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Retail Shocks and City Structure

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Abstract
This paper evaluates the consequences of opening out-of-town big-boxes on the commercial structure of cities. I use a discontinuity in a commercial regulation in Spain that restricts the entry of big-box stores in municipalities of less than 10,000 inhabitants for the period 2003 to 2011. I then use this discontinuity as an instrument for the big-box opening. The results show that three years after the big-box opening, around 15% of the grocery stores in the municipality have disappeared. However, some of the empty commercial premises are taken by other new small retailers in other sectors. As a result, the total number of retail stores in the municipality remains unchanged. These results show that a retail shock in the suburbs does not necessarily empty the city center but can also change only the composition of its commercial activity.

Key words: retails shocks, city structure, small stores, commercial activity
JEL Codes: D2; J22; L81; R1

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1. Introduction

Before 1990, many European countries underwent increasing market liberalization. As a consequence of which the retail sector, and the food retail sector in particular, expanded greatly with the opening of many new supermarkets. In the Spanish case, the five biggest supermarket chains opened their first stores in the 1970s, and by 1990 they accounted for 45% of the market, according to figures published by the Spanish Ministry of Economy[2]. In this way, a highly traditional sector, made up primarily of city center grocery stores, found itself up against a new type of competitor. The economic consequences of the opening up of these new supermarkets, typically out-of-town big-boxes, became an important policy concern in most countries. In particular, the main concern was (and still is) the impact of these stores on the quality of cities and their structure (see, for example, Basker, 2007, for an analysis of the impact of the growth of Wal-Mart, one of the biggest big-box chains in the US). However, the proponents of big-box stores argue that they tend to push prices down, making consumers better off when they locate in their municipalities. In response, throughout the 1990s, many European countries, most notably the UK, Italy and France, introduced stringent policies to restrict the entry of big-box stores, or, at least, implemented controls on the type of store that could be built and where they could locate.

In this paper, I exploit a similar regulation introduced in Spain in 1997 to evaluate the effects that the opening of such big-boxes have on the commercial structure of the city where they open. More specifically, I use the fact that cities fell under this regulation or not according to a population threshold. Implementing a fuzzy Regression Discontinuity Design, I test whether the opening of big-box stores is emptying the city center of commercial activity. The results show that non-regulated municipalities experience 0.3-0.4 more big-box openings than regulated municipalities, or roughly 16% more. As a consequence, three years after the first big-box opening, around 15% of the grocery stores in the area disappear, offering clear evidence that city centers are losing part of their economic activity. However, the results on other retailers also indicate that this loss in grocery stores is compensated by the arrival of other type of small retailers. Almost 60% of the new shops are devoted to home products, whereas the rest is much diversified. Additionally, results on the total number of shops – grocery and other – show that the overall number of stores in the municipality remains unchanged. These results point out that most of the recent concerns about big-box store openings hollowing out the city center of small/medium cities are relatively unlikely to occur.

[2] Informe de Distribución Comercial 2003 (http://www.comercio.mineco.gob.es/es-ES/comercio-interior/Distribucion-Comercial-Estadisticas-y-Estudios/Pdf/InformeDistribucion_2003.pdf)

I also examine whether these effects differ according to the location of the big-box (city center vs. out-of-town) and the type of the big-box opened (conventional vs. discount). The results show a significant difference between big-box stores operating closer to the city center and those operating clearly in the suburbs. Moreover, they also show that conventional big-box stores (as opposed to discount ones) are the ones forcing to pull down grocery stores' shutters.

Several papers have examined the impact of planning (and/or commercial) regulations in the retail sectors of various countries. For instance, Bertrand and Kramarz (2002) exploit a French regulation requiring regional approval for the opening of large retail stores. They show that this barrier to entry and high levels of concentration among large retail chains significantly reduce retail employment, stemming its growth rate. Schivardi and Viviano (2011) exploit a similar regulation in Italy and, using political variables as instruments, find that this entry barrier is associated with substantially larger profit margins and lower productivity of incumbent firms. Griffith and Harmgart (2008), for the UK case, build a theoretical model allowing for multiple store formats and introduce a restrictive planning regulation. They find that planning regulations have an impact on market equilibrium outcomes, although not as large as suggested by the previous literature. Haskel and Sadun (2012), also focusing on the UK retail sector, find that by preventing the emergence of more productive, large format stores and by increasing the costs of space, planning policies impede the growth of the sector's total factor productivity (TFP). The same results are reported by Cheshire et al. (2015) in their examination of the effects of 'Town Centre First' policies in the UK's large supermarket sector. They find that such policies directly reduce output by forcing stores onto less productive sites.

Thus, the focus of the literature so far has been the direct productivity and employment effects of stringent regulations in the retail industry. In this paper, I change the object of analysis from the industry to the city. Although I make use of a similar regulation for identification purposes, the ultimate goal is to study the less direct consequences of these policies on other policy relevant issues such as city structure and city centers' activity.

The issues addressed in this paper are also closely related to another branch of the literature that examines the effects of big-boxes on grocery stores. Most studies here have analyzed the impact of Wal-Mart stores in the US. Basker (2005) reports an instantaneous positive effect of a Wal-Mart opening on retail employment, although the effect is halved five years after the opening. Others, including Neumark *et al.* (2008), using an instrumental variables approach, show that Wal-Mart openings have a negative effect on retail employment and wages in US counties. Haltiwanger *et al.* (2010) use data from grocery stores in the Washington DC metropolitan area to evaluate the effects of the first Wal-Mart opening on grocery stores and small supermarkets. They find negative

effects of the big-box on other retailers, especially for those located closest to the Wal-Mart facility. The same results are reported by Ellickson and Grieco (2011) in their analysis of a panel dataset for the years 1994 to 2006 for the whole country. Jia (2008) also evaluates the effects of Wal-Mart openings on grocery stores but, in line with the present paper, focusing on their exit decisions.[3] Finally, using household microdata in Mexico, Atkin et al. (2018) evaluate the effects of foreign supermarkets' entries on household welfare, finding that such entries reduced the cost of living for average Mexican households.

However, the European food retail sector works very differently from that in the US or Mexico, given the continent's different city structures and the agglomeration forces operating in its cities. Sadun (2015) is the only paper, to date, to analyze the European case. In a study of UK retailers, she finds that following the introduction of stringent policies, supermarket chains adapted the size of their outlets to the regulation resulting in stores that can compete even more directly with the grocery stores, harming them even more than before the policy. My findings showing the negative effects on grocery stores of closer-to-the-city-center big-boxes point in the same direction. Adopting a theoretical perspective, Uschev *et al.* (2015) build a model in which, combining spatial and monopolistic competition, they find that downtown retailers only gradually disappear when a big-box is sufficiently large. In line with this, my results also show that the opening of a big-box does not always translate in other shops disappearances but instead the city center changes its retail composition.

The contributions of this paper are threefold. First, the source of exogenous variation to study the effect of big-box store openings on a city's commercial structure is generated by the commercial regulation itself. This allows for a clearer identification than that of the current literature. In fact, the previous literature has relied on political instruments that exploit the fact that left-wing politicians tend to favor regulation (see Sadun, 2015 or Bertrand and Kramarz, 2002). My approach, instead, uses arbitrary population thresholds to generate quasi-random variation in commercial regulations directly and thus allows for an arguably cleaner identification. Second, to the best of my knowledge, all papers in the existing literature have focused on the direct productivity or employment effects of big-box store openings while this paper examines other outcomes – such as city structure – that have arisen as concerns in recent years and that could potentially drive new waves of regulations in the future. Finally, this is the first paper drawing on all available data for big-box openings and, hence, distinguishing the effects by location and type

[3] Other studies of the impact of Wal-Mart stores, including Basker (2005) and Basker and Noel (2009), focus on other outcomes such as grocery store prices.

of these stores. Previous studies in the US have been limited to the role played by Wal-Mart stores and studies in the UK have also focused on a unique retail company.

The rest of the paper is structured as follows. Section 2 presents the institutional setting as well as the regulation exploited while Section 3 introduces the different data sources. Section 4 states the empirical strategy and presents the results for the first stage estimations, i.e. the effect of the commercial regulation on big-box openings. Section 5 shows the results of the effect of big-box openings on grocery stores, other retailers and total number of shops and reports some robustness tests and heterogeneous effects. Section 6 concludes.

