) = \frac{(D_m - c_m)}{\sqrt{f_m}} - 1 \tag{4}$$

This equilibrium represents the pure-strategy subgame-perfect Nash equilibrium, as no firm would change its entry decision given the entry decision of other firms.[5] Using equation (4) and assuming that c_m=0 and f_m=2, we represent in Figure 1 the number of establishments, $N_m^*(\cdot)$, that supplies the market as a function of the market size, D_m. As shown below, it should be noted that this curve provides a *maximum* due to the fact that the existence of entry costs and barriers to entry might yield an observed number of firms, N_m, less than the maximum.

[Insert Figure 1 here]

Entry barriers can be modeled as an entry cost,[6] much (if not all) of which is likely to be fixed and even sunk. A cost is sunk when it cannot be recovered or reversed by simply stopping the activity that gave rise to it. Sunk costs raise barriers to entry (and exit) by imposing very high penalties for failure on potential competitors: if entry fails, then the entrant, unable to recover sunk costs, incurs greater losses. Therefore, when a new firm decides to enter, the possibility of failure becomes a critical factor in that decision because the new firm must be prepared to incur substantial upfront costs and to absorb the entire sunk portion of that cost in the event that it fails.[7]

In this model, entry can be thought of as a two-stage process: a firm first incurs an entry cost and then competes for business. A firm thus enters whenever profits in the second stage cover the entry cost (i.e. there is neither strategic effects nor first-mover advantage). The profit-maximizing behavior and entry decision imply that barriers to entry reduce the number of firms in the market. Specifically, let b_m denote the *mth* market's barriers to entry. The relation between barriers and the number of stores can then be expressed as:

$$N_m = \frac{(D_m - c_m)}{\sqrt{f_m + b_m}} - 1 = \frac{(D_m - c_m)}{\sqrt{f_m}} \cdot \frac{\sqrt{f_m}}{\sqrt{f_m + b_m}} - 1 = \left[N_m^* + 1\right]\frac{\sqrt{f_m}}{\sqrt{f_m + b_m}} - 1 \tag{5}$$

After some manipulation and taking natural logs we get the following relationship:

$$ln(N_m + 1) = ln(N_m^* + 1) - ln\, F_m \tag{6}$$

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[5] Note that fixed cost in this equation works as a barrier to entry. This is a technological barrier to entry as the existence of fixed cost implies that the technology exhibits increasing returns to scale.

[6] The Barker Review (2006) reports that applications for large retail stores cost an average of £70,000. In a recent inquiry conducted on the UK Grocery market, the Competition Commission (2000) reports an average cost of £50,000. The Competition Commission also reports that application delays for the major supermarkets could vary from a minimum of 4 months to a maximum of 24 months.

[7] Therefore, a new firm that wishes to enter the market must carefully weigh its chances of surviving in the long run. Cabral and Ross (2007) pointed out, however, that in a strategic context where an incumbent may prey on the entrant, sunk entry costs have a countervailing effect: they may effectively commit the entrant to stay in the market. By providing the entrant with commitment power, sunk investments may soften the reactions of incumbents. The net effect may imply that entry is more profitable when sunk costs are greater.

where

$$F_m = \frac{\sqrt{f_m + b_m}}{\sqrt{f_m}} \geq 1$$

is a measure of the relative importance of the barriers to entry. If F_m=1, there are no entry barriers. If $F_m \rightarrow \infty$, entry barriers tend to infinity. Note also that if entry costs are mainly formed by sunk costs, F_m can be interpreted as the entire sunk portion of total fixed cost in the event that it fails.

As mentioned above, equation (6) indicates that the existence of barriers to entry (i.e. lnF_m>0) yields an observed number of firms (N_m) less that the maximum. Therefore, if we have a data set comprising several markets and the number of establishments that are actually supplying those markets, equation (6) can be interpreted as a frontier that envelops all observations. Given the magnitude of the entry barriers in each market, the picture we observe is that provided by Figure 2, where all observations are below the frontier that indicates the maximum number of potential establishments.

[Insert Figure 2 here]

Once the parameters that define the frontier number of firms are estimated, an *entry efficiency* index can be calculated by dividing the observed number of stores by the estimated (maximum) number of stores that would exist were there no entry cost or entry barriers, that is:

$$E_m = \frac{N_m}{N_m^*(\cdot)} \tag{7}$$

Two comments are in order. First, the relative importance of entry cost and barriers to entry can be measured as one minus the entry efficiency index (7). Note, on the other hand, that this new index can be interpreted as a measure of the deficit of establishments in a particular market. Second, the above index always takes a zero value when the actual number of stores is zero and/or it cannot be calculated when the estimated maximum number of stores is close to zero. To avoid these problems, the following adjusted index can be used:

$$AE_m = \frac{N_m + 1}{N_m^*(\cdot) + 1} \tag{8}$$

By definition $AE_m > E_m$, and hence the alternative entry efficiency index tends to overestimate (underestimate) the right entry efficiency index (the real importance of entry cost and barriers to entry), but it can be calculated even when there are no establishments in the market. If we are mainly interested in changes in the efficiency index with or without legal and political barriers to entry, the abovementioned bias, however, is not so important and both indexes would yield similar results.

3. Empirical Model

Following Manuszak and Moul (2008) the latent profit function for a particular firm in market *m* and period *t* can be written as:

$$\pi_{mt}(\cdot) = Z_{mt}\delta - \beta \ln(N_{mt} + 1) + \xi_{mt} \tag{9}$$

where $Z_{mt}=(D_m,c_m)$ are market-specific demand and cost factors that affect profitability in market m, ξ_{mt} are unobserved factors in that market, and (δ,β) are unknown parameters of the latent profit function. We assume in the latent profit function (9) that firms' profits are decreasing in N_{mt}, so that (9) can be interpreted as the reduced form of the expected present discounted value of profits that result from post-entry competition between firms and that all firms observe. [8] In accordance with (6), and in order to avoid taking logs when the number of stores in a particular market is zero, we have added one unity to the number of stores in (9). Here we assume a logarithmic relationship between profit and the number of firms, as in many theoretical models of imperfect competition where the effect of entry on firms' profits is decreasing.

Regarding the firms' entry decisions, three comments are in order. First, a firm enters whenever profits cover its entry cost. Since we do not observe this entry cost we treat entry cost in a particular market m, F_{mt}, as a random variable. Second, we assume that F_{mt} can be modeled as a non-negative random term because entry cost always reduces the number of firms in all theoretical models of entry. And, third, we assume that entry cost in a particular market m is a function of *observed* barriers to entry, b_{mt}. That is:

$$\ln F_{mt} = \ln F_{mt}(b_{mt},\alpha) \quad , \quad \ln F_{mt} \geq 0 \tag{10}$$

The resulting number of retail competitors supplying the market in the long run can be obtained from the zero-profit condition once the entry cost is accounted for. Assuming that all retail outlets are identical, the equilibrium number of firms in market m is characterized by the following equation:

$$Z_{mt}\delta - \beta \ln(N_{mt}+1) + \xi_{mt} = \ln F_{mt}(b_{mt},\alpha) \tag{11}$$

Rearranging (11), we find that the endogenous number of firms in market m in the long run can be written as:

$$\ln(N_{mt}+1) = Z_{mt}\delta' - u_{mt} + \varepsilon_{mt} \tag{12}$$

where $\delta'=\delta/\beta$, $u_{mt}=lnF_{mt}(b_{mt},\alpha)/\beta$ is a random term which measures the effect of entry cost and barriers to entry on market structure (i.e. the number of stores), and $\varepsilon_{mt}=\xi_{mt}/\beta$ is a noise term that captures unobserved demand and cost factors in market m that affect market structure.[9] We expect that the data generating processes behind both random terms, u_{mt} and ε_{mt}, are quite different because the nature of entry costs (i.e. barriers to entry) is quite different to that of other unobserved demand and cost variables.

