Small shops for sale! The effects of big-box openings on grocery stores

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Abstract

This paper evaluates the effects of big-box openings on the closure of grocery stores at the municipality level. To estimate these effects, I use a discontinuity in commercial regulation in Spain as the source of exogenous variation for the period 2003 to 2011. More specifically, this regulation, which varies by region, establishes entry barriers on big-box stores in municipalities of less than 10,000 inhabitants. I first test whether there is a discontinuity on the number of big-box openings when crossing the population threshold from regulated to non-regulated areas. This first stage shows that non-regulated municipalities recorded 0.3 more big-box openings than the regulated ones. I then use this discontinuity as an instrument to examine the effects of these openings on the number of grocery stores. The results show that, four years after the big-box opening, between 20 and 30% of the grocery stores in the municipality have disappeared. There do not seem to be significant differences in this respect between big-box stores located in the city centre and those in the suburbs, at least in the short run. However, when examining by typology, the conventional big-boxes (those selling well-known brands) seem to compete more with grocery stores than do the discount big-boxes (those selling their own, lower price brands) and the former are, therefore, more instrumental in forcing them to close down.

JEL classification: D2, J22, L81, R1

Keywords: big-box openings, grocery stores, commercial regulations.

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1. Introduction

In recent years many governments have adopted restrictive policies in response to the opening of big-box stores. 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 centre 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 market 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 and, so, consumers tend to be 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 of the entry of big-box stores on traditional grocery stores. More specifically, by implementing a 'fuzzy' Regression Discontinuity Design, I test whether the opening of big-box stores is causing grocery stores to close. If this is the case, and given that grocery stores are typically located in city centres, the opening of big-box stores would be 'hollowing out' city centres. The results show that non-regulated municipalities experience 0.3 more big-box openings than regulated municipalities, and, as a consequence, four years after the first big-box opening, between 20 and 30% of the grocery stores in the area disappear, offering clear evidence that city centres are losing part of their economic activity. I also examine whether these effects differ according to the location of the big-box (city centre vs. out-of-town) and the typology of the big-box opened (conventional vs. discount). To this end, I exploit the possibility that big-boxes located in the city centre, and therefore closer to the grocery stores, have a different impact to that of big-boxes

[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)

opened in the suburbs. I also analyse whether conventional big-box stores, selling well-known brands, have a different impact to that of discount stores, selling their own brands at lower prices. The results show that there does not seem to be a significant difference between big-box stores operating downtown and those operating in the suburbs, at least in the short run. However, in the case of the typology, results show that it seems to be the conventional supermarkets that are competing with grocery stores and forcing them to pull down their 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 report that planning regulations have an impact on market equilibrium outcomes, although not as great 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 reduced output by forcing stores onto less productive sites.

The issues addressed in this paper are closely related to another branch of the literature examining the effects of big-boxes on grocery stores, but more specifically focused on the role of competition and its impact on employment. Most studies here have analysed 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. Finally, 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. The study develops an empirical model to assess the effects on discount grocery stores of big-box store openings.[3]

However, the European food retail sector works very differently from that in the US, given the continent's different city structures and the agglomeration forces operating in its cities. Sadun (2015) is the only paper, to date, to analyse the European case. In a study of UK retailers, the author 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, and so harming them even more than before the policy. Adopting a theoretical perspective, Uschev *et al.* (2015) build a model in which, combining spatial and monopolistic competition, they find that downtown retailers gradually disappear when a big-box is sufficiently large.

The main contribution of this paper is that it is, to the best of my knowledge, the first attempt to study the direct effects of big-box store openings on grocery stores using a quasi-experimental design, in this case that of a Regression Discontinuity Design. Previous papers, exploiting similar regulations, use political variables as their instruments to evaluate the causality of the effects (see Sadun, 2015). The novelty of this paper is that the source of exogenous variation is generated by the commercial regulation itself, thanks to the fact that this regulation varies across the regions and across the municipalities within each region. Therefore, it is unnecessary to rely on any other external source of exogenous variation. In addition, this is the first paper to show the impact of the opening of big-box stores on grocery store closures drawing on all available data for big-box openings and, hence, distinguishing the effects by location and typology of these stores. Previous studies in the US have been limited to the role played by Wal-Mart stores. Moreover, this is the first European study to focus specifically on the number of grocery stores forced out of the market, given that the only other paper available (Sadun, 2015) focuses on the employment effects of the opening of big-box stores. The results reported here show that, following the introduction of stringent policies, non-regulated municipalities experienced more grocery store closures than were suffered by regulated municipalities, pointing to the policies' effectiveness in saving existing businesses. These findings seem to complement those reported by Sadun (albeit focused more specifically on employment), suggesting that restrictive policies in the retail sector may have a different impact in southern Europe to the effects described in the UK. Finally, my results are in

[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.

line with the theoretical findings of Uschev *et al.* (2015) who conclude that big-box stores may contribute to the 'hollowing out' of the city centres.