2. Institutional setting

Between 1985 and the mid-1990s, Spain experienced a change in its market structure with the complete international liberalization of the retail sector, affecting above all the food retail trade[4]. Thus, a market that had previously been dominated by independent grocery stores saw the arrival of the (mostly foreign) chain supermarket. These changes ushered in a major policy debate between those in favor and those opposed to trade liberalization and free market entry. This debate became even more heated when the supermarket chains began opening large out-of-town stores. The opponents of such stores argue that big-box openings create enormous externalities for the local community, including more pollution, distortions to the existing retail market structure and the hollowing-out of city centers. One of their main arguments is that these stores affect the pre-existing body of firms, especially small, traditional businesses, causing their eventual disappearance from the area.

To prevent this from happening and in response to the growing unrest in the sector, in 1996, the Spanish parliament passed the Retail Trade Law 7/1996. Among other things, this law aimed at restricting the entry of big-big stores.[5] The law required a developer seeking to open a big-box store in Spain to obtain a second license, in this case from the regional government, in addition to the municipal license. The fact that the two licenses (municipal and regional) had to be solicited from two different entities meant that big-box developers incurred an additional entry cost vis-à-vis other type of stores. While this was not a monetary cost, it did represent a considerable cost in terms of time and uncertainty given the amount of red tape that developers had to contend with in applying for this second license.

[4] Matea and Mora-Sanguinetti (2009) show an increase in restrictiveness from the late 1990s with respect to the previous decade

[5] The law also regulated store opening hours as well as licences for hard discount stores.

The central government opted to define a big-box as one with at least 2,500m^2. However, nine (out of Spain's seventeen) regions chose to strengthen the law by further limiting the number of square meters. This they did in line with the population of their municipalities. Thus, in smaller cities a more restrictive definition was placed on the size of big-box stores, making their market entry even more difficult. These measures were introduced between 1997 and 2004.[6] The regions adopted different arbitrary population thresholds below which the restrictions became more stringent. In my analysis, I focus on those municipalities centered around 10,000 inhabitants. For most regions, this was the lowest population threshold. This means that, for all regions, municipalities below the 10,000-population threshold restrict the opening of big-box stores, while municipalities above this threshold are non-regulated. Note that three regions did in fact define lower thresholds, but these are discarded because they do not provide enough observations to perform the analysis. Additionally, most Spanish municipalities are very small (almost 60% have less than 5,000 inhabitants), which means establishing a threshold above 10,000 would only capture restrictions for a specific set of large cities. Thus, using a larger threshold would not be operative here either. For the same reason, there will be more observations to the left of the threshold than there are to the right. Table 1 shows the specific details of the regulations – size restrictions and the year they were introduced – for the nine regions included in the analysis. Note that the definition of a big-box varies across the regions, ranging from 600 to 1,500 m^2. In the empirical analysis I use each region's specific definition, but I also include region fixed effects in all the estimations. As such, the analysis undertakes a within region comparison.

3. Data and sample

I use two different datasets to perform the analysis. First, data concerning the openings of big-box stores are drawn from a private dataset compiled by Alimarket, S.A, a company that generates information (from sources that range from news articles to databases) for different industries in Spain. I draw specifically on their food and beverages dataset and use their 2011 Census of Chain Supermarkets in Spain. I use the 2011 census because after that year, some of the affected regions modified some aspects of their commercial regulation, potentially affecting the identification of the question at hand. For each big-box, this census contains information on its date of opening, exact location, size (in square meters) and the chain to which it belongs. Although this is not a panel dataset, the time dimension can be added by exploiting the information on the date each

[6] Note that the adoption of the regulation was not a party-political issue as the nine regions were governed by different parties with different ideologies at the time of its introduction. Four regions had a socialist party in office, three were governed by a conservative party and the other two regions were governed by regional nationalist parties.

big-box store was opened. This means that, as with any census, the dataset only contains information on the stores surviving in 2011. However, the closure of a big-box store, especially in the period analyzed, is highly unlikely.[7] It should be stressed at this juncture that information regarding the number of licenses per municipality is unavailable, which means little can be said about the administrative process for the granting of licenses. Indeed, I am only able to observe those that met with success (i.e. the actual number of big-box openings per municipality and year). For information on grocery and other retail stores (i.e., the outcome variables), I use the *Anuario Económico de España* (AEE), a municipality dataset, for the period 2003 to 2011. This dataset includes detailed local demographic and economic variables for municipalities with more than 1,000 inhabitants. More specifically, in the case of the food retail sector, it records the exact number of stores in each Spanish municipality and year, classifying them in two categories: traditional stores (i.e. grocery stores) and supermarkets (i.e. chain stores, not necessarily big-boxes). The number of traditional stores is used to identify the effects of big-box openings on grocery store closures. According to the literature (for example, Bertrand and Kramarz, 2002) and anecdotal evidence from local planners in Spain (provided by Matea and Mora-Sanguinetti, 2009), four years would appear to be the plausible average time lag between applying for a license to build a big-box store and its eventual opening. This means that the effects of the 1997 regional regulation would not make themselves manifest until 2001 and so the period of analysis should start in 2001. However, the AEE only began distinguishing between grocery stores and supermarkets in 2003, further restricting the period of analysis from 2003 to 2011, the latter year corresponding to the Alimarket Census. In the case of the other retailers (i.e. the non-food stores), the AEE also splits them into different types. They are classified as clothes and shoes shops, home products shops – these being furniture, home appliances or home textile shops – and other retail shops – including stores such as book shops, beauty and perfumery or flower stores, among others. These different counts of shops will be used to analyze the effects of big-box openings on other retailers.

There are a number of other variables that may, at the same time, be influencing the numbers of big-box openings and grocery stores or other retail stores. In order to control for this, local economic and socio-demographic variables extracted from the Spanish National Institute of Statistics (INE) 2001 Census are used. Specifically, I use an index representing the average economic activity of each municipality, computed by the INE using data about the occupation and professional activity of the population in the municipality. Additionally, I also use two indicators

[7] Using the 2007 Census of Chain Supermarkets it can be verified that between 2007 and 2011 there were no big-box closures, that is, those stores operating before 2007 remained in the sample in 2011. This is indeed reassuring since the financial crisis took place in between both census and yet no big-box was closed.

of education levels: compulsory education and post-compulsory education, defined as a percentage of the overall local population. I also include the share of immigrants as a percentage of the overall population and the share of the services sector within a municipality's total activities. Finally, based on data from the AEE I also include the surface of the municipality, measured in km^2. Table 2 shows the descriptive statistics for the outcome variables, i.e. number of grocery stores, number of other retail stores by category and overall number of stores at the municipality level, as well as for the control variables. Their values are all presented around the threshold (+/- 3,000 inhabitants from the 10,000 threshold).

As discussed above, there is, on average, a four-year lag between the developers applying for a license and the big-box being opened. Therefore, as I only observe the date of opening but the regulation applies from the moment developers request the license, each opening has to be matched with its corresponding population at a point four years earlier – that is, I match the openings from 2003 to 2011 with population data from 1999 to 2007, respectively, as extracted from INE data. The initial pooled sample size comprises a total of 5,937 municipalities per year belonging to the nine regions that strengthened the central law. I restrict the sample to municipalities with between 1,000 and 30,000 inhabitants that did not have a big-box store before the onset of my period of analysis[8]. This shrinks the sample to 1,754 municipalities. I also exclude a further 92 municipalities that crossed the threshold before the opening happened. Finally, I only include municipalities once the region in which they lie has implemented the regulation; thus, for each year, I only observe the regulated regions' municipalities. This means that I can only estimate the post-regulation effect.[9] Table 3 reports the number of municipalities, i.e. the sample size, and the number of big-box openings per year.

4. Identification strategy

The openings of big-box stores are not randomly allocated in space or time. The main concern is that the same characteristics that determine the location of such big-box stores might be correlated with the outcomes of interest, either directly or through other unobservable characteristics. As a consequence, an OLS estimation of the effect would lead to problematic estimates. In order to overcome this problem, I use a Regression Discontinuity Design (RDD) framework to estimate the effects of big-box openings on cities' commercial structure. As discussed, to build a big-box

[8] Note that municipalities with less than 1,000 inhabitants are also excluded from the sample due to AEE data availability.