[8] This framework ignores the dynamics of the entry process and the fact that firms are not symmetric (in terms of size, reputation, quality, etc.). Modelling decisions when both entry decisions are discrete and firms are asymmetric is a complex task. Mazzeo (2002a) relaxed this symmetry assumption by introducing different types of products (or firms), conditioning the analysis on the number of entering firms of each type. However, Einav (2007) pointed out that the main restrictions still remain (e.g. all potential entrants are ex-ante identical), and extending Mazzeo's model to more than two or three types is computationally infeasible.

[9] The model (12) that is going to be estimated is called "reduced form" because the number of firms is thought of as deriving from the interaction of a demand function with a supply relation that captures both profit-maximizing behavior and entry decisions. As a result, the parameters of a reduced form equation are themselves typically functions of the structural parameters of the underlying economic relationship (Baker and Rubinfeld, 1999).

To justify this, note first that ε_{mt} can be interpreted as a specification error term that appears when the researcher tries to model the firm's latent profit π_{mt} as a function of market-specific demand and cost factors, Z_{mt}. Since ε_{mt} captures specification errors, it might take both positive and negative values. Note also that this random term is associated to period-by-period profit maximization once a previous decision to enter has been made. That is, the unobserved demand and cost factors captured by ε_{mt} only affect entry decisions indirectly. However, by construction, entry cost (i.e. u_{mt}) directly affects the decision to enter into a particular market, and hence u_{mt} is likely negative distributed. Second, while other unobserved demand and cost variables are probably market-driven, entry costs are more likely to be strongly determined by regulators as retail regulation in Spain is mainly designed to limit the entry of large retail establishments.[10] Third and finally, while ε_{mt} may capture unobserved costs that can be recovered in case of exit, u_{mt} may capture sunk costs that cannot be recovered. As mentioned above, sunk costs exaggerate the penalties for failure on potential competitors, reducing the probability of entry.

In summary, since barriers to entry involve substantial sunk costs and their effect on market structure is more direct, stronger and more certain than the effect of ε_{mt}, we assume that the effect of entry barriers on market structure can be modeled as a non-positive random term, i.e. $u_{mt} \geq 0$. Identification of the barriers-to-entry random term relies on the non-symmetry of u_{mt}. Whereas it is conventionally assumed that the noise term is symmetric with zero mean, we expect u_{mt} to be negative and asymmetrically distributed. If both right hand side and left hand side tails of the distribution of u_{mt} are symmetric, we cannot get separate estimates of statistical noise and entry cost from estimates of the composed error for each market. In this situation, neither can we estimate market-specific entry efficiency scores.[11] If the barriers-to-entry random term is asymmetric, we can apply the stochastic frontier techniques developed in the production literature (see Kumbhakar and Lovell, 2000) in order to estimate (12). Moreover, in this case, we can take advantage of the skewness of the barriers-to-entry term to get market-specific barriers-to-entry scores.

Let us assume that the barrier-to-entry random term follows a truncated-normal distribution. A general specification including a vector of determinants of entry costs, b_{mt}, can be written as $u_{mt} \rightarrow N^+[\mu(b_{mt}),\sigma(b_{mt})]$. However, for several reasons that we mention below, we assume that u_{mt} satisfies the so-called *scaling property* (see Wang and Schmidt, 2002). In this case, u_{mt} can be written as:

$$u_{mt} \rightarrow g(b_{mt},\alpha)\cdot\theta_{mt} \quad , \quad \theta_{mt} \rightarrow N^+(\mu,\sigma) \tag{13}$$

where $g(b_{mt},\alpha)$ *is* a scaling function and θ_{mt} is a random variable that does not depend on b_{mt}. Although it is an empirical question as to whether or not the scaling property should hold, it has some features that we find attractive. First, this type of model has a convenient economic interpretation, i.e. while the scaling function $g(\cdot)$ captures the effect on market structure of *observable* barriers to entry (such as the regional retail regulation that limits the entry of large retail establishments in a particular region and the degree to which this entry legislation is enforced by local governments), θ_{mt} is a

[10] In this sense, ε_m might theoretically capture barriers to entry associated with the degree of firms' scale economies, and hence this term is also determined by the available technology.

[11] Note, however, that in this situation we can estimate the market structure equation (12) and the *average* entry cost for all markets as a constant term due to the fact that $E(u_m)>0$.

random term which captures the effect of *unobserved* barriers to entry and allows entry cost to vary within a particular region. Second, the observed entry barriers in (13) determine both the shape and magnitude of the one-sided random term, and their coefficients can generally be estimated using maximum likelihood techniques (MLE). As noted by Simar, Lovell and van den Eeckaut (1994), and Wang and Schmidt (2002), some portion of the model can be estimated by non-linear least squares (NLLS) without making any distribution assumption on the random variable θ_{mt}.

Finally, the question of whether the effects of the b_{mt}, on market structure are monotonic can be easily handled by the choice of scaling function. If one wishes to impose monotonicity, we can simply use a monotonic scaling function such as the exponential scaling function $exp(b_{mt}'\alpha)$. If not, a non-monotonic scaling function can be used. The interpretation of α does not depend on the distribution of θ_{mt}, and simple scaling functions yield simple expressions for the effect of the b_{mt} on the magnitude of entry costs. For example, if we use the exponential scaling function, so that $u_{mt}=exp(b_{mt}'\alpha)\cdot\theta_{mt}$, the market structure equation to be estimated is:

$$\ln(N_{mt}+1) = Z_{mt}\delta' - \exp(b_{mt}'\alpha)\cdot\theta_{mt} + \varepsilon_{mt} \tag{14}$$

In this case, the coefficients α are just the derivatives of $ln(u_{mt})$ with respect to b_{mt}.

3. Estimation strategy

In order to estimate (14) we can use maximum likelihood techniques (MLE). The MLE approach simultaneously estimates both the parameters describing the structure of the two error components and the parameters describing the configuration of the market structure equation, once distributional assumptions on both error components are invoked.

In particular, in addition to assume that the noise term ε_{mt} is symmetric with zero mean and standard deviation σ_ε, this method relies on assuming a specific distribution for the asymmetric barrier-to-entry random term, θ_{mt}. Assume, for instance, that this term can be modelled by allowing θ_{mt} to follow a truncated normal distribution.[12] If we assume that $\theta_{mt}\sim N^+(\mu,\sigma^2)$ then

$$f(\theta_{mt}) = \frac{1}{\sqrt{2\pi}\cdot\sigma}\cdot\Phi^{-1}(\mu/\sigma)\cdot\exp\left\{-\frac{(\theta_{mt}-\mu)^2}{2\sigma^2}\right\} \tag{15}$$

In this case the log likelihood function can be derived from Stevenson (1980) with (μ,σ) being replaced with $(\exp(b_{mt}'\alpha)\cdot\mu, \exp(b_{mt}'\alpha)\cdot\sigma)$. This yields the following log likelihood function:

[12] We have chosen this distribution because it is a generalization of the one-parameter half-normal distribution and it is one of the most frequently employed in the production frontier literature.