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 used 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 and reports some robustness tests and heterogeneous effects. Section 6 concludes.

2. The institutional setting

Between 1985 and the mid-1990s, Spain experienced a change in its market structure with the complete international liberalisation of the retail sector, affecting above all the food retail trade (Matea and Mora-Sanguinetti, 2009, show an increase in restrictiveness from the late 1990s with respect to the previous decade). Thus, a market that had previously been dominated by grocery stores saw the arrival of the supermarket, most belonging to foreign chains. These changes ushered in a major policy debate between those in favour and those opposed to trade liberalisation and free market entry, a debate that became even more heated when the supermarket chains began opening large out-of-town stores. The detractors 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 centres. One of their chief arguments is that these stores affect the pre-existing body of firms, especially small, traditional businesses, causing their eventual disappearance from the area. Thus, to prevent this from happening and in response to the growing unrest in the sector, in 1996, the Spanish parliament passed a law aimed, among other things, at restricting the entry of big-box stores.[4] [5] The law required a developer seeking to open a big-box store in Spain to obtain a second licence, in this case from the regional government, in addition to the municipal licence. The fact that the two licences (municipal and regional) have to be solicited from two different entities means that big-box developers incur an additional entry cost vis-à-vis grocery stores. While this is not a monetary cost, it does represent a considerable cost in terms of time and uncertainty given the amount of red tape developers have to contend with in applying for this second licence.

[4] Retail Trade Law 7/1996 of 15 January 1996

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

The key to this new regulation lies in its definition of what should be considered a "big-box store". The central government opted to define a big-box as one with at least 2,500 m^2. However, nine (out of Spain's seventeen) regions chose to strengthen the law by further limiting the number of square metres. 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. Each region set their own arbitrary population thresholds, introducing the corresponding measures between 1997 and 2004[6]. Here, therefore, in order to identify the causal effects of big-box openings on grocery stores in an operative way, I focus on those municipalities centred on the lowest population threshold as defined by most of the regions: namely, 10,000 inhabitants. 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. 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 where the size threshold is the same for all municipalities in that region, independently of the regulation.

[Insert Table 1 here]

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

[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.

Supermarkets in Spain. For each big-box, this census contains information on its date of opening, exact location, size (in square meters) and the chain to which they belong. Although this is not a panel dataset, the time dimension can be added by exploiting the information on the date each 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 analysed, is highly unlikely.[7] It should be stressed at this juncture that information regarding the number of licences per municipality is unavailable, which means little can be said about the administrative process for the granting of licences. 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 stores (i.e., the outcome variable), 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 licence to build a big-box store and its eventual opening. This means 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.

Other variables may, at the same time, be influencing the numbers of big-box openings and grocery 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 of level of education achieved: compulsory education and post-compulsory education, defined as a percentage of the overall local

[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.

population. Finally, a variable showing the share of immigrants as a percentage of the overall population is included as is another variable capturing the importance of the services sector, i.e., the share of the services sector within a municipality's total activities. In addition to the Census data, a variable capturing the surface of the municipality (km^2) is included. Table 2 shows the descriptive statistics for the outcome variable, i.e. number of grocery 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).

[Insert Table 2 here]

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 the developers request the licence, 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 2,020 municipalities per year belonging to the nine regions that strengthened the central law. I restrict the sample to municipalities with between 1,000 and 50,000 inhabitants that did not have a big-box store before the onset of my period of analysis[8]. This means discarding 656 municipalities from the sample. I also exclude a further 83 municipalities that crossed the threshold three, two or one year(s) prior to the opening. Finally, I only include municipalities once the region in which they lie has implemented the regulation; thus, for each year, I only include the regulated regions' municipalities. This means I only estimate the post-regulation effect.[9]

[Insert Table 3 here]

4. Identification strategy

I use a Regression Discontinuity Design (RDD) framework to estimate the effects of big-box openings on grocery store closures. As discussed, to build a big-box store in a municipality of less than 10,000 inhabitants, a second regional licence is required. However, this licence should be seen

[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. Table 3 reports the number of municipalities, i.e. the sample size, and the number of big-box openings per year.

as an additional barrier to entry, since it is by no means a binding constraint. In a "sharp" RDD, the treatment jumps from zero to one at the threshold. In a setting such as the one described here, this would mean that non-regulated areas (those with more than 10,000 inhabitants) are the only ones in which big-box stores open. However, as this is not the case, 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. Before empirically estimating the existence of such a jump, I first examine it graphically using the raw data. 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 we observe a jump at the threshold of around 0.3, meaning that, when crossing from regulated to non-regulated municipalities, there are, on average, 0.3 more big-box openings. We also see that there is very little difference when fitting different order polynomials. 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 running 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}), 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 grocery stores. These are the pre-regulation levels of population, economic activity, education levels, size of the municipality (in km^2), immigration level, unemployment rate and the importance of the services sector.