[9] It would have been interesting to estimate the before- and after-policy effects but, as the study period starts in 2003, I lack pre-regulation data for three of the regions.

store in a municipality of less than 10,000 inhabitants, a second regional license is required. However, this license should be seen as an additional barrier to entry, and not as a binding constraint. Therefore, this regulation only changed the probability of opening a big-box and hence, the setting requires the use of a "fuzzy" RDD, the crucial assumption being that there is a discontinuity in the probability of assignment at the threshold (see Imbens and Lemieux, 2008 and Lee and Lemieux, 2010 for a fuller discussion of "sharp" and "fuzzy" RDDs). In other words, the probability of establishing a big-box store jumps on crossing the threshold from regulated to non-regulated municipalities. This is the so-called 'first stage' that is used afterwards as an instrument in a two-stage least squares (2SLS) regression to identify the causal effect. In this section, I begin by examining this first stage; that is, testing whether there are systematically more openings in non-regulated municipalities than there are in their regulated counterparts around the threshold.

The "fuzzy" RDD relies on the assumption that the probability of assignment to treatment jumps at a particular threshold and, as such, this can be used as a source of exogenous variation. However, this assumption needs to be tested. Figure 1 shows the jump in the number of big-box openings at the threshold. Panel (a) presents the results for a first order polynomial fit while panel (b) reports the results for a second order polynomial. In both cases I observe a jump at the threshold of around 0.3-0.4. This means that when crossing from regulated to non-regulated municipalities, there are, on average, 0.3-0.4 more big-box openings, corresponding to approximately 16% more openings than in regulated municipalities. We also see that there is very little difference when fitting polynomials of different order. In order to assess this more formally, I estimate variants of the following equation:

$$big\text{-}box\ openings_{it} = \alpha_{it} + \beta_{it} \cdot T_{it} + \gamma_{it} \cdot f(P_{i,t-4}) + \delta_t + \theta_r + X'_{it}\omega + \varepsilon_{it} \quad (1)$$

where $big\text{-}box\ openings_{it}$ is the number of big-box openings in municipality i up to time t, that is, the change in the stock of big-box stores up to time t. The variable that identifies the jump in treatment is T_{it}, which takes a value equal to one if the municipality is above the threshold and zero otherwise. The forcing variable is the four-year lagged population ($P_{i,t-4}$), which enters the equation using different polynomial degrees. The regression also includes a set of control variables (X'_{it}) and region and time fixed effects to control for time invariant region characteristics and countrywide shocks, respectively. Additionally, the region fixed effect controls for the fact that the regulation varies by region; thus, by incorporating this fixed effect, I am performing a within-region analysis. The controls are included in order to capture variables that might affect both big-

box store openings and the change in the number of either grocery stores or other retail stores. These are the pre-regulation levels of population, economic activity, education levels, size of the municipality (in km^2), immigration, unemployment rate and the importance of the services sector.

Table 4 presents the results of this first stage equation, i.e. the effect of commercial regulation on the number of big-box openings. The first four columns show the results of estimating equation (1) using polynomial regressions while the last three present the results of estimating the same equation using local linear regressions. For the polynomial regressions, I use first- and second-degree polynomial fits, which according to Figure 1 would seem to fit the data well.[10] Columns (1) and (2) show the results without the control variables while columns (3) and (4) report the results when including them. All the regressions seem to adapt well to the features presented by the raw data in Figure 1. The preferred estimation is the one in column (4), which presents a better fit and controls for observables that may be influencing both the outcome and the explanatory variable. Columns (5) to (7) report the results of local linear regression estimations using the Calonico et al. (2014a) methodology[11]. Column (5) presents the results for the optimal bandwidth while columns (6) and (7) show the results for half and twice the optimal bandwidth, respectively. All the results also show a jump in treatment at the threshold of around 0.3-0.4 – or slightly higher – coinciding with the graphical inspection.

One assumption of the RDD strategy is that the 'forcing' variable must be continuous at the threshold. In order to reject any manipulation of this forcing variable, I inspect the histogram of the population around the threshold. A more formal way of assessing this is to run local linear regressions of the density of the forcing variable on both sides of the threshold, as proposed by McCrary (2008). Figure 2 presents the results of both methods for examining the continuity of the forcing variable at the threshold. Panel (a) shows the histogram of the population using different bin widths: the largest width is 1,000 inhabitants; the mid-scale is 400 inhabitants and the smallest is 200 inhabitants. Panel (b) shows the results of the McCrary test. In both cases, we observe that the forcing variable is not discontinuous at the threshold. Interestingly, Foremny *et al.* (2017), in a study of Spanish local government manipulation of reported population levels to obtain higher transfers, conclude that municipalities around the 10,000 threshold do not misreport their population numbers as grants do not change at this threshold.

A further assumption that must be met in order for an RDD to work is that no other variable at the municipality level should experience a jump at the threshold to avoid confounding.

[10] I also estimated the regressions using a third-degree polynomial fit, but the polynomial turned out to be non-significant.

[11] Updated in Calonico, Cattaneo and Farrell (2017).

In order to test that this does not occur in this setting, at least for the observables, I examine the continuity of the control variables used in the regression (i.e. those reported in Table 2) at the threshold. I adjust local linear regressions on each side of the threshold for each of the control variables and plot them. Figure 3 shows the results. As can be seen, none of the control variables presents a jump at the threshold and, therefore, the coefficient previously estimated is only capturing the effect of the regulation on big-box openings.

In order to test the robustness of these first stage results, I estimate equation (1) again, but instead of using the sample of post-regulation municipalities, I perform the analysis using the non-regulated municipalities in each year, i.e. the pre-regulation sample. If this placebo exercise works, there should be no difference in the number of big-box openings around the threshold. Table 5 reports the results of this placebo test. The structure of the table is the same as that in Table 4, with the first four columns presenting the results for polynomial regressions with and without control variables and the last three columns showing the results for local linear regressions. All the estimations show that there is no difference between municipalities around the threshold prior to the regulation. Thus, this gives further support that the difference in the number of big-box openings at the threshold identified in Table 4 is due to the causal effect of the commercial regulation.

5. Results

In this section, I first present the results of the 2SLS regressions estimating the effects of big-box openings on grocery store closures, the closest competitors to the big-box stores. In addition, a number of robustness tests of these results as well as the potentially heterogeneous effects of the location and type of big-box opened are evaluated. Then, I evaluate the effects of big-box openings on other stores that are not competing directly with the big-box but populate the city center as well. Finally, I estimate the effects on the overall numbers of retail shops in the city center in order to evaluate the total effect on the cities' commercial structure.

5.1. The impact of big-box openings on grocery stores

I estimate the following 2SLS equation, where the key variable regarding the opening of big-box stores is instrumented with the treatment variable from the first stage (T_{it}) obtained when estimating equation (1):

$$\Delta\, grocery\ stores_{it} = \theta_{it} + \varphi_{it} \cdot big\text{-}box\ openings_{it} + \sigma_{it} \cdot g(P_{i,t-4}) + \varrho_t + \pi_r + X'_{it}\vartheta + \epsilon_{it} \quad (2)$$

where Δ *grocery stores*$_{it}$ is the change in the number of grocery stores between *t* and *t-n* (where *n* is between 1 and 6) aggregated at the municipality level. This equation is also estimated for the two different degrees of polynomial fit: a first-degree and a second-degree fit. As before, *big-box openings*$_{it}$ is the number of big-box openings in municipality *i* up to time *t,* so it also represents the change in the stock of big-box stores. The regression also includes the same control variables as in the first stage, (X'_{it}) as well as region and time fixed effects. The coefficient of interest is φ_{it}, which can be interpreted as the ratio between two "sharp" RDDs. The "intent-to-treat" estimation, i.e. a reduced form of the effect of T_{it} on *grocery stores*$_{it}$, is divided by β_{it} obtained from equation (1).