$$\ln f(\omega_{mt}) = -\ln\Phi(\mu/\sigma) - 0.5\ln\left(\sigma_\varepsilon^2 + \sigma^2\exp(b_{mt}'\alpha)^2\right)$$
$$+\ln\phi\left[\frac{\ln(N_{mt}+1) - z_{mt}'\delta + \mu\exp(b_{mt}'\alpha)}{\sigma_\varepsilon^2 + \sigma^2\exp(b_m'\alpha)^2}\right]$$
$$+\ln\Phi\left(\sigma_\varepsilon^2 + \sigma^2\exp(b_{mt}'\alpha)^2\right)^{1/2}\cdot\left[\frac{\sigma_\varepsilon}{\mu\sigma\exp(b_{mt}'\alpha)} - \frac{\sigma\exp(b_{mt}'\alpha)}{\sigma_\varepsilon}\left(\ln(N_{mt}+1) - z_{mt}'\delta\right)\right] \tag{16}$$

where $\omega_{mt} = \varepsilon_{mt} - \exp(b_{mt}'\alpha)\cdot\theta_{mt}$. Hence, $\left(\hat{\delta},\hat{\alpha},\hat{\mu},\hat{\sigma},\hat{\sigma}_\varepsilon\right) = arg\,min\sum_m\sum_t ln\,f(\omega_{mt})$. As is customary, for estimation purposes the model above is parameterized in terms of the overall variance, $\tilde{\sigma}^2 = \sigma_\varepsilon^2 + \sigma^2$, and an indicator of the relative importance of noise and unobserved entry costs, $\lambda = \sigma_\varepsilon^2/\sigma^2$.

Once the parameters in (16) are estimated, entry efficiency scores can be estimated for each market by decomposing the estimated residual into a noise component and a barrier-to-entry component. We have estimates of $\omega_{mt} = \varepsilon_{mt} - \tilde{\theta}_{mt} = \varepsilon_{mt} - \exp(b_{mt}'\alpha)\cdot\theta_{mt}$, which obviously contains information on θ_{mt}. The problem is to extract the information that ω_{mt} contains on $\tilde{\theta}_{mt}$ and, given $\exp(b_{mt}'\alpha)$, on θ_{mt}. Jondrow *et. al* (1982) faced the same problem in the frontier production function literature and proposed using the conditional distribution of the one-sided random term (here $\tilde{\theta}_{mt}$) given the composed error term (here ω_{mt}). The conditional distribution f($\tilde{\theta}_{mt} \mid \omega_{mt}$) is given by

$$\ln f(\tilde{\theta}_{mt} \mid \omega_{mt}) = \frac{f(\tilde{\theta}_{mt},\omega_{mt})}{f(\omega_{mt})} = \frac{1}{\sqrt{2\pi}\cdot\sigma_*}\Phi^{-1}\left(\frac{\mu_*}{\sigma_*}\right)\exp\left\{-\frac{\left(\tilde{\theta}_{mt}-\mu_*\right)^2}{2\sigma_*^2}\right\} \tag{17}$$

Note that $f(\tilde{\theta}_m \mid \omega_m)$ is distributed as $N^+(\mu_*,\sigma_*^2)$, where $\mu_* \equiv \left(-\sigma_{mt}^2\omega_{mt} + \mu_{mt}\sigma_\varepsilon^2\right)/\tilde{\sigma}_{mt}$, $\sigma_*^2 \equiv \left(\sigma_{mt}^2\cdot\sigma_\varepsilon^2\right)/\tilde{\sigma}_{mt}^2 = \left(\sigma_{mt}^2\cdot\sigma_\varepsilon^2\right)/\left(\sigma_{mt}^2 + \sigma_\varepsilon^2\right)$, $\sigma_{mt} = \exp(b_{mt}'\alpha)\cdot\sigma$, $\mu_{mt} = \exp(b_{mt}'\alpha)\cdot\mu$, and $\tilde{\sigma}_{mt}^2 = \sigma_\varepsilon^2 + \exp(b_{mt}'\alpha)^2\cdot\sigma^2$. Thus, the mean of $f(\tilde{\theta}_{mt} \mid \omega_{mt})$ can be used to get market-specific estimates of $\tilde{\theta}_{mt}$.[13] The mean is given by

$$E(\tilde{\theta}_{mt} \mid \omega_{mt}) = \mu_* + \sigma_*\cdot\frac{\phi(\mu_*/\sigma_*)}{\Phi(\mu_*/\sigma_*)} \tag{18}$$

As mention above, some portion of the model can be estimated by NLLS without making any distribution assumption on the random variable θ_{mt}. To show this, let us to rewrite the market structure equation (14) as:

$$\ln(N_{mt}+1) = f_m(\delta) - g_m(\alpha)\cdot\bar{\theta} + v_m \tag{19}$$

[13] The mode of this distribution can also be used as a point estimator for $\tilde{\theta}_{mt}$. However, it is far more common to employ the mean in the frontier literature.

where $\bar{\theta} = E(\theta_m)$, $f_m(\delta) = Z_m\delta'$, $g_m(\cdot) = exp(b_m'\alpha)$, and $v_m = \varepsilon_m - g_m(\alpha)\cdot\{\theta_m - \bar{\theta}\}$. Note that (19) is equivalent to the traditional specification of a market structure equation where an average entry cost level is estimated altogether with other cost and demand parameters.[14]

The parameters in equation (19) can be estimated by non-linear least squares by means of

$$\left(\hat{\alpha},\hat{\delta},\hat{\bar{\theta}}\right) = \arg\min \sum_m \sum_t \left[\ln(N_{mt}+1) - f_{mt}(\delta) + g_{mt}(\alpha)\cdot\bar{\theta}\right]^2 \qquad (20)$$

That is, except for the variances of both random terms, least squares can be used to generate consistent estimates of the remaining parameters in the equation (20) describing the configuration of the market structure.[15]

4. The market

To measure the effect of entry barriers on the number of large retail establishments it is necessary to define the relevant product and geographical market.

Since legal barriers to entry are more restrictive for large retail establishments than for either medium establishments (i.e. supermarkets) or small and specialized stores (such as bakeries, butchers, grocers, clotheswear shops, shoe shops, etc.), we will mainly focus our analysis on hypermarkets or shopping centers. The *Spanish Shopping Center Association* defines shopping centers as commercial units of relevant size, with a selling area usually not less than 1,500 m^2 and formed by several individual stores that do not belong to the same brand but which share a common image and a common management. Most of the shopping centers are hypermarkets, i.e. stores with an aggregate selling area not inferior to 2,500 m^2 belonging to a brand where a broad range of products can be acquired through one-stop shopping.

A more critical issue for our analysis is defining the geographical arena in which the large retail establishments compete with each other. In some merger cases in the retail distribution sector the EC has carried out the analysis at the national level, based mainly on the fact that most of the strategic decisions (e.g. advertising campaigns, bargaining with suppliers/producers, client fidelization strategies and selection of the range of products sold) were made at the national level. The overlapping in the catchment area of the stores also favors the nationwide approach.

However, the EC decisions state that the coverage area of a given sales location (supermarket or hypermarket) is limited: 10 to 30 driving minutes are generally mentioned as the radius of coverage of a given store.[16] On the other hand, several

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[14] If panel data is available, the market structure equation (19) can be extended to allow for market-specific barriers to entry as follows:

$$\ln(N_{mt}+1) = f_{mt}(\delta) - g_{mt}(\alpha)\cdot\bar{\theta}_m + v_{mt}$$

This model assumes that market-specific barriers-to entry parameters are time-invariant and it is only consistent when long panel data sets are available (i.e. as $T\to\infty$). In addition, the incidental parameter problem appears as $N\to\infty$.