[Insert Figure 1 here]

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 properly.[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 Imbens and Kalyanaraman (2012) methodology. 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, with the exception of the half optimal bandwidth (owing to the small sample size), also show a jump in treatment at the threshold of around 0.3 – or slightly higher – coinciding with the graphical inspection.

[Insert Table 4 here]

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.* (2015), in a

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

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.

[Insert Figure 2 here]

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, because if this were not the case, the coefficient would also be identifying this jump. 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. We observe that 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.

[Insert Figure 3 here]

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. In fact, if anything, according to columns (1) and (5), it would be negative. Thus, we conclude that the difference in the number of big-box openings at the threshold identified in Table 4 is due to the commercial regulation.

[Insert Table 5 here]

5. Results

In this section, the results of the 2SLS regressions estimating the effects of big-box openings on grocery store closures are presented and interpreted. In addition, a number of robustness tests are

presented. Finally, the potentially heterogeneous effects of the location and type of big-box opened are evaluated.

5.1. The impact of big-box openings on grocery store closures

This section presents the results of evaluating the effect of big-box openings on grocery store closures. To address this question, 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):

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

where $\Delta\, grocery\ stores_{it}$ is the change in the number of grocery stores between t and $t\text{-}n$ (where n is between 1 and 5) 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, $big\text{-}box\ openings_{it}$ 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. The first four columns show the results of estimating polynomial regressions, while the fifth reports the results of estimating a local linear regression using the optimal bandwidth. In columns (1) and (2) 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 store closures, equation (2) is estimated using the change between t and $t\text{-}2$, t and $t\text{-}3$, t and $t\text{-}4$ and t and $t\text{-}5$. Specifically, I estimate the equation separately for each of these four time spans, their results being presented in each row of Table 6. As in Table 4, the preferred estimation 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 effects on the number of grocery stores, these effects being manifest two to four years after the opening. Indeed, the opening of a big-box store in a given municipality results in the gradual closure of grocery stores. Around ten grocery stores have shut down two years after a big-box opening and the number of closures increases to between 14 and 20 stores by the end of the fourth year. Note

that the regressions representing the effects five years after the opening present very similar coefficients, showing that the impact seems to be concentrated within the first four years following the opening. To put these numbers into perspective, they should be compared with the means around the threshold reported in Table 2. Thus, losing between 14 and 20 grocery stores in the four-year period represents a loss of between 20 and 30% of the existing grocery stores in an area where a big-box store has opened. If we examine the last column, which shows the local linear regression, we observe that, although the point estimates are the same as before, the conventional errors are larger and the coefficients are no longer significant.

[Insert Table 6 here]

These results are robust to different tests. Table 7 shows the results of estimating equation (2) in three different settings. It also presents the first stage results for each of the three tests. Only the results for the preferred estimations are presented in each setting, i.e. the second-degree polynomial regression and the local linear regression using the optimal bandwidth. The first two columns present the results of estimating the effects of big-box openings on grocery stores when the municipalities that experienced a big-box opening before the regional law was passed are also included. In this case, we observe a very similar first stage and a slightly smaller, but qualitatively similar, second stage. This is a reasonable result given that the municipalities affected by a big-box opening prior to the introduction of the regulation may have already experienced grocery store closures. As such, their inclusion is offsetting to some extent the previous results. Columns (3) to (4) and (5) to (6) present the results when using as the running variable the population lagged one year more and one year less than in the original regression, i.e. using the three-year lagged population and the four-year lagged population, respectively. In both cases, the first stage remains the same as in Table 4 and the second stage is the same as that shown in Table 6. This test shows that the results are not sensitive to the lags of the running variable.

[Insert Table 7 here]

The previous results confirm the negative effect of big-box openings on the number of pre-existing grocery stores. 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 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[11], 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. If we take the coefficients from our preferred estimation in Table 6, about 14 grocery stores were found to shut down in the four-year period after a big-box opening, which means a municipality loses 27.72 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.[12] Therefore, the net employment effect would be an increase of around 14.28 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. These results are consistent with the theoretical predictions and the policy recommendations made in Ushchev *et al.* (2015) where it is claimed that big-box openings tend to hollow out city centres but that the regulation should only be implemented when malls are not efficient enough to capture the whole market.