Table 6 presents the results of estimating the effects of big-box openings on grocery store closures using polynomial regressions. Note that I move away from estimating local linear regressions in the second stage due to the lack of observations around the threshold. Unlike the first stage which includes the whole sample, the second stage regressions are estimated in different periods of time. As a consequence, each municipality is only observed once in the regression and the number of observations reduces dramatically, especially around the threshold. However, as a robustness check, I do run local linear regressions in Table A1 columns (1) and (2) in the Appendix where the point estimates are consistent with the findings but non-significant since the small sample size pushes standard errors up. In columns (1) and (2) of Table 6, the control variables are not included, while in columns (3) and (4) they are. To test whether there are any effects of big-box openings on grocery stores, equation (2) is estimated using the change between *t* and *t-1*, *t* and *t-2*, *t* and *t-3*, *t* and *t-4, t* and *t-5* and *t* and *t-6*. Specifically, I estimate the equation separately for each of these six-time spans, their results being presented in each row of Table 6 and showing the cumulative effect as time passes from the first opening. As in Table 4, my preferred specification is the one in the fourth column. Examining the results in Table 6, it can be seen that the opening of big-box stores has some negative effects on the number of grocery stores, mostly after two years of the opening. Around five grocery stores have shut down two years after a big-box opening and the number of closures increases to between 8 and 9 stores by the end of the third year. To put these numbers into perspective, they should be compared with the means around the threshold reported in Table 2. Thus, losing between 8 and 9 grocery stores in the three-year period represents a loss of around a 15% of the existing grocery stores in an area where a big-box store has opened.

It is important to note that not all regions passed the law at the same time and some of them did so relatively late. As a consequence, despite presenting the results beyond three years

from the first opening, the results for the fourth, fifth and sixth differences do not include all the regions that strengthened the law but only those that did it first. However, it is reassuring to see that the regressions representing the effects four, five and six years after the opening present very similar coefficients to those of the third year after, showing that the impact seems to be concentrated within the first three years following the opening. In order to be able to work with the full sample, I will estimate all the remaining results in my paper using the longest time difference where I can observe everybody, i.e. *t* and *t-3*.

My baseline results are robust to different alternative specifications. Table A1 in the Appendix shows the results of estimating equation (2) in four different settings: using local linear regressions, including the municipalities that experienced an opening before the regional law was passed and using the three-year and five-year lagged population as the forcing variable. It also presents the first stage results for each of the four tests. All results show very similar results to those described before.

The previous results confirm the negative effect of big-box openings on the number of pre-existing grocery stores which are the direct competitors of the big-boxes. This implies that the commercial regulation restricting the opening of big-box stores may be fulfilling its main goal, namely, the protection of grocery stores. However, we need to evaluate any other indirect effects that this regulation may have. The most straightforward one is the impact that the entry of big-boxes could have on employment in the municipality. Typically, grocery stores in Spain are family-owned business that do not usually hire any extra staff. On average, the size of such stores is 0.98 employees plus the owner[12], giving an average total of 1.98 jobs per grocery store. Thus, for every grocery store forced to pull down its shutters, 1.98 jobs are lost. Using the coefficients from my preferred specification in Table 6, about 9 grocery stores were found to shut down three years after a big-box opening, which means a municipality loses around 18 jobs. However, this number needs to be put into perspective, as we have to consider the number of jobs created when a big-box store is opened. On average, a big-box store employs 42 employees.[13] Therefore, the net employment effect would be an increase of around 24 jobs. So, even if the commercial regulation is preventing the disappearance of grocery stores, it may also have an indirect negative net effect on *local* employment. Unfortunately, detailed data on employment figures at the municipality level for small and medium municipalities in Spain do not exist, so that I cannot test this back-of-the-envelope calculation rigorously. Such data are only available for municipalities beyond 40,000

[12] Extracted from the Spanish Ministry of Agriculture's database.

[13] This average is computed using data available in the 2011 Census of Chain Supermarkets, which reports (in some instances) the number of employees in big-box stores. The number has been corroborated by examining information available on the websites of the main chains of big-box stores in Spain.

inhabitants, a threshold far too big for the focus of this paper. However, these back-of-the-envelope calculations are consistent with the theoretical predictions and the policy recommendations made in Ushchev *et al.* (2015), who also find that big-box openings tend to hollow out city centers, but that the regulation should only be implemented when malls are not efficient enough to capture the whole market.

It is important to note that the above results also depend on the exact definition (size in square meters) of a big-box store. In fact, each region, as observed in Table 1, sets its own limits on what it considers a big-box store. Thus, it might be the case that chains seek to bypass the regulation by building stores just below the threshold (in order for the store not to be considered a big-box) and so they can avoid having to apply for a second license. Indeed, in the case of the UK, Sadun (2015) reports evidence of this actually happening, thus undermining the regulation. This paper has shown that opening a new big-box store reduces the number of grocery stores. Therefore, were we to observe a bunching of stores just below the threshold in those municipalities, this would only indicate that the previous results are biased towards finding a zero effect. Figure 4 presents the size distribution of chain stores computed using the 2011 Census of Chain Supermarkets dataset. It reports this distribution for municipalities below the 10,000 inhabitants' threshold. Given that the regions included in the study have different size definitions for a big-box store, the size axis has been normalized. As can be seen, there is indeed evidence of bunching just below the threshold, indicating that some chains have tried to avoid the regulation. Thus, this graph presents evidence that, while the previous findings indicate an impact of big-box openings on grocery stores, it may be an underestimate of the real effect, in terms of store closures.

5.2. Heterogeneous effects of big-box openings on grocery stores

My results so far describe the average impact of all big-box openings on grocery stores within the period analyzed, regardless of the specific characteristics of the big-box store opened. In this section, I evaluate whether the effects are driven by the location of the big-box – closer or further away from the city center – or the typology of big-box opened – conventional versus discount big-box stores. Note that the total number of big-box openings is 270 (Table 3). Of these, 72 were opened closer to the city centers while 198 were located clearly in the suburbs. Likewise, by typology, 106 correspond to discount supermarkets and 164 to conventional chain stores. The reason for exploring any (possible) geographical effects of big-box openings is that big-box stores opening in locations closer to existing grocery stores, i.e., in city centers, might be competing more directly with these small shops and harming them more (Sadun, 2015). On the other hand, it might

also be the case that certain complementarities are created between big-box and grocery stores, stimulating demand for non-substitutable products. To this end, I estimate the following equation:

$$\Delta\, grocery\ stores_{it} = \theta_{it} + \varphi_{it} \cdot big\text{-}box\ openings_{it} + \mu_{it} \cdot big\text{-}box\ openings_{it} \cdot location_{s} + \tau \cdot location_{s} + \sigma_{it} \cdot g\,(P_{i,t-4}) + \\ + \varrho_{t} + \pi_{r} + X'_{it}\vartheta + \epsilon_{it} \quad (3)$$

where $\Delta\, grocery\ stores_{it}$ is the change in the number of grocery stores between *t* and *t-3* aggregated at the municipality level, indicating only the cumulative effect three years after the big-box opening. The variable $location_{s}$ indicates the location of the big-box store. It takes a value equal to one if the big-box opens close the city center, that is less than 2km away from the town hall, and a value equal to zero if it locates more than 2km away from the city center. It is important to keep in mind that these cities are relatively small, so that there is almost no commercial activity 2km away from the city center. In the regression, this indicator is interacted with the main explanatory variable and, thus, I can estimate the opening effect allowing for some geographical differences in how big-box openings may affect grocery store closures. The results are presented in the first two columns of Table 7. I find that there are negative effects of big-box openings on grocery stores when the opening happens closer to the city center and no significant effects for the more suburban openings. Thus, we can conclude that the shock that a big-box opening represents to the city center's commercial structure is bigger when its location is closer to that of its direct competitors. These findings point in the same direction as those reported by Sadun (2015) for the UK.