[15] In the next sections we only provide the MLE estimates due to the NLLS results were quite similar to that obtained using the MLE estimators. They are available upon request.

[16] See the Promodes/Carrefour case, Alcosto/Caprabo case, and the Caprabo/Eroski case.

studies have established a relationship between prices and concentration in the retailing sector. The fact that local concentration affects prices in many price-concentration studies is an argument in favor of a local market analysis rather than a nation-wide approach when assessing the impact of entry barriers on the number of firms.

Most of the shopping centers in Spain are located in or around the main Spanish cities. Most of these cities are the capital of one of the 50 Spanish provinces. For a hypermarket or a shopping center, the boundaries of their market do not coincide with the boundaries of the municipalities where they are located. The reason is that in urban areas many people commute daily from their town of residence, enlarging the geographical market in which consumers shop.[17]

Given these considerations, our local markets are defined as the commercial areas formed by the municipality of one of the main Spanish cities and its surrounding municipalities.[18] On the other hand, it is important to note that these commercial areas can be viewed roughly as independent commercial markets due to the fact that the main Spanish cities (which form the main or "lead" municipality of the commercial areas) are, in general, quite far away from each other, and no other significant towns are located between them.

In order to measure the number of large retail establishments in each of these commercial areas, we follow the radius approach (or isochrones approach) used by the Competition authorities, and assume that a given store in the lead municipality of a commercial area competes directly with all other stores in the same location, and other stores placed in locations which are within less than 30 kms away from the lead of the commercial area.

5. Data set and variables

As mentioned above we explain market structure variation using demand and cost drivers to capture differences across commercial areas where retail outlets are located, in addition to some indicators of both regional regulation and approval policy. This section summarizes the data we used.

Most of the explanatory variables are obtained from the *Anuario Económico de España 2008*, a dataset elaborated by *La Caixa*, a Spanish savings bank.[19] This dataset includes, for the period 1997-2007, some demographic, economic and commercial variables on all Spanish municipalities with more than 1,000 inhabitants. More significantly, this database also includes several variables that have been elaborated with the aim of measuring the demand for retail products in a particular municipality and in a particular commercial area. These commercial areas were defined in turn using gravity models, based on commercial flows between municipalities, and surveys filled in by the municipal authorities.

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[17] Claycombe (2000) used commuting variables to estimate a price-concentration model. He found that concentration has a strong positive correlation with furniture and clothing prices in the US Metropolitan Statistical Areas.

[18] This is the approach followed, for instance, by Manuszak and Moul (2008), and the FTC to define the relevant geographical market in the Staples/Office Depot merger case. The FTC concluded using confidential documents from the parties that metropolitan areas and regions arguably outside of a metropolitan area formed the relevant market. See also Claycombe (2000).

[19] See www.anuarieco.lacaixa.comunicacions.com/java/X?cgi=caixa.le_menuGeneral.pattern for more details on this database.

In our empirical application we analyze the determinants of retail market structure in 76 local markets, corresponding to all the commercial areas defined in the *Anuario* with the exception of Ceuta. We have excluded Ceuta because Matea and Mora (2009) do not provide regulation indicators for this commercial area. Although data on most variables is available from 1997, the period of time analyzed in the empirical exercise begins in 2002 because the existence of a construction lag between the opening of a new large establishment and the decision to enter in a particular market. In their study on Spanish hypermarkets, Matea and Mora (2009) found that the appropriate lag is five periods. Bertrand and Kramarz (2002), that analyze the effect of legal regulation on employment in the French retail sector, allow for a four year period lag between a granted application and an actual entry of a store. These results are consistent with the assumptions made by retail developers that suggest an average construction delay between four and five years. In summary, our data set is formed by 76 commercial areas observed from 2002 to 2007, and hence it includes 456 observations.

To capture differences in demand size across local markets we have used the logarithm of the overall consumption capacity of the population living in the commercial area, CONSUM. This variable is normalized by the national level of population (expressed in units of 100,000 persons) and elaborated using information about population, number of home telephones, vehicles, bank offices, etc. Hence, the consumption capacity in a particular commercial area is measured not only as a function of population but also as a function of several purchasing power proxy variables. Population is often used as a variable measuring market's demand size. However, unlike CONSUM, this variable does not account for differences in per capita purchasing power across local markets. We expect a positive value for the parameters associated with CONSUM.

To capture possible differences in demand structure among local markets (i.e. demand heterogeneity) we have included several variables. The first variable measures the proportion of overall demand (measured by consumption capacity) represented by the main municipality, PROCON. We expect a positive value for the parameter of this variable because hypermarkets and commercial centers are often located close to the most important cities in order to minimize consumers' driving costs, thereby increasing consumers' demand and their local market power. The second variable, DISTANCE, is the distance from the lead municipality to the other municipalities of the commercial area. This variable is constructed by averaging the distance from the lead municipality to all the municipalities belonging to a particular commercial area using population as weights. Since most large retail establishments are located in the main municipality and its surrounding municipalities, consumers' driving costs tend to be higher as the distance to the main municipality increases. Hence, we expect a negative value for the parameter associated with DISTANCE.

The number of competitors in a particular market depends on operating costs and fixed costs. Following Bresnahan and Reiss (1991) and de Juan (2006) we model these costs as a function of the characteristics of the local markets. To capture differences in retails costs across commercial areas, we have included three variables in our estimations. The first is the occupation rate (in percentage terms) in the commercial area, OCURATE. This variable is chosen as a proxy for labor wages and other labor expenses, and is constructed as a weighted average of the occupation rates of all the municipalities belonging to a particular commercial area.[20] Hence, we expect a negative effect of OCURATE on the number of retail outlets. It should be noted, however, that the sign of this coefficient might be not statistically significant if OCURATE also captures a demand effect. The second variable is the real estate price, RSPRICE. This variable was obtained from the Spanish Ministry of Housing, and it is measured at the province level. Hence, it takes the same value for all commercial areas located in the same province. This variable is used in order to measure differences in fixed costs, so we expect a negative effect on the number of retail establishments.[21]

As a determinant of entry costs we have included two variables associated with the barriers created by regional legislation that limit the entry of new large retail establishments. To capture legal entry barriers we make use of the retail market regulation indicators developed by Matea and Mora (2009). As in Table 2, the synthetic regulation indicator has increased over time and its dispersion across Spain's autonomous regions is high, reflecting the high degree of regional autonomy in raising barriers to entry. Much of the regulation contained in the synthetic indicator refers to both small and large retail establishments. For this reason we make use of two regulation indicators that only affect large retail establishments, i.e. the establishment of taxes (TAX) and outright bans (BAN) for/on large retail establishments. These indicators take values between zero and one, where a zero value indicates respectively that no taxes and outright bans are established in a particular region (for more details on these variables, see Matea and Mora, 2009). We expect a positive parameter for both variables, indicating that specific legal regulation on large establishments have effectively deterred the creation of new hypermarkets and shopping centers. Since there is a large construction lag between the opening of a new establishment and the decision to enter in a particular market, these variables are lagged five periods.

As mentioned in the introduction section, since 1996 entry of large retail stores requires approval of both municipal and regional authorities, i.e. it requires two licenses. The stringency of entry deterrence though the approval of these two licenses might diver from region to region, and from one to another commercial area, because the approval policy is likely related to electoral results. Consistent with the considerable political weight of local middle-class homeowners and small retailers in the nationalist parties (such as *Partido Nacionalista Vasco*, PNV, and *Convergencia i Unió*, CiU), we expect that these parties tend to protect traditional stores as a way to shore up electoral constituencies. Left and social-democrat parties (such as *Partido Socialista Obrero Español*, PSOE and *Izquierda Unida*, IU) also tend to protect traditional stores as a way to enhance employment in these businesses and to protect underprivileged families that usually live in urban areas and cannot easily drive to large out-of-town establishments. On the other hand, national center-right parties (such as *Partido Popular*, PP) usually represent the interests of not only small private employers but also large employers and hence they try to not introduce more legal or administrative restrictions on any private business.