However, it is important to note that the above results also depend on the exact definition (size in square metres) given to 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 to be. 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 licence. Indeed, in the case of the UK, Sadun (2015) reports evidence of this actually happening, thus undermining the regulation. This paper has shown that the regulation is positively affecting the regulated municipalities, at least in terms of grocery store closures. Therefore, were we to observe a bunching of stores just below the threshold in those municipalities, this would indicate that the previous results are downward-biased. 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 inhabitant threshold. Given that the regions included in the study have different size definitions for a big-box store, the size axis has been normalised. We observe that, in the regulated municipalities 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.

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

[12] 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.

5.2. Heterogeneous effects of big-box openings on grocery store closures

The results reported above describe the average impact of all big-box openings on grocery store closures within the period analysed, regardless of the specific characteristics of the big-box store. In this section, I evaluate whether the effects are driven by the location of the big-box – in the city centre or in the suburbs – or the typology of big-box opened – conventional supermarkets versus discount supermarkets. Note that the total number of big-box openings is 317 (Table 3). Of these, 88 were opened in city centres while 229 were located in the suburbs. Likewise, by typology, 129 correspond to discount supermarkets and 188 to conventional chain stores. The reason for exploring any (possible) geographical effects of big-box openings is that big-box stores opening in locations close to existing grocery stores, i.e., in city centres, 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:

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

where $\Delta\, grocery\ stores_{it}$ is the change in the number of grocery stores between *t* and *t-4* aggregated at the municipality level, indicating only the cumulative effect four 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 near the city centre and a value equal to zero if it locates in the suburbs. 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 8. We observe that there are negative effects of big-box openings in both the city centre and the suburbs on grocery store closures, but that there is no significant difference between the two locations. Thus, it does not seem to be the case that the city centre big-box stores affect grocery stores any differently to the way in which out-of-town big-boxes affect them.

[Insert Table 8 here]

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-4*. The variable $type_s$ indicates the typology of the big-box store, taking a value equal to one if the big-box is conventional and zero 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 8. 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.

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 centres, as grocery stores 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 grocery stores to close. 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 licence from the regional government, in addition to the municipal licence.

Using an RDD analysis, I first tested whether this regulation does in fact prevent developers from establishing big-box stores in regulated municipalities. The findings show that, indeed, non-regulated municipalities experienced 0.3 more openings than regulated municipalities. I then used this jump around the threshold to instrument the effect of big-box openings on grocery store closures. The results suggest that, following the opening of a big-box, the affected municipality gradually loses grocery stores, typically from the city centre, showing some evidence of downtown hollowing out. In fact, four years after the opening, between 20 and 30% of the pre-existing grocery stores have closed down. When evaluating the heterogeneity of these effects, the results seem to show that there are no significant short-run differences between big-box store openings in the city centre and those out-of-town. This may show, at least in the short run, that both downtown and suburb big-boxes act as direct competitors of grocery stores. I performed an additional heterogeneity analysis in which I examined conventional and discount big-box stores separately, where the former are chain stores selling all well-known brands at market prices while the latter typically sell their own, low-price brands. In this case, all the effect could be attributed to the conventional stores, offering some evidence that these shops, which sell the same kind of products as grocery stores but in a one-stop shop, may match consumer preferences better and may also be more convenient, at least in the short run.

The findings reported herein 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. In fact, some bunching of stores below the size threshold was also observed, suggesting that the results may even be underestimating the effects. However, while the regulation may have served its purpose, there may be other indirect effects that need to be taken into consideration but, unfortunately, due to problems of data availability, this paper has been unable to do so. The main concern associated with this policy is the (possible) negative impact it has on employment. However, if the loss of jobs generated by the closure of grocery stores is offset by the employment created by big-box opening, the net employment effect would be positive. Thus, the regulation may be undermining *local* employment instead of protecting it.

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

Region	Size restrictions	Year of introduction
Andalusia	> 1000 m^2	2002
Castile and Leon	> 1000 m^2	1997
Castile-la Mancha	> 750 m^2	2004
Catalonia	> 800 m^2	2001
Extremadura	> 750 m^2	2002
Balearic Islands	> 600 m^2	2001
La Rioja	> 1000 m^2	1997
Community of Madrid	> 1500 m^2	1999
Basque Country	> 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 inhabitant 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
Outcome					
Number of grocery stores	795	58.94	35.12	5	236
Controls					
Economic activity	795	0.919	0.157	0.61	1.25
Compulsory education (%)	795	47.13	10.36	22.19	72.27
Post-compulsory education (%)	795	34.21	8.73	10	62.51
Square kilometres	795	119.26	124.96	2	586
Immigrants (%)	795	2.48	3.53	0.02	21.92
Unemployment rate (%)	795	15.98	9.74	4.07	61.23
Importance of the services sectors (%)	795	50.38	12.40	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	241	5
2004	241	6
2005	544	11
2006	1,113	41
2007	1,113	85
2008	1,281	49
2009	1,281	45
2010	1,281	55
2011	1,281	20
Total		317