Additionally, I evaluate whether the effects from Table 6 differ depending on the typology of the big-box opened. I divided the sample into two different types of big-boxes: conventional and discount stores. The former are those chains that sell well-known brands, whereas the latter typically sell their own, lower price brands. To evaluate whether there is any differential effect between these two types, the following equation is estimated:

$$\Delta\, grocery\ stores_{it} = \theta_{it} + \varphi_{it} \cdot big\text{-}box\ openings_{it} + \mu_{it} \cdot big\text{-}box\ openings_{it} \cdot type_{s} + \tau \cdot type_{s} + \sigma_{it} \cdot g\,(P_{i,t-4}) + \varrho_{t} + \\ + \pi_{r} + X'_{it}\vartheta + \epsilon_{it} \quad (4)$$

where $\Delta\, grocery\ stores_{it}$ is again the change in the number of grocery stores between *t* and *t-3*. The variable $type_{s}$ indicates the typology of the big-box store, taking a value equal to zero if the big-box is conventional and one if it is a discount one. The results of interacting this indicator with the variable capturing the big-box opening are presented in the last two columns of Table 7. We see

that there is a clear negative and significant effect of big-box openings on grocery store closures when the big-box is conventional. In contrast, discount big-boxes do not seem to have any impact on grocery store closures. These results may be indicating a persistence of consumer preferences. It could be that consumers are used to certain kinds of products and brands and do not easily switch to unknown products even if they can be purchased relatively cheaper in discount big-box stores. Thus, conventional big-box stores may be competing more directly with grocery stores. They sell the same products but in a one-stop shop, which could be more convenient for consumers than having to make the two or more stops typically needed when buying food from grocery stores. So, both heterogeneity results point into the same direction: the closer the big-box is to the current set of traditional grocery stores in a municipality, both geographically and in terms of products sold, the bigger the harm to them after the opening.

5.3. The effects of big-box openings on other retailers and on the overall city center's commercial structure

The results presented in the previous sections show that big-box openings are a big threat to grocery stores, which are mainly located in the city center and competing for the same consumers. Therefore, in line with these results, it might be the case that the opening of such big-boxes is indeed hollowing out the city center if the grocery stores that disappear are not replaced by other shops. In order to assess this, I estimate equation (2) but, instead of taking the change in the number of grocery stores as the dependent variable, I use the change in the number of other retailers' shops between *t* and *t-3*. This variable is also computed in the AEE dataset and also split into different types of stores for the period 2003-2011. More specifically, the "non-food" stores are classified as clothes and shoes shops, home products shops, these being furniture, home appliances or home textile shops and other retail shops. The last category includes stores such as book shops, beauty and perfumery or flower stores, among others. By performing this exercise, I am able to see the indirect effects of these openings on stores that are not selling the same type of products as the big-boxes that opened.

Table 8 presents the results of the effects of big-box openings on all the retailers excluding the grocery stores. In particular, it presents the results for the three different types of non-food stores: clothes and shoes, – columns (1) and (2) – home products, – columns (3) and (4) – and others – columns (5) and (6). Additionally, the last two columns present the overall results for all non-food retailers. The results show that big-box openings have a small negative effect on clothes and shoes stores but a significantly positive effect on home products and other small retailers. In fact, the sum of these three effects has a net positive effect of around 12 new non-food stores in the

municipalities. Therefore, whereas three years after the big-box opening around 8-9 grocery stores are closed, within the same years, around 12 other retailers open new shops. This implies that the commercial premises that the grocery stores leave empty are filled by other type of small retailers. More specifically, more than the 60% of the new shops are devoted to home products whereas the rest is much diversified.

After analyzing the effects of big-box stores on food and non-food stores, I find that a big-box store opening is a big threat to grocery stores, their biggest competitor, making them shut down after the opening, but it also encourages other retailers to take the empty premises. The next question then is what the overall effect on the city center's commercial structure is. If the negative effect on the direct competitors is bigger, planning policies that restrict the opening of big-boxes might also help to prevent the hollowing-out of city centers. However, if the positive effects on other retailers are bigger than those for grocery stores, we can conclude that retail shocks in the suburbs of cities do not necessarily translate into a loss of city center's commercial activity but only a change in its composition. In order to assess this, I estimate equation (2) again, using the change in the number of all retailers' shops (grocery stores and non-food stores) between *t* and *t-3*. The results are presented in columns (5) and (6) in Table 9. Columns (1) to (2) and (3) to (4) show again the results for grocery stores of Table 6 and for non-food retailers of Table 8, respectively. Figure 5 depicts the results graphically. By looking at the coefficients in columns (5) and (6) we can observe that the loss in grocery stores is fully compensated by the appearance of other new retailers in the municipality, leaving the overall number of retailers unchanged. Therefore, none of the rationales behind planning policies aimed at restricting the entry of big-box stores seems to be valid. In big cities in the UK, where the worry was productivity and employment, Sadun (2015) already showed that, if anything, restrictions were harmful. In this paper, I show that for small to medium cities where the worry is mainly focused on the disappearance of the city center's commercial structure, there are also no negative net effects.

6. Conclusions

The opening of big-box stores has become a political concern in many countries over the last few decades. Their critics claim they create enormous negative externalities in pre-existing market and city structures, exacerbating pollution levels and contributing to the hollowing out of city centers, as grocery stores, their main competitors, are forced into closure. Yet, there are those who argue that these stores tend to push prices down and, so, consumers are better off when big-box stores locate to their municipalities. In this paper, I exploit a commercial regulation in Spain, aimed at restricting the entry of big-box stores, to evaluate the extent to which these openings cause changes

in the city center's commercial structure. More specifically, this regulation requires developers seeking to build a big-box store in a municipality with less than 10,000 inhabitants to obtain a second license from the regional government, in addition to the municipal one.

Using an RDD analysis, I first test whether this regulation does in fact prevent developers from establishing big-box stores in regulated municipalities. The findings show that non-regulated municipalities experienced 0.3-0.4 more openings than regulated municipalities. This corresponds to about 16% more openings. I then used this jump around the threshold to instrument the effect of big-box openings on the city's commercial structure. The results suggest that, following the opening of a big-box, the affected municipality gradually loses grocery stores, showing some evidence of downtown hollowing out. In fact, three years after the opening, around 15% of the pre-existing grocery stores have closed down. When evaluating the heterogeneity of these effects, I find that the closer the big-box is to the current set of traditional grocery stores, both geographically and in terms of product sold, the larger its adverse effects. However, even if a big-box store opening is a big threat to grocery stores, my results also indicate that it does not seem to be the case for the city center's commercial activity as a whole. In fact, I find that the overall number of retailers remains unchanged, suggesting that new retail stores take over the empty commercial premises. The big-box only affects the composition of the commercial activity in the city center, but it does not make it disappear.

My findings have a number of policy implications. First, the regulation introduced was designed to restrict the entry of big-boxes and as such to prevent grocery stores from closing. This paper has shown that this aim has indeed been met, given that non-regulated municipalities suffered more closures than regulated municipalities. However, while the regulation may have served its purpose, there may be other indirect effects that need to be taken into consideration. For instance, my results indicate a greater number of non-grocery retail stores. Because of this, the overall employment or productivity effects of the policy are unclear. For example, if the loss of jobs generated by the closure of grocery stores is offset by the employment created by the big-box opening and the new stores, the net employment effect would be positive. Additionally, if the exiting grocery stores are less productive than the new entrants, also average productivity might have increased. Unfortunately, due to data availability this is very difficult to test in the Spanish case, but it might be a promising avenue for further research.