[20] This variable was constructed using the unemployment rate with respect to the registered population provided by La Caixa, whose definition is quite different to that used by the Survey of the Working Population (EPA).

[21] In order to capture the fixed costs associated with the opening of new establishments in some industries, Bresnahan and Reiss (1991) used the price of cultivated land. De Juan (2006) also used the housing price as a proxy for the fixed cost of bank branches.

Following Bertrand and Kramarz (2002) and Sadun (2008) that analyze respectively the employment effects of planning regulations in the UK and France, we use several electoral variables based on the percentage of votes obtained by each party in both regional and municipal electoral constituencies in order to check whether the concession of licenses depends on the political profile of both regional and municipal governments. In particular, we use three regional dummies (REGPP, REGNAT, REGPSOE) that take the value one when respectively the percentage of votes obtained by PP party, the nationalist parties and the PSOE party in the regional constituencies is higher than 40%, and zero otherwise. This allows us to identify which party is, (alone or with other party in coalition) in the government of a particular region. Since large establishments are usually located in (or close to) the main municipality of the commercial area, we also have constructed similar dummy variables (MUNPP, MUNNAT, MUNPSOE) using the municipal electoral results of the main municipalities.

The dependent variable in our empirical models is the logarithm of one plus the number of large retail establishments, ln(NUM+1). We have added one unity to the number of stores in order to avoid taking logs when NUM is zero. As mentioned in the previous section, we have constructed the variable NUM as the number of establishments located in the main municipality of a particular commercial area and those located within a radius of 30 kilometers.[22]. The locations of all hypermarkets and shopping centers are obtained from the list of all the shopping centers in Spain in 2007 (*Directorio de Centros Comerciales*) included in the *Anuario* elaborated by *La Caixa*. This directory also provides information on the opening year, the store selling area, and other facilities. On the other hand, *La Caixa* database also provides details about the distance of each municipality from the lead municipality of the commercial area they belong to. With this information and the location of each shopping center (namely the municipality and town each store belongs to) we have identified the establishments located within a radius of 30 kilometers.

A summary of the descriptive statistics for the above variables are shown in Table 3.

[Insert Table 3 here]

6. Results

Several specifications of the market structure of equation (14) were estimated using MLE. In all specifications we used a half-normal distribution (i.e. we have assumed that μ=0) in order to avoid the well-known convergence problems when both μ and σ parameter are estimated (see Ritter and Simar, 1997). The results are presented in Table 4. We have also estimated several models using as dependent variable the aggregate selling area of all the large retail establishments belonging to the same commercial area. They are not showed in Table 4 because the main results regarding either the demand and cost shifters, and regulation and political variables were almost the same.

[Insert Table 4 here]

[22] In a previous version of the paper we found that the main results were invariant to the selection of a broader definition of the geographic market by using, for instance, a 40 kms criteria to count the number of competitors in a commercial area (see Orea, 2008).

The indicator of the relative importance of noise and unobserved entry costs, $\lambda = \sigma_{\varepsilon}^{2} / \sigma^{2}$, in all estimated models is statistically significant and close to one, indicating the existence of important unobserved entry costs. For large retail establishments this result is quite reasonable given that the opening of a new establishment requires getting the licenses, developing the land, building the establishment, etc. For these reasons retail developers suggest an average construction lag between four and five years.

The demand driver, lnCONSUM, in all estimated models has a significant and positive effect on the number of large retail stores, indicating that market size reflected in the overall consumption capacity of the population living in the commercial area is clearly an important determinant of market structure (for a similar results in terms of population see Manuszak and Moul, 2008). However, while an increase of 1% in consumption capacity yields roughly a 0.85% increase in the number of large establishments, this increase in consumption capacity yields a 1.24% increase in the surface of this store format when the aggregate selling area is used as dependent variable. This indicates that the average size of large establishments increases with consumption capacity.

In order to control for demand heterogeneity, we have included the proportion of consumption that correspond to the main municipality (PROCON), and the average distance from the main municipality of all municipalities of the commercial area (DISTANCE). As expected, while the effect of PROCON on the number of retail establishments is positive and statistically significant, the effect of DISTANCE is negative and statistically significant. Taken together these results suggest that differences in demand structure among local markets should be controlled for when analyzing the effect of regional barriers to entry on market structure.

As we expected, the occupation rate in the commercial area, OCURATE, has a negative effect on the number of competitors in a particular market. Remember that this variable was chosen as a proxy for labor wages and other labor expenses. Hence, this result indicates that the number of stores depends on this type of cost.[23] The second cost variable is the real estate price, RESTAPR. The estimated parameter for this variable is always negative as expected, but in some of the specifications it is not statistically significant.

In Model 2 we have added the legal barriers established by each region to the entry of large stores, i.e. the establishment of taxes (TAX) and outright bans (BAN).[24] Remember that both variables are lagged five periods because the large construction lag between the opening of a new establishment and the decision to enter in a particular market. Note also that entry barriers enter the equation with a negative sign. Hence, a positive coefficient indicates that the regulation variable has a negative effect on the number of establishments. As expected, we have got a positive and statistically significant parameter for both variables, indicating that taxes and outright bans have increased entry costs and hence they have effectively deterred the creation of new

[23] The effect in terms of surface was also negative and statistically significant.

[24] One might consider that both regulation variables could be endogenous if the decision to introduce regulation depends on the presence of hypermarkets and shopping centers. However, we expect that this issue is not relevant in this application as the regulation variables are defined at a regional level and each region includes several local markets. That is, unobserved demand and cost shocks that affect the number of large establishments located in a particular local market are unlikely to determine the regional regulation variables.

hypermarkets and shopping centers.[25] In summary, the above results corroborate the Spanish Competition Authority's statement that the entry of large retail establishments was effectively deterred by regional regulation. This reduced number of large retail establishments is likely to have harmed consumers' welfare due to the reduced variety of retail products and the higher prices they probably pay for the products they purchase from nearby hypermarkets compared to those they would have paid with free entry.

The following two models, i.e. Model 3 and 4, are focused respectively on the effect of regional and municipal electoral results. In particular, in Model 3 we added to Model 2 the three regional dummies REGPP, REGNAT, and REGPSOE. These variables identify the type of political party that likely is in the government of a particular region. While REGPP and REGPSOE are not statistically significant, REGNAT is positive and statistically significant. This seems to suggest that "nationalist" regions tend to raise barriers to entry compared to other regions. This higher entry deterrence can be achieved either by increasing the stringency of the legal barriers to entry (establishing, for instance, taxes, outright bans and other administrative restrictions) or though a more stringent approval policy when granting regional licenses. In the last models we try to distinguishing among these two alternatives.

In Model 4 we replace the regional electoral dummies by the municipal ones, i.e. MUNPP, MUNNAT, and MUNPSOE. These variables identify the type of political party that likely is in the government of the main municipality of each commercial area. The parameter estimates indicate now that not only nationalist parties but also the PSOE party tend to raise, though a more stringent approval policy, the barriers to entry in their commercial area.