Note: The initial sample comprised the 2,020 municipalities belonging to the nine regions that strengthened the central law. However, the sample shown here is a restricted sample based on the following criteria: municipalities with less than 50,000 inhabitants and having a big-box store before the period of analysis have been discarded. This means eliminating 656 municipalities from the sample. The 83 municipalities that crossed the threshold three, two or one year(s) prior to the opening 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}	0.219*	0.303***	0.277**	0.331***	0.429***	0.735***	0.385***
	(0.13)	(0.111)	(0.123)	(0.108)	(0.111)	(0.175)	(0.072)
Polynomials	1	2	1	2	--	--	--
Bandwidth	--	--	--	--	Optimal	-50%	+50%
Controls	No	No	Yes	Yes	Yes	Yes	Yes
Observations	7,095	7,095	7,095	7,095	6,696	1,445	6,937

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 inhabitant 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) to (7) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometres, 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}	-0.163*	-0.005	-0.060	0.016	-0.030***	0.000	-0.009
	(0.088)	(0.059)	(0.072)	(0.053)	(0.011)	(0.017)	(0.020)
Polynomials	1	2	1	2	--	--	--
Bandwidth	--	--	--	--	Optimal	-50%	+50%
Controls	No	No	Yes	Yes	Yes	Yes	Yes
Observations	2,641	2,641	2,641	2,641	2,495	531	2,581

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 inhabitant 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) to (7) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometres, 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 6. The effect of big-box openings on grocery store closures

		Dependent variable: Change in the number of grocery stores				
		Polynomial regressions				LLR
		(1)	(2)	(3)	(4)	(5)
Big-Box openings t,t-2	Coef.	-6.35	-5.42	-10.44*	-9.21**	-13.67
	s.e.	(6.25)	(4.12)	(6.11)	(4.45)	(8.91)
	Obs.	5,814	5,814	5,814	5,814	4,247
Big-Box openings t,t-3	Coef.	-13.80	-9.11*	-16.17*	-12.87**	-16.49
	s.e.	(9.38)	(5.52)	(8.37)	(5.75)	(10.62)
	Obs.	4,533	4,533	4,533	4,533	4,062
Big-Box openings t,t-4	Coef.	-20.28	-10.72	-20.33*	-13.82**	-10.47
	s.e.	(12.78)	(6.98)	(10.77)	(6.96)	(8.66)
	Obs.	3,252	3,252	3,252	3,252	1,708
Big-Box openings t,t-5	Coef.	-23.78*	-11.86	-20.92**	-13.01*	-8.73
	s.e.	(13.03)	(8.07)	(10.57)	(7.48)	(8.53)
	Obs.	2,139	2,139	2,139	2,139	1,355
Polynomials		1	2	1	2	--
Bandwidth		--	--	--	--	Optimal
Controls		No	No	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-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) to (5) also include the pre-regulation levels of population, economic activity and education levels, size of the municipality in square kilometres, 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 – Robustness checks

		Dependent variable: Change in the number of grocery stores					
		Openings before the law		3-years-lagged population		5-years-lagged population	
		PR	LLR	PR	LLR	PR	LLR
		(1)	(2)	(3)	(4)	(5)	(6)
Big-Box openings t,t-2	Coef.	-7.03*	-8.81	-9.36**	-8.53	-8.586*	-10.05
	s.e.	(3.91)	(8.89)	(4.74)	(7.83)	(4.40)	(6.75)
	Obs.	6,321	5,708	5,844	5,513	5,814	5,517
Big-Box openings t,t-3	Coef.	-10.89**	-11.63	-12.26**	-11.14	-12.03**	-16.52*
	s.e.	(4.94)	(9.60)	(6.14)	(9.83)	(5.62)	(10.04)
	Obs.	4,929	4,478	4,558	4,288	4,533	3,353
Big-Box openings t,t-4	Coef.	-10.85*	-11.68	-11.9	-9.06	-13.24*	-13.19*
	s.e.	(6.05)	(9.23)	(7.76)	(9.60)	(6.83)	(7.88)
	Obs.	3,537	3,200	3,272	3,042	3,252	1,934
First stage	Coef.	0.324***	0.355***	0.302***	0.393***	0.327***	0.443***
	s.e.	(0.092)	(0.09)	(0.105)	(0.112)	(0.107)	(0.106)
	Obs.	7,713	7,066	7,130	6,707	7,095	6,720
Polynomial		2	--	2	--	2	--
Bandwidth		--	Optimal	--	Optimal	--	Optimal
Controls		Yes	Yes	Yes	Yes	Yes	Yes