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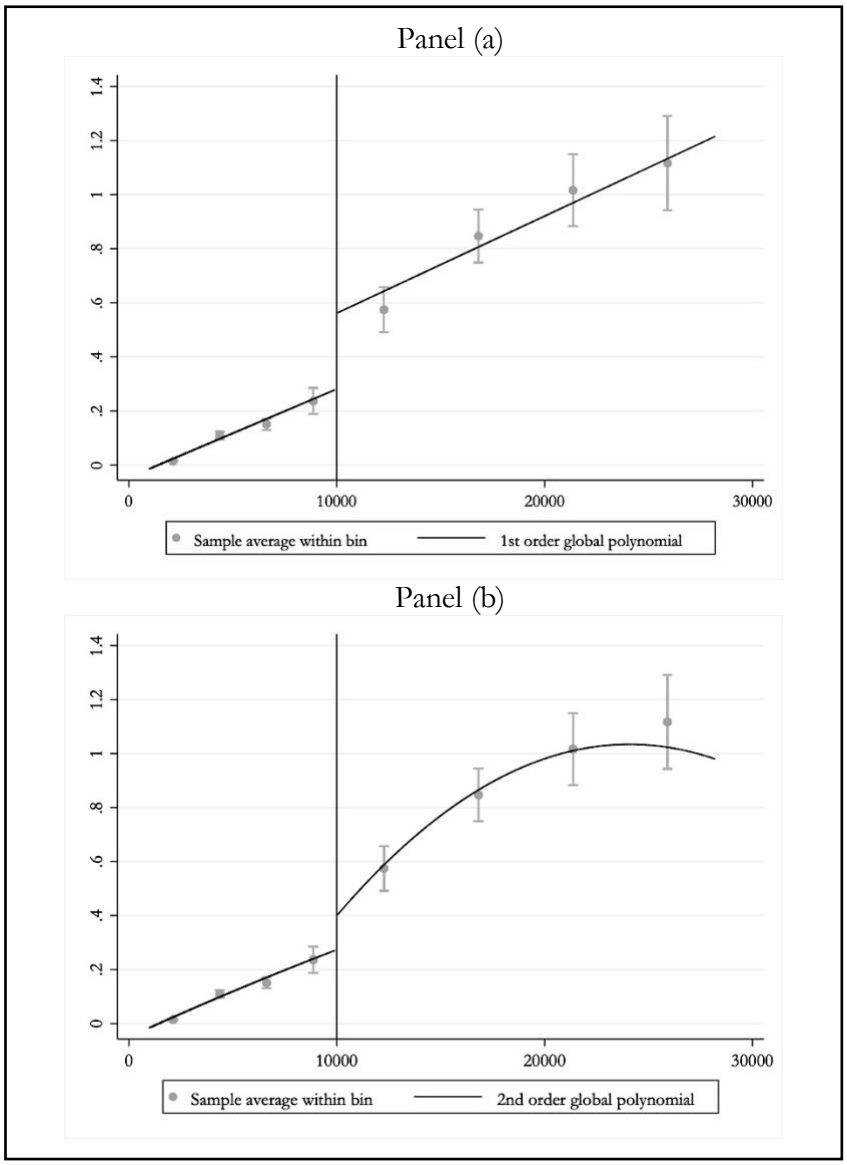
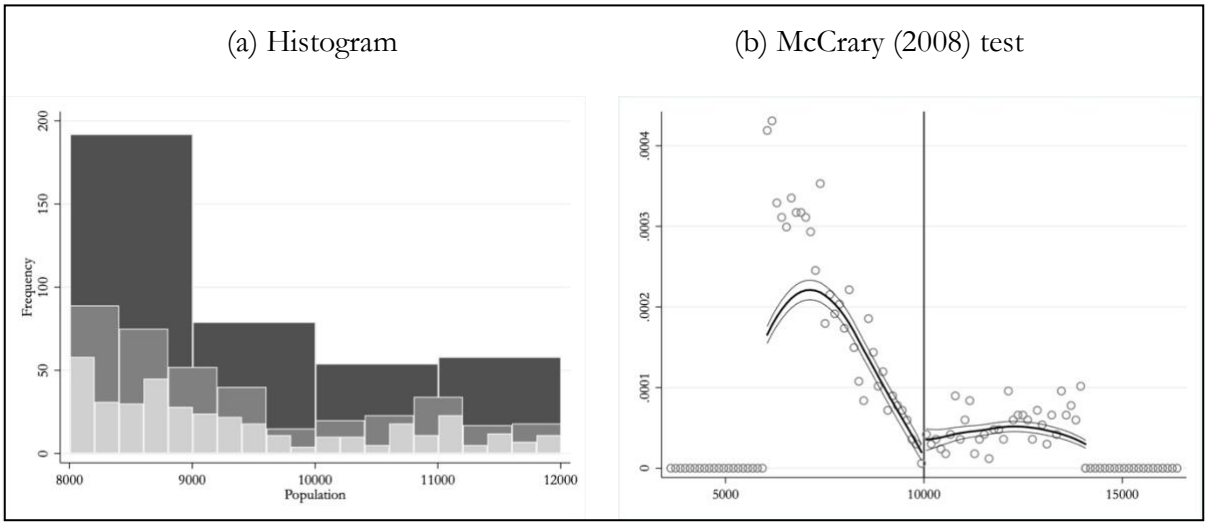
Figure 1: Jump in the number of big-box stores at the threshold



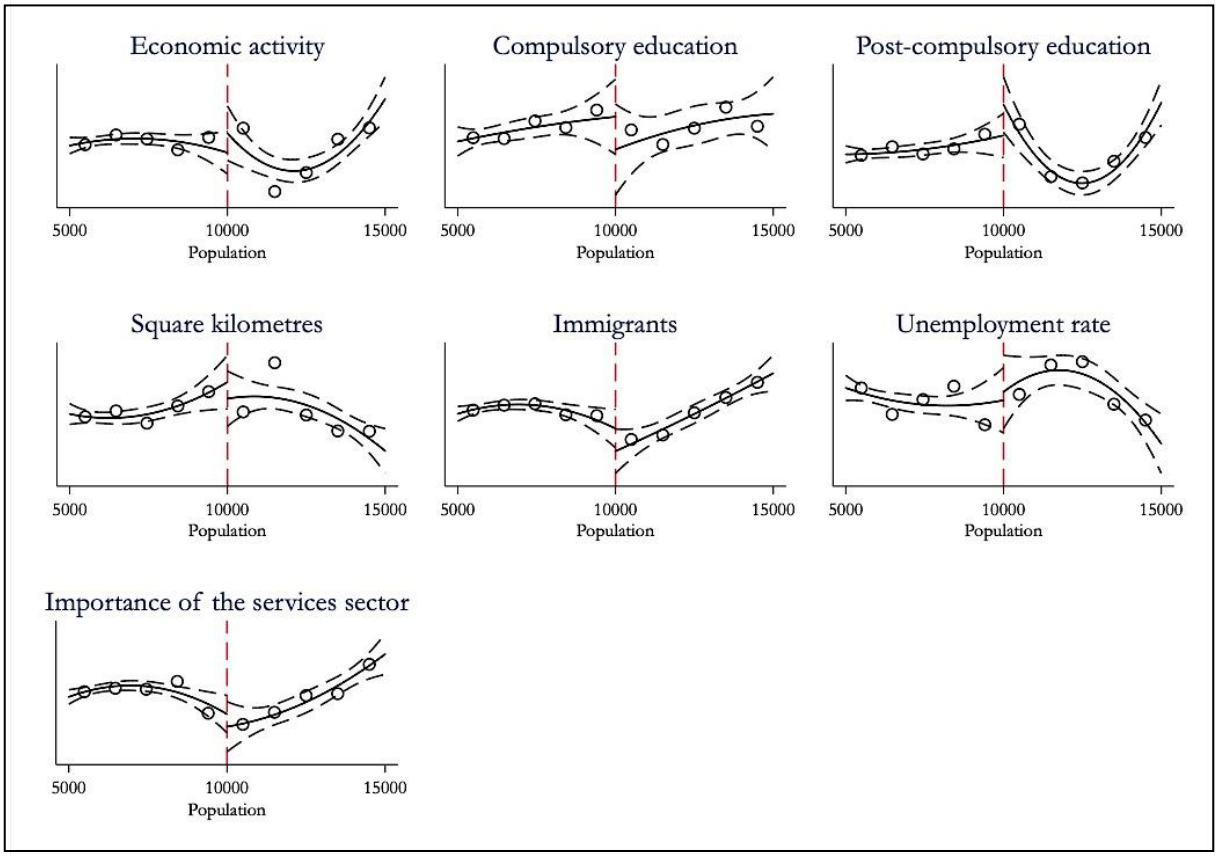
Note: Panel (a) shows bin averages of the number of big-box openings adjusting a linear polynomial at each side of the threshold. Panel (b) shows bin averages of the number of big-box openings adjusting a quadratic polynomial at each side of the threshold.