In Model 5 we use both the legal barriers established by each region to the entry of large stores and the regional electoral dummies. Two comments are in order. First, the parameter estimate of TAX is positive but not statistically significant. This suggests the existence of some correlation with the regional electoral dummies. Taxes for large retail establishments were only established by a few regions since 2001, including Catalonia where nationalist parties have always been in the government of that region. This is the reason why REGNAT is positive and statistically significant. On the other hand, TAX is probably not statistically significant because there are only a few remaining observations (corresponding to Aragón and Asturias) with taxes for large establishments. In summary, due to taxes for large establishments are a recent phenomena and we still do not have enough observations, it is not clear whether the variable TAX is capturing the pure effect on market structure of taxes or is capturing a more stringent approval policy of nationalist parties. A longer time period would probably allow us to distinguish between both effects. Regarding the outright bans, the coefficient of BANS is statistically significant and higher than in Model 2. As expected, this indicates that outright bans have deterred the opening of new large stores, ceteris paribus the regional electoral results.

The last model (Model 6) adds two interactions between regional and municipal electoral results of both PP and PSOE parties. Since 1996 entry of large retail stores requires two licenses, i.e. it requires approval of both municipal and regional authorities. Hence, the opening of a particular large store can be stopped either the

[25] The effect on aggregate selling area of taxes was higher. This result is reasonable due to these taxes are defined in term of surface. We have not got however a significant effect on aggregate selling area of outright bans.

municipal or the regional authority deny its license. We have found in Model 3 that the regional PP party does not tend to raise, though a stringent approval policy, the barriers to entry in their region. However, the positive and statistically significant coefficient we get for the interaction between REGPP and MUNPSOE in Model 6 indicates that this flexible regional approval policy is not effective when the main municipality is governed by the PSOE party. That is, while some applications have been approved by the regional authority, they have been block by local left-social-democrat authorities. The coefficient of the opposite interaction, i.e. between REGPSOE and MUNPP is not statistically significant, indicating that the dominant approval policy is that followed by the regional left-social-democrat authorities.

Once we have examined the estimated coefficients of the market structure equation, entry efficiency scores can be estimated for each market using the Jondrow *et al.* formula by decomposing the estimated residual into a noise component and a barriers-to-entry component. We have applied this formula using the parameter estimates of our preferred model, Model 6 in Table 4. The efficiency scores classified by years are showed in Table 5.

Since our dependent variable is the logarithm of one plus the number of large retail establishments, the Jondrow *et al.* formula yields an estimate of the so-called Alternative Entry Efficiency index (8). Given (14), the stochastic specification of the AEE index can be written as:

$$AEE_{mt} = \frac{N_{mt} + 1}{\left(N^*_{mt} + 1\right)e^{\varepsilon_{mt}}} = e^{-u_{mt}} = e^{-\exp(b_{mt}'\alpha)\cdot\theta_{mt}} \tag{15}$$

where the denominator is the stochastic maximum number of stores (plus one) that would exit in case of no entry cost or entry barriers. The relative importance of entry cost and barriers to entry in a particular local market can be measured as one minus the AEE index. By definition, this new variable (labelled DEFICIT) measures in percentage terms the deficit of establishments in a particular market. In addition, using (15) and the efficiency scores we can also estimate the potential number of stores that would exit in a particular market.

It is also worthy to note that the right hand side of (15) indicates that the AEE index measures the effect of both *observable* barriers to entry created by regional and/or municipal governments captured by $exp(b_{mt}'\alpha)$, and *unobservable* entry cost captured by θ_{mt}. However, we can define an entry efficiency index only associated to *unobservable* entry cost and barriers to entry. This Unobservable Entry Efficiency index (UEE) can be written as:

$$UEE_{mt} = e^{-\theta_{mt}} \tag{16}$$

The results in Table 5 show that the average AEE efficiency score is about 73%. This indicates that the average deficit of establishments in all local markets is about 27%. This outcome suggests therefore that in the hypothetical case of no entry cost or entry barriers the number of stores would increase in a 27%. As mentioned above, this magnitude suggests in turn the existence of large entry cost for big retail stores. The UEE index increases over the whole period, indicating a reduction of *unobservable* entry cost. However, the AEE index decreases since 2004, indicating an increase of barriers to entry attributed to regional and/or municipal governments. The different between both efficiency indexes is about 3.8 percentage points, which represent a 17% of the overall deficit of large retail establishments. Hence we can conclude that regional legislation (in particular, taxes and outright bans) and the entry deterrence though the approval policies of both municipal and regional authorities represent a 17% of the overall large establishments' entry cost.

[Insert Table 5 here]

The entry efficiency scores using both the AEE and EE index and the associated deficit of establishments classified by regions are showed in Table 6 (see also Figure 3). Note that while the AEE index is calculated using the full sample, for the EE index we have excluded local markets with no large establishments and hence with efficiency scores equal to zero. As expected the AEE index is higher than the EE index, and hence the alternative entry efficiency index tends to overestimate (underestimate) the right entry efficiency index (the real deficit of large establishments).

[Insert Table 6 here]

[Insert Figure 3 here]

Using both efficiency indexes, Madrid is the region with the highest entry efficiency score (about 84%), followed by Castille-La Mancha, Canary Islands and Cantabria, with AEE scores close to or higher than 78%. On the other hand, the regions with the lowest entry efficiency scores are Catalonia and Baleares with scores between 61% and 57%. Remember that AEE index measures the effect of both *observable* (i.e. created by regional and/or municipal governments) and *unobservable* barriers to entry. In Table 7 we show the UEE indexes that are not associated to *observable* barriers to entry created by regional and/or municipal governments. The deficit indexes are in turn represented in Figure 4.

[Insert Table 7 here]

[Insert Figure 4 here]

The results in Table 7 allow us to identify the regions where the establishment of taxes and outright bans and/or the regional and municipal approval policy explain an important portion of the efficiency indexes showed in Table 6. Note that in most of the regions the ratio AEE/UEE is quite close to one, except for three regions: Basque Country, Catalonia, and Balearic Islands. In these three regions the UEE index is quite larger than the AEE, indicating that the legal and political barriers to entry created by regional and/or municipal governments have been quite effective. Moreover, Figure 2 suggests that in these regions the different between both efficiency indexes is about 14 percentage points in the Basque Country and Balearic Islands and about 21 points in Catalonia. These numbers suggest that legal and political barriers to entry explain about 50% of the deficit of large retail establishments in the Basque Country and Catalonia, and about 40% in The Balearic Islands.

In Table 8 we show the efficiency scores we have got for each local market, grouped by regions. The dispersion of the efficiency scores is often high within a particular region, indicating that there are significant within-differences in entry costs among local markets and hence that a regional approach is not appropriate when measuring entry costs and barriers to entry. On the other hand, since most observed barriers to entry are constructed at regional levels (TAX, BANS and regional electoral results), the differences in a particular region reflect differences in unobserved barriers to entry or differences in enforcement of regional entry restrictions by local governments. This table might suggest that regional legal entry restrictions were enforced to differences degrees in each local market, and that in some local markets differences in enforcement have notably aggravated the entry restrictions imposed by regional legislators.

[Insert Table 8 here]

7. Conclusions

Recent studies have shown that barriers to entry for large retail establishments promoted by Spain's autonomous regions have been increased in the last decade In the present paper we try to test whether the entry of large retail establishments was effectively limited by regional regulation, and whether the approval policy is related to electoral results., To achieve these aims we merge the literatures on stochastic production frontiers and on barriers to entry by estimating a frontier entry model. One advantage of the proposed frontier approach is that it allows us to capture either observed and non-observed entry costs or barriers to entry. In order to control for market heterogeneity and aggregation errors that might bias our empirical results, we use a local market approach. This allows us to check whether a regional approach is appropriate when measuring entry costs and barriers to entry in the Spanish retail market.