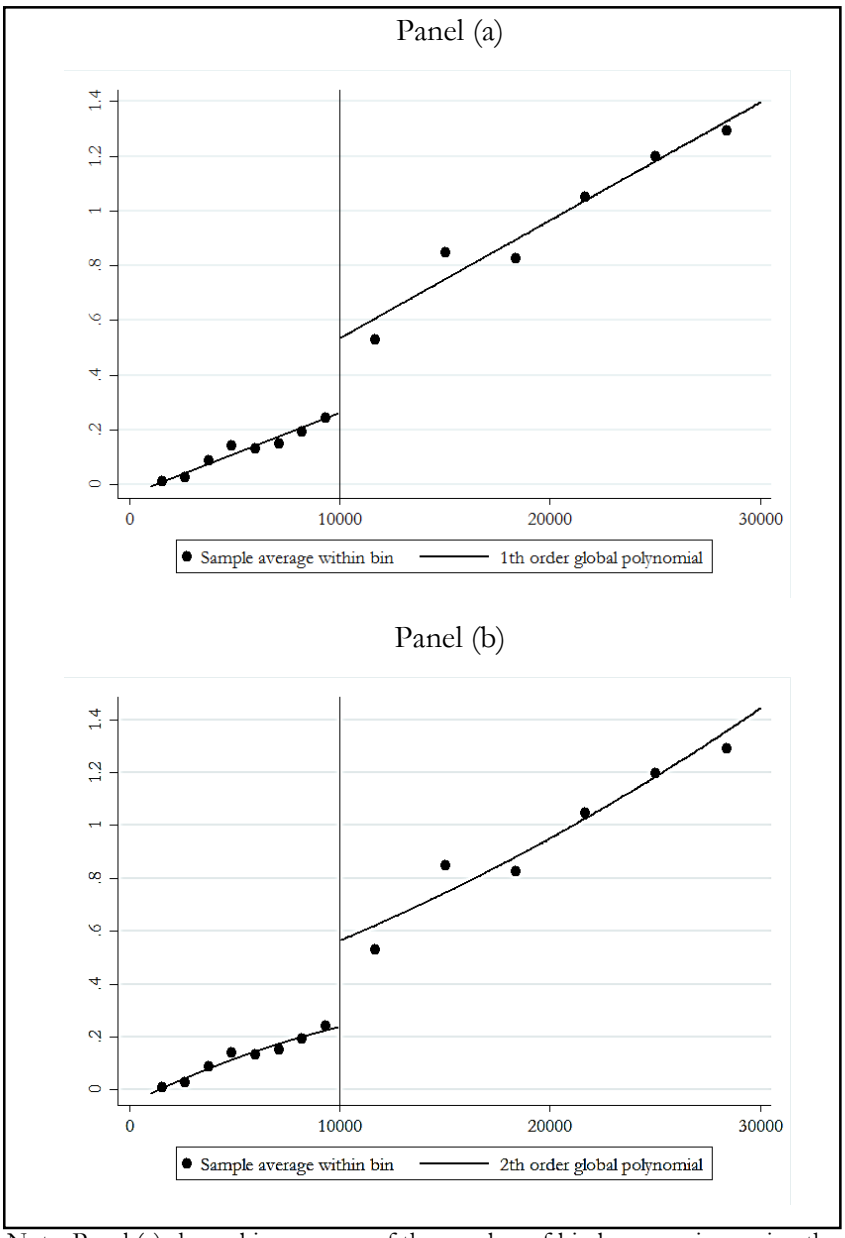
Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big-box openings between t and t-n at the municipality level, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. Each row represents a different regression. (3) Columns (1) and (2) present the results when including all the municipalities that experienced a big-box opening before the regional law was implemented. Columns (3) and (4) show the results of including the municipalities that changed from one side of the threshold to the other during the period of analysis. 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 kilometres, 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 8. 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-4	City Centre (*Location=1*)	-19.22***	-16.09**		
		(7.04)	(6.43)		
	Suburbs (*Location=0*)	-27.09**	-20.33*		
		(12.75)	(11.53)		
	Conventional (*Type=1*)			-27.33**	-24.42**
				(10.71)	(10.16)
	Discount (*Type=0*)			-3.50	-1.50
				(8.84)	(8.86)
Polynomials		1	2	1	2
Controls		Yes	Yes	Yes	Yes
Observations		4,407	4,407	4,407	4,407