Figure 2: Continuity of the forcing variable at the threshold



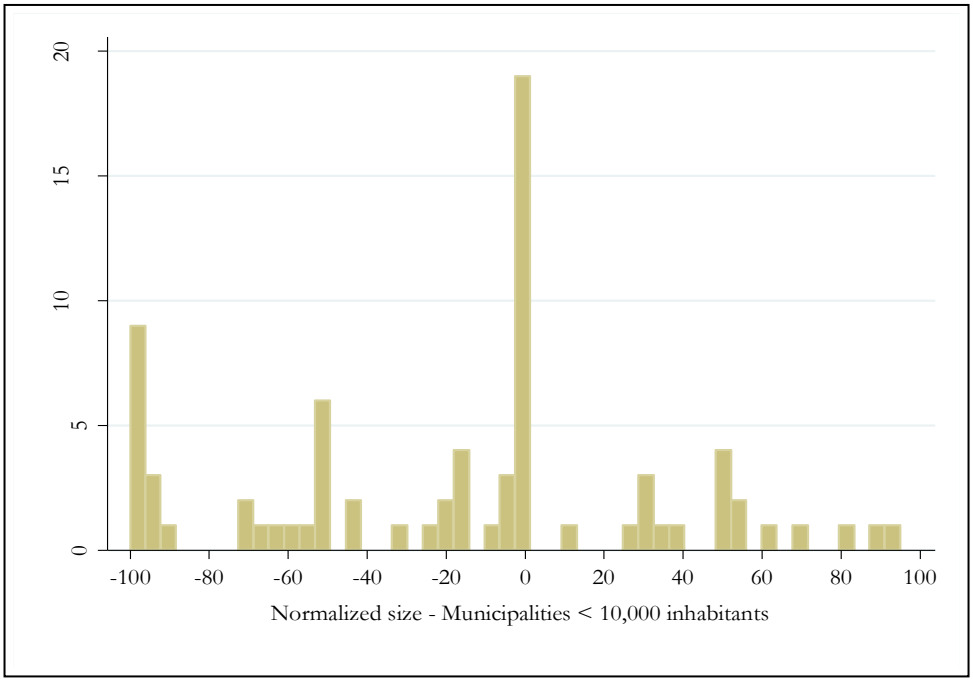
Note: Panel (a) shows the histogram for three different bin widths: 1,000, 400 and 200 inhabitants. Panel (b) presents the results of the McCrary test, consisting on running local linear regressions at both sides of the threshold. The circles represent bins of the population density.

Figure 3: Continuity of the control variables



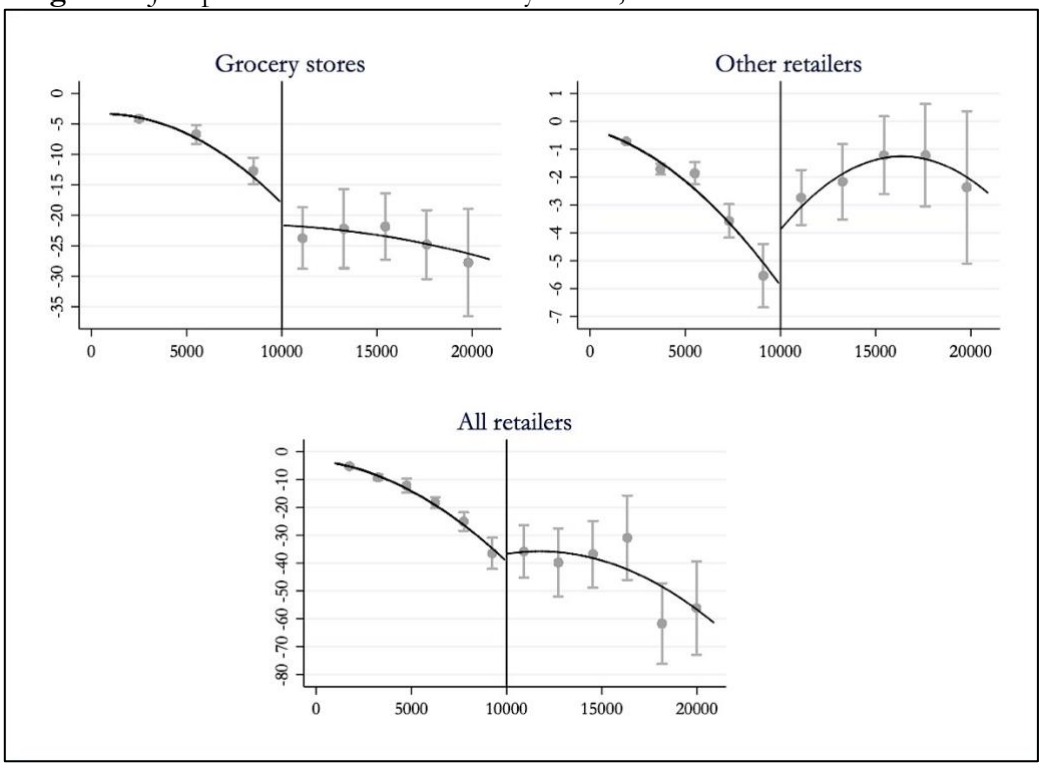
Note: All graphs present local linear regressions of the control variables on each side of the threshold. Starting from the top left corner the variables shown are economic activity, compulsory education, post-compulsory education, surface (in km^2), share of immigrants, unemployment rate and importance of the services sector.

Figure 4: Bunching around the threshold of big-box sizes



Note: This figure shows a frequency histogram of the number of big-box openings around the Threshold for municipalities smaller than 10,000 inhabitants. The size (in square meters) is normalized according to the criterion of each region in order to consider a store a 'big-box'.

Figure 5: Jump at the threshold. Grocery stores, other retailers and all retailers



Notes: (1) The variables plotted are the change in the number of grocery stores, other retailers' shops and all retailers in the municipality between t, and t-3. (2) All graphs show bin averages of the change in the number of grocery stores, other retailers' shops or all retailers in the municipality adjusting a quadratic polynomial at each side of the threshold.

Table 1: Commercial regulations per region for the 10,000 inhabitants' threshold

Region	Size restrictions	Year of introduction
Andalucía	> 1000 m^2	2003
Castilla y León	> 1000 m^2	1997
Castilla-la Mancha	> 750 m^2	2004
Catalunya	> 800 m^2	2001
Extremadura	> 750 m^2	2002
Illes Balears	> 400 m^2	2001
La Rioja	> 1000 m^2	1997
Comunidad de Madrid	> 1500 m^2	1999
País Vasco	> 800 m^2	2001

Note: The table shows the definition of big-box store used in each of the nine regions that strengthened the central law and the year this regional law was introduced for the 10,000 inhabitants' threshold.

Table 2. Outcome and control variables - Descriptive statistics around the threshold (+/- 3,000 inhabitants of the 10,000 threshold)

	Obs.	Mean	S.D.	Min	Max
Outcomes					
Overall number of small retailers	810	185.48	86.09	35	449
Number of grocery stores	810	57.28	34.22	5	202
Number of 'non-food' stores	810	105.72	52.10	19	271
Number of clothes and shoes stores	810	21.52	14.66	0	80
Number of home products stores	810	28.65	16.31	2	87
Number of other 'non-food' stores	810	55.57	24.77	12	129
Controls					
Economic activity	810	0.947	0.161	0.61	1.25
Compulsory education (%)	810	48.33	10.52	22.19	72.27
Post-compulsory education (%)	810	35.35	9.10	10	62.51
Square kilometres	810	106.72	117.69	2	586
Immigrants (%)	810	2.54	3.37	0.02	21.92
Unemployment rate (%)	810	14.79	9.43	4.07	61.23
Importance of the services sectors (%)	810	50.78	12.05	20.32	81.77

Source: Based on AEE and Census data. Notes: (1) The outcome variable is defined using AEE data and represents the universe of grocery stores at the municipality level. (2) The control variables are all extracted from the 2001 Census. (3) The variable *Economic activity* represents the average of an index of the economic activity of each municipality. It is computed using data on the occupation and professional activity of the population in the municipality. The variables *Compulsory education, Post-compulsory education* and *Immigrants are* computed as a percentage of the overall population. The *Importance of the services sectors* variable is computed as a percentage of the overall activities within a municipality.

Table 3. Sample size

Year	Observations	Big-Box Openings
2003	307	4
2004	307	4
2005	795	11
2006	955	31
2007	1,431	68
2008	1,662	46
2009	1, 662	37
2010	1, 662	49
2011	1, 662	20
Total		270

Note: The initial sample comprised the 1,992 municipalities belonging to the nine regions that strengthened the central law that were bigger than 1,000 inhabitants. However, the sample shown here is a restricted sample based on the following criteria: municipalities with less than 30,000 inhabitants and having a big-box store before the period of analysis have been discarded. This means eliminating 238 municipalities from the sample. Additionally, 92 municipalities that crossed the threshold over the period of analysis have also been excluded. Finally, municipalities are only included once their region has implemented the regulation; thus, for each year, the sample consists only of the regulated regions' municipalities.