We have found that the approval policy of nationalist parties (for instance, PNV and CiU) is more stringent than the approval policy of other political parties, such as PP and PSOE. As expected, outright bans have deterred the opening of new large stores, ceteris paribus the regional and municipal political results. However, to distinguish the effect of taxes for large establishments from the effect of the more stringent approval policy of nationalist parties we need a longer data set.

The estimated average entry efficiency score is about 73%, indicating that entry costs have decreased the number of large establishments by some 27%. This magnitude suggests in turn the existence of significant entry cost for large retail stores. While Madrid is the region with the highest entry efficiency score, followed by Castile-La Mancha, Canary Islands and Cantabria, the regions with the lowest entry efficiency scores are Catalonia and the Balearic Islands with scores between.

We have also found that, on average, regional legislation (in particular, taxes and outright bans) and the entry deterrence though the approval policies of both municipal and regional authorities represent a 17% of the overall large establishments' entry cost. However, we have found that the legal and political barriers to entry created by regional and/or municipal governments in The Basque Country, Catalonia, and The Balearic Islands have been especially quite effective. Indeed, the deficit of large retail establishments in the Basque Country and Catalonia is about 50% and in Balearic Islands is about 40%. These results corroborate the Spanish Competition Authority's statement that the entry of large retail establishments was effectively deterred by regional regulation.

In addition, we have found that the entry restrictions imposed by regional legislators were enforced to different degrees in each local market. The notable within-region dispersion of the estimated efficiency scores suggests the existence of significant differences in entry costs among local markets, suggesting in turn using a local rather than regional approach to analyze entry costs and barriers to entry in the Spanish retail industry.

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Table 1. Legal Barriers to Retail Distribution by Region, 1996–2005

	Location definition of large firm	*Multiple criteria to define large firms*	*Ownership Definition*	*Idiosyncratic definition of large firm*	*Restriction in the transfer of ownership*	*Financial viability plan*	*Outright ban*
Andalusia	x			x			x
Aragón	x						x
Asturias				x	x		x
The Balearic Islands	x	x	x				x
The Canary Islands	x						x
Cantabria				x			x
Castile-La Mancha							
Castile and León	x						x
Catalonia	x				x	x	x
Madrid	x			x	x		
Valencian Community	x						
Extremadura	x						
Galicia	x						
La Rioja	x						
Murcia	x			x			
Navarra	x			x	x		x
The Basque Country	x	x	x				x

Source: Spanish Competition Authority (TDC, 2003) and Hoffmaister (2006).
Note: The symbol "x" denotes whether a specific region has imposed the barrier type listed in the column header at some time during the period 1996–2005.

Table 2. Retail market regulation level by region

Region	*1997*	*2007*	*Rate of growth (%)*
Andalusia	35	53	51.4
Aragón	41	56	36.6
Asturias	35	62	77.1
The Balearic Islands	40	51	27.5
The Canary Islands	45	56	24.4
Cantabria	33	47	42.4
Castile and León	38	51	34.2
Castile-La Mancha	33	41	24.2
Catalonia	41	54	31.7
Valencian Community	46	44	-4.3
Estremadura	33	58	75.8
Galicia	41	33	-19.5
Madrid	32	42	31.3
Murcia	35	53	51.4
Navarra	39	63	61.5
La Rioja	40	38	-5.0

Source: Matea and Mora (2009)
Note: They do not provide the aggregated indicator for The Basque Country due to its inclusion made the factorial analysis worse, and changed significantly the other scores.

Table 3. Descriptive statistics

Variable	**Mean**	**Std**	**Min**	**Max**
ln(NUM+1)	1.362	0.910	0	4.736
lnCONSUM	6.643	1.111	3.932	9.636
PROCON	38.044	12.427	12.748	67.925
DISTANCE	27.021	11.477	4.909	59.309
OCURATE	95.901	1.475	91.448	98.825
RSPRICE	2.406	1.177	0.660	4.890
BANS	0.094	0.261	0	1
TAX	0.034	0.174	0	1
REGPP	0.493	0.501	0	1
REGNAT	0.145	0.352	0	1
REGPSOE	0.309	0.463	0	1
MUNPP	0.625	0.485	0	1
MUNNAT	0.066	0.248	0	1
MUNPSOE	0.151	0.359	0	1
REGPP*MUNPSOE	0.099	0.299	0	1
REGPSOE*MUNPP	0.237	0.426	0	1

Table 4. MLE estimates

	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*		*Model 6*	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Constant	4.229	3.725	3.813	3.401	1.931	1.535	2.352	1.954	3.187	3.001	2.464	2.176
lnCONSUM	0.862	42.842	0.855	42.815	0.853	41.015	0.856	42.344	0.832	43.124	0.843	42.143
PROCON	0.019	11.236	0.018	10.752	0.017	9.716	0.018	10.191	0.016	9.713	0.016	9.524
DISTANCE	-0.013	-6.745	-0.014	-7.249	-0.015	-7.642	-0.014	-7.333	-0.014	-7.333	-0.015	-7.782
OCURATE	-0.089	-7.730	-0.084	-7.349	-0.064	-5.165	-0.069	-5.716	-0.076	-6.976	-0.069	-6.001
RSPRICE	-0.038	-1.993	-0.032	-1.743	-0.020	-1.116	-0.022	-1.184	-0.016	-0.892	-0.014	-0.743
BANS			0.437	2.558	0.582	2.229					0.488	2.500
TAX			0.534	2.315	0.032	0.131					0.052	0.207
REGPP					0.020	0.094	-0.017	-0.117			-0.052	-0.330
REGNAT					0.722	2.152	0.631	3.076			0.756	3.277
REGPSOE					-0.200	-0.871	-0.171	-0.972				
MUNPP									0.124	0.933		
MUNNAT									0.786	3.466		
MUNPSOE									0.822	4.503		
REGPP*MUNPSOE											0.433	2.254
REGPSOE*MUNPP											-0.043	-0.237
sigma	0.461	13.904	0.432	13.655	0.375	5.976	0.414	8.250	0.358	11.352	0.370	9.115
lambda	1.515	4.316	1.392	4.124	0.991	1.716	1.260	2.920	1.008	3.223	1.043	2.689
Mean log-likelihood	-0.344		-0.329		-0.300		-0.311		-0.298		-0.294	
Number of cases	456		456		456		456		456		456	

Table 5. Entry efficiency scores and deficit of establishments by years

Year	N	N*(·)	AE Index	100-AE	UE Index	100-UE
2002	4.9	7.0	71.6	28.4	75.2	24.8
2003	5.3	7.4	73.3	26.7	76.4	23.6
2004	5.6	7.7	73.9	26.1	76.9	23.1
2005	5.9	8.0	73.7	26.3	77.1	22.9
2006	6.1	8.2	73.4	26.6	77.9	22.1
2007	6.1	8.3	73.2	26.8	78.4	21.6

Table 6. Entry efficiency scores and deficit of establishments by regions

	Full sample			Selected sample (a)		
Region	Obs	AEE Index	100-AEE	Obs	EE Index	100-EE
Andalusia	72	74.0	26.0	66	69.0	31.0
Aragón	36	76.3	23.7	12	66.8	33.2
Asturias	18	76.7	23.3	18	73.0	27.0
The Balearic Islands	18	61.1	38.9	6	68.5	31.5
The Canary Islands	18	78.0	22.0	18	74.6	25.4
Cantabria	6	78.0	22.0	6	75.0	25.0
Castile and León	66	76.8	23.2	56	69.0	31.0
Castile-La Mancha	36	78.8	21.2	36	71.6	28.4
Catalonia	48	57.1	42.9	33	50.7	49.3
Valencian Community	18	76.4	23.6	18	73.6	26.4
Estremadura	24	77.6	22.4	24	68.6	31.4
Galicia	42	73.5	26.5	42	66.8	33.2
Madrid	6	84.1	15.9	6	84.0	16.0
Murcia	18	72.9	27.1	18	65.1	34.9
Navarra	6	74.8	25.2	6	70.9	29.1
The Basque Country	18	70.6	29.4	18	67.5	32.5
La Rioja	6	73.8	26.2	6	66.3	33.7

(a) The average of the Efficiency Index excludes local markets with no large establishments.