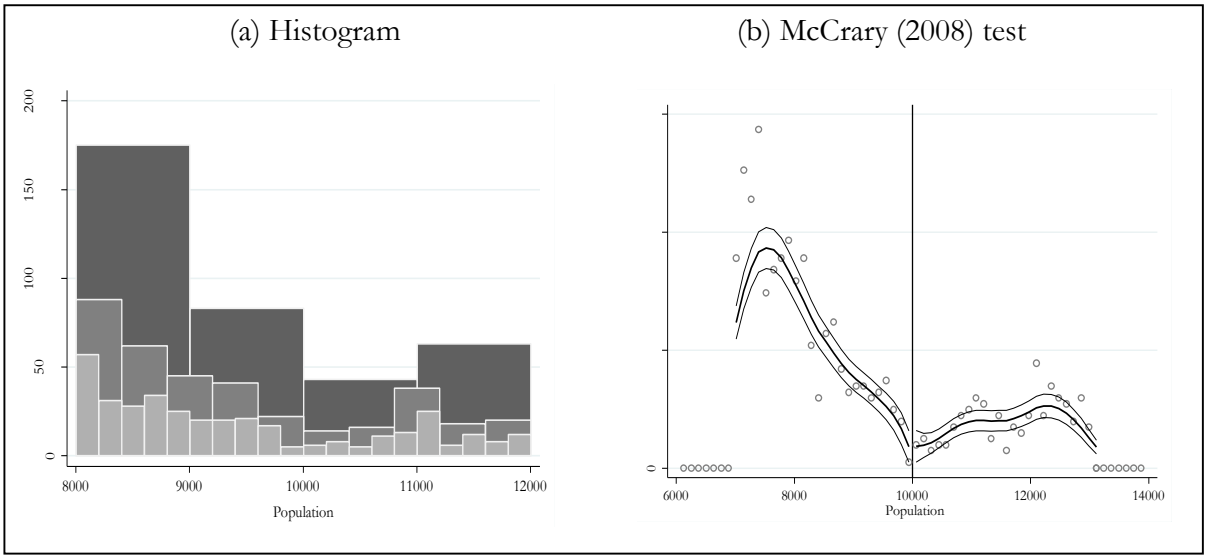
Notes: (1) Robust standard errors in parentheses, clustered at the municipality level (2) The independent variable is the number of big-box openings between t and t-4, instrumented by a dummy that captures the change in the probability of treatment due to the commercial regulation. In columns (1) and (2), this variable is interacted with a dummy variable equal to one if the big-box is opened in (or next to) the city centre and zero if it is opened in the suburbs. In columns (3) and (4) the dummy variable is interacted with a dummy equal to one if the big-box is considered to be a conventional supermarket, i.e. selling all brands and equal to zero if it is a discount big-box, i.e. typically selling their own, lower price brands. (3) 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 kilometres, immigration level, unemployment and importance of the services sector in order to control for trends. (4) *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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