Table 4. The effect of commercial regulations on big-box openings

	Dependent variable: Number of big-box openings						
	Polynomial Regressions				Local Linear Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	0.307***	0.311**	0.350***	0.361***	0.509**	0.526*	0.406*
	(0.113)	(0.125)	(0.113)	(0.124)	(0.251)	(0.316)	(0.219)
Polynomials	1	2	1	2	--	--	--
Bandwidth	--	--	--	--	Optimal	-50%	+50%
Controls	No	No	Yes	Yes	No	No	No
Observations	8,781	8,781	8,781	8,781	796	590	3,082

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is a dummy that takes a value equal to one if the municipality is above the 10,000 inhabitants' threshold and zero otherwise. (3) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks. (4) Columns (3) and (4) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sector in order to control for trends. (5) *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5. Placebo test - The effect of commercial regulations on big-box openings in non-regulated municipalities

	Dependent variable: Number of big-box openings						
	Polynomial Regressions				Local Linear Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	0.049	0.057	0.046	0.055	-0.215	-0.510	-0.060
	(0.103)	(0.101)	(0.103)	(0.101)	(0.181)	(0.336)	(0.107)
Polynomials	1	2	1	2	--	--	--
Bandwidth	--	--	--	--	Optimal	-50%	+50%
Controls	No	No	Yes	Yes	No	No	No
Observations	3,437	3,437	3,437	3,437	397	172	1,132

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The sample used in all regressions consist on the pool of the non-regulated municipalities in each year. (3) The independent variable is a dummy that takes a value equal to one if the municipality is above the 10,000 inhabitants' threshold and zero otherwise. (3) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks. (4) Columns (3) and (4) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sector. (5) *** p<0.01, ** p<0.05, * p<0.1

Table 6. The effect of big-box openings on grocery stores

		Dependent variable: Change in the number of grocery stores			
		(1)	(2)	(3)	(4)
Big-Box openings t, t-1	Coef.	0.080	0.777	-2.081	-1.690
	s.e.	(2.565)	(2.666)	(2.356)	(2.315)
	Obs.	8,781	8,781	8,781	8,781
Big-Box openings t, t-2	Coef.	-2.730	-1.371	-5.977*	-5.023
	s.e.	(3.858)	(3.821)	(3.534)	(3.450)
	Obs.	7,119	7,119	7,119	7,119
Big-Box openings t, t-3	Coef.	-5.431	-4.284	-8.585**	-7.700*
	s.e.	(4.598)	(4.562)	(4.221)	(4.140)
	Obs.	5,457	5,457	5,457	5,457
Big-Box openings t, t-4	Coef.	-6.381	-6.534	-8.908**	-9.149**
	s.e.	(4.665)	(4.692)	(4.288)	(4.271)
	Obs.	3,795	3,795	3,795	3,795
Big-Box openings t, t-5	Coef.	-5.981	-8.090**	-8.059**	-9.727***
	s.e.	(3.684)	(3.824)	(3.322)	(3.437)
	Obs.	2,364	2,364	2,364	2,364
Big-Box openings t, t-6	Coef.	-8.157**	-12.38***	-8.147**	-11.51***
	s.e.	(3.990)	(4.271)	(3.586)	(3.809)
	Obs.	1,409	1,409	1,409	1,409
Polynomials		1	2	1	2
Controls		No	No	Yes	Yes

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big-box openings between t and t-n at the municipality level, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. Each row represents a different regression. (3) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks. (4) Columns (3) and (4) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sector in order to control for trends. (5) *** p<0.01, ** p<0.05, * p<0.1

Table 7. The effect of big-box openings on grocery store closures – Heterogeneous effects

		Dependent variable: Change in the number of grocery stores			
		Polynomial regressions			
		(1)	(2)	(3)	(4)
Big-Box openings t, t-3	Close to the city center (*Location=1*)	-10.76***	-9.752**		
		(4.130)	(4.055)		
	Far from the city center (*Location=0*)	2.675	3.925		
		(5.285)	(5.197)		
	Discount (*Type=1*)			0.099	0.442
				(2.637)	(2.612)
	Conventional (*Type=0*)			-11.04**	-10.10**
				(4.669)	(4.591)
Polynomials		1	2	1	2
Controls		Yes	Yes	Yes	Yes
Observations		5,457	5,457	5,457	5,457

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big-box openings between t and t-3, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. In columns (1) and (2), this variable is interacted with a dummy variable equal to one if the big-box is opened close to the city center – between 1km and 2km from the town hall and zero if it is opened far away from it, i.e. more than 2km away. In columns (3) and (4) the dummy variable is interacted with a dummy equal to zero if the big-box is considered to be a conventional supermarket, i.e. selling all brands and equal to one if it is a discount big-box, i.e. typically selling their own, lower price brands. (3) The coefficients shown correspond to the overall effects of each category (baseline and interaction for the values equal to 1 and baseline for those equal to 0). (4) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks. They also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sector in order to control for trends. (4) *** p<0.01, ** p<0.05, * p<0.1

Table 8. The effect of big-box openings on other retailers

	Dependent variable: Change in the number of other retailers' shops							
	Clothes and shoes		Home products		Others		All other retailers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Big-Box openings t, t-3	-1.601*	-1.744**	6.603***	6.711***	7.099***	6.801***	12.07***	11.76***
	(0.888)	(0.874)	(0.916)	(0.907)	(1.249)	(1.215)	(2.509)	(2.455)
Observations	5,457	5,457	5,457	5,457	5,457	5,457	5,457	5,457
Polynomials	1	2	1	2	1	2	1	2
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big box openings between t and t-3 at the municipality level, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. Each row represents a different regression. (3) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks as well as the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sectors in order to control for trends. (4) *** p<0.01, ** p<0.05, * p<0.1

Table 9. The effect of big-box openings all retailers

	Dependent variable: Change in the number of all retailers					
	Grocery stores		Other retailers		All retailers	
	(1)	(2)	(3)	(4)	(5)	(6)
Big-Box openings t, t-3	-8.585**	-7.700*	12.07***	11.76***	1.588	2.848
	(4.221)	(4.140)	(2.509)	(2.455)	(5.705)	(5.617)
Observations	5,457	5,457	5,457	5,457	5,457	5,457
Polynomials	1	2	1	2	1	2
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big box openings between t and t-3 at the municipality level, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. Each row represents a different regression. (3) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks and also the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sectors in order to control for trends. (4) *** p<0.01, ** p<0.05, * p<0.1

Appendix

Table A1. The effect of big-box openings on grocery stores – Robustness checks

	Dependent variable: Change in the number of grocery stores							
	Local linear regressions		Openings before the law		3-years-lagged population		5-years-lagged population	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Big-Box openings t, t-3	-3.937	-13.92	-10.09*	-11.48**	-9.229**	-8.398**	-7.336*	-6.437
	(10.83)	(32.42)	(5.421)	(5.372)	(4.258)	(4.202)	(4.155)	(4.045)
First stage	0.611**	0.763**	0.351***	0.410***	0.468***	0.482***	0.474***	0.493***
	(0.277)	(0.327)	(0.132)	(0.117)	(0.141)	(0.157)	(0.142)	(0.157)
Observations	435	841	5,857	5,857	5,457	5,457	5,457	5,457
Polynomial	1	2	1	2	1	2	1	2
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big-box openings between t and t-3 at the municipality level, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. (3) Columns (1) and (2) show the results of running local linear regressions using the optimal bandwidth. Columns (3) and (4) present the results when including all the municipalities that experienced a big-box opening before the regional law was implemented. Columns (5) and (6) and (7) and (8) report the results when using the 3-year lagged population and the 5-year lagged population as running variables respectively. (4) All regressions include region and time fixed effects in order to control for region specific time invariant characteristics and countrywide time shocks. They also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometers, immigration level, unemployment and importance of the services sector in order to control for trends. (5) *** p<0.01, ** p<0.05, * p<0.1

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