Table 7. Entry efficiency scores and deficit of establishments by regions

Region	Obs	AEE	UEE	AEE/UEE	100-AEE	100-UEE
Andalusia	72	74.0	75.1	0.99	26.0	24.9
Aragón	36	76.3	77.6	0.98	23.7	22.4
Asturias	18	76.7	77.6	0.99	23.3	22.4
The Balearic Islands	18	61.1	75.5	0.81	38.9	24.5
The Canary Islands	18	78.0	78.0	1.00	22.0	22.0
Cantabria	6	78.0	79.6	0.98	22.0	20.4
Castile and León	66	76.8	76.2	1.01	23.2	23.8
Castile-La Mancha	36	78.8	79.9	0.99	21.2	20.1
Catalonia	48	57.1	78.4	0.73	42.9	21.6
Valencian Community	18	76.4	75.3	1.01	23.6	24.7
Estremadura	24	77.6	76.7	1.01	22.4	23.3
Galicia	42	73.5	74.7	0.98	26.5	25.3
Madrid	6	84.1	83.3	1.01	15.9	16.7
Murcia	18	72.9	75.2	0.97	27.1	24.8
Navarra	6	74.8	74.5	1.00	25.2	25.5
The Basque Country	18	70.6	85.0	0.83	29.4	15.0
La Rioja	6	73.8	72.7	1.02	26.2	27.3

Table 8. Deficit of establishments by commercial areas

Region	Commercial Area	Deficit	Region	Commercial Area	Deficit
Andalusia	Almería	26.5	Castile-La Mancha	Albacete	21.5
	Algeciras	26.3		Ciudad Real	20.6
	Cádiz - San Fernando	32.7		Cuenca	16.9
	Jerez de la Frontera	16.6		Guadalajara	21.4
	Córdoba	24.7		Talavera de la Reina	26.7
	Granada	27.3		Toledo	20.4
	Huelva	23.6	Catalonia	Barcelona	32.4
	Jaén	37.4		Manresa	41.3
	Úbeda	21.7		Vic	54.1
	Málaga	22.5		Figueres	28.9
	Ronda	33.2		Girona	63.5
	Sevilla	20.1		Olot	45.2
Aragón	Barbastro	18.3		Lleida	48.4
	Huesca	21.2		Tarragona	29.3
	Monzón	21.8	Valencia	Alicante	21.7
	Teruel	30.5		Castellón de la Plana	26.0
	Calatayud	21.4		Valencia	23.1
	Zaragoza	29.0	Extremadura	Badajoz	24.1
Asturias	Avilés	21.6		Don Benito	21.4
	Gijón	26.7		Cáceres	22.8
	Oviedo	21.6		Plasencia	21.2
The Balearic Islands	Eivissa	50.3	Galicia	A Coruña	31.1
	Maó	37.3		Ferrol	20.9
	Palma de Mallorca	29.1		Santiago de Compostela	41.6
The Canary Islands	Arrecife	17.9		Lugo	19.7
	Las Palmas de Gran Canarias	19.8		Ourense	27.6
	Santa Cruz de Tenerife	28.3		Pontevedra	18.2
Cantabria	Santander	22.0		Vigo	26.8
Castile and León	Ávila	18.2	Madrid	Madrid	15.9
	Burgos	24.7	Murcia	Cartagena	26.0
	León	24.6		Lorca	33.6
	Ponferrada	21.6		Murcia	21.8
	Palencia	33.0	Navarra	Pamplona	25.2
Castile and León	Ciudad Rodrigo	21.1	The Basque Country	Vitoria	39.8
	Salamanca	19.7		San Sebastián	18.4
	Segovia	25.5		Bilbao	30.0
	Soria	24.7	La Rioja	Logroño	26.2
	Valladolid	20.6			
	Zamora	21.9			

Figure 3. Deficit of establishments by region (AEE and EE)

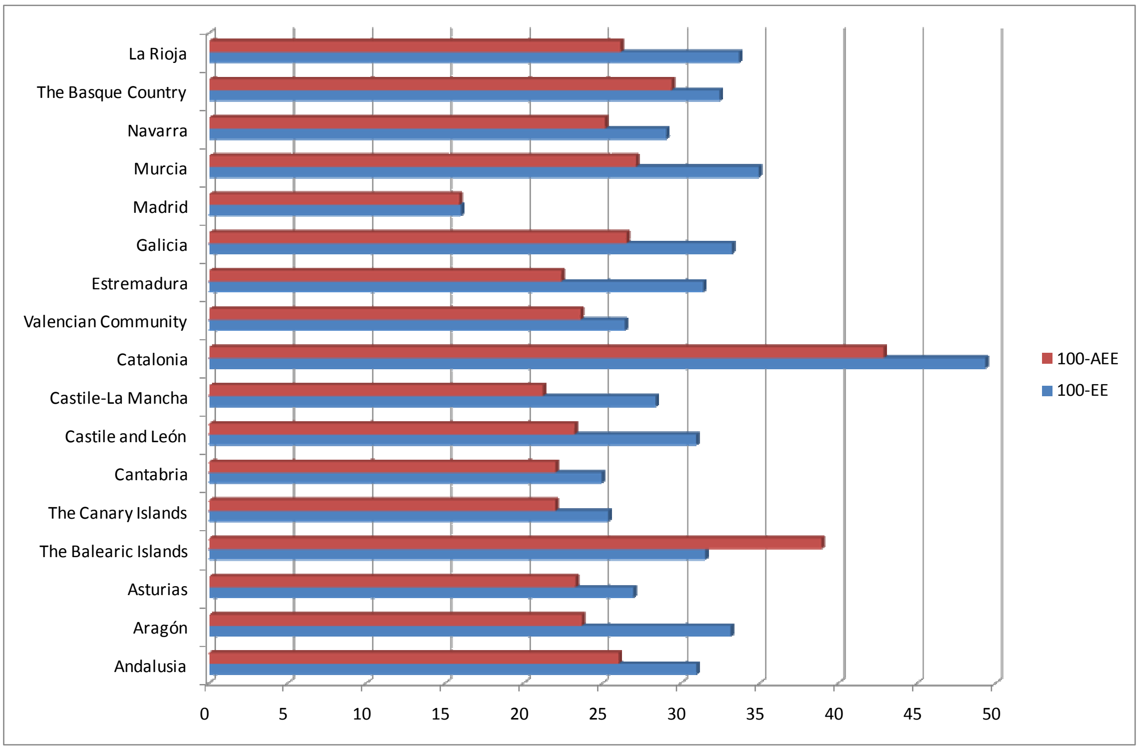

Figure 4. Deficit of establishments by region (AEE and UEE)