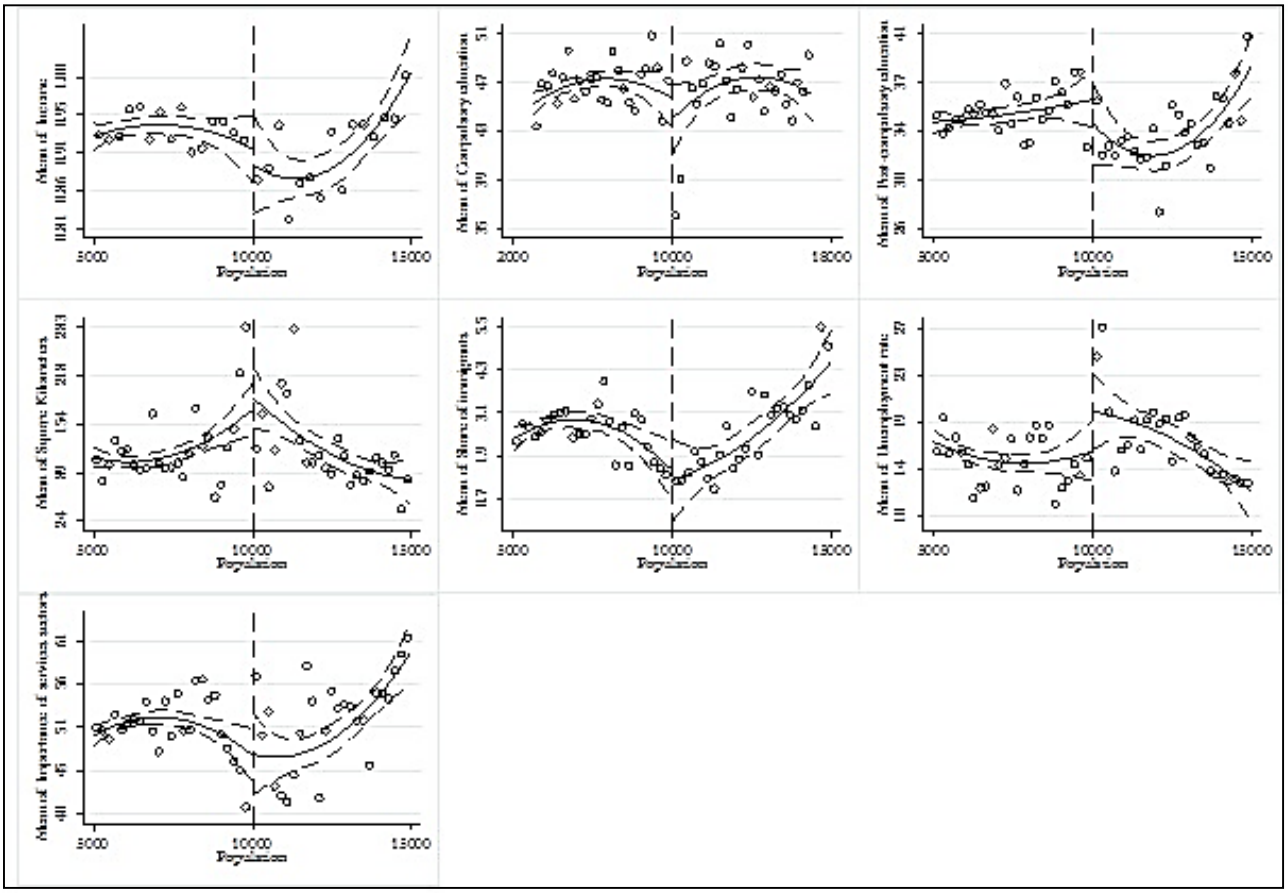
Note: Panel (a) shows bin averages of the number of big-box openings using the raw data and adjusting a linear polynomial at each side of the threshold. Panel (b) shows bin averages of the number of big-box openings using the raw data and adjusting a quadratic polynomial at each side of the threshold.

Figure 2: Continuity of the forcing variable at the threshold



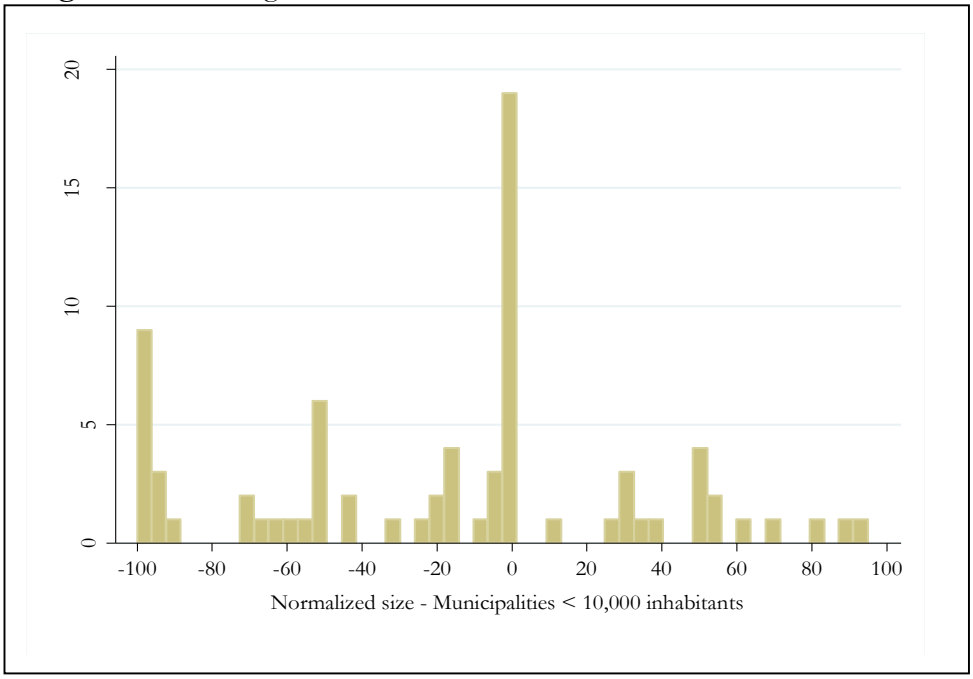
Note: Panel (a) shows the histogram for three different bin widths: 1,000, 400 and 200 inhabitants. Panel (b) presents the results of the McCrary test, consisting on running local linear regressions at both sides of the threshold. The circles represent bins of the population density.

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



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'.