Preliminar version. Comments welcome

ENTRY UNDER QUALITY UNCERTAINTY: LESSONS FROM SUPERMARKETS[1]

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Abstract

Entry barriers in the retail sector are a frequent policy regulation in some countries. We evaluate the price effects of the entry of LIDL, a German hard discount supermarket chain, in the Gran Canaria (Canary Islands, Spain) in 2010 and only after winning a long legal battle. We first make a theoretical analysis of how an incumbent reacts when entry by a new operator is announced but does not know the level of quality the entrant will offer. We also analyze the incumbent's pricing strategy after entry has materialized and uncertainty disappears. Secondly, we use a database obtained from a special survey for a representative sample of supermarkets in Gran Canaria to estimate how incumbents reacted to entry in the products sold and not sold by LIDL. We show that there is some evidence that prices for all goods prior to entry were initially lower in supermarkets close to the future entrant compared to supermarkets further away. However, after entry incumbents' prices for products not sold by the entrant actually rose near the entrant's new stores, compared to a suitable control group of supermarkets farther away.

Keywords: Entry, Quality uncertainty, Prices, Retailing

J.E.L. Classification: L2, L15, L81.

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1. Introduction

This paper analyses the pricing effects of entry in the supermarket industry in the Gran Canaria Island, Spain. We use a novel data set of prices for 30 products gathered in over 120 supermarkets in the island just before and just after the entry of LIDL, a German hard discount supermarket chain, in 2010. During the period LIDL opened up four stores in the island in those municipalities where planning regulations permitted entry.

One of the curious characteristics of the data is that after entry incumbents' prices for certain products did not fall near the entrant's new stores, compared to a suitable control group of supermarkets farther away. This was the case for those products that both the incumbents and the entrant sell and that would be expected to fall after entry due to the increased competition. However, for those products not sold by the entrant, incumbent prices rose near the new entrant's stores, compared to prices for the same products further away.

We rationalize these results by presenting a model of entry under uncertain product variety and a habit formation (or consumer loyalty) demand structure, and show that under certain conditions an incumbent will reduce prices prior to entry on all products, and then increase prices on those products it sees ex–post that its new competitor does not offer.

Unfortunately, our database does not contain prices before the announcement of the future entry by LIDL and thus we are unable to confirm that prices actually fell for all products in the areas near the future new stores. However, evidence from other countries seems to suggest that incumbent supermarkets decrease prices when entry is announced, even by as much as six months before actual entry occurs (Lira, Rivero and Vergara, 2007).

Our article presents like main contribution how the incumbents react when they know the entry of new operators, but do not know at what level of quality enter in the market, and as further adjusted its pricing strategy after entry has materialized and uncertainty disappears. This analysis has not been done before and may be of great interest to know the effects of entry of new operators in the

short and long term. Second contribution of this paper is the distinction made between products sold by the entrant and those products that the new entrant does not sold. The incumbents strategically alter the prices of these two groups of products to accommodate the entry of new operators.

Our analysis using a difference in difference estimator of prices right before and right after entry —with supermarkets in areas further away from the entrant's store as a control group— does show the second prediction of our model; that is, that prices rise for products that the entrant does not sell, while they remain constant for products that it does sell.

After this introduction, section two contains a literature review on retail competition in supermarkets. A theoretical model of entry under quality uncertainty is developed on section three. Section four describes the supermaket industry in Gran Canaria and the data used in this study. The results are presented in section five and the last section presents the conclusions.

2. Literature review

There have been many issues discussed within the supermarket industry by the economic literature. One of the issues discussed are the factors affecting the entry of new competitors (Cotterill and Haller, 1992; and Daunfeldt, Orth and Rudholm, 2010) and how barriers to entry may increase equilibrium prices (Griffith and Harmgart, 2008) or reduce the generation of employment (Bertrand and Kramarz, 2002, Griffith and Harmgart, 2008).[3] Related to market entry, Foster, Haltiwanger and Krizan (2006) show the dynamics of entry and exit of establishments in the United States during the 90's and how this dynamic was responsible for the increase in productivity in this sector.[4]

In addition to the factors affecting entry, another issue studied has been the effects of mergers. Gómez-Lobo and González (2009) show how supermarket mergers in Chile did not lead to price reductions. In the Japanese market

[3] Orea (2010) and Hoffmaister (2010) show like the entry barriers existing in Spain explain the difference in prices between the different territories and the higher prices than average of European countries.

[4] For more formal models of market behavior see: Ellickson (2006), Ellickson (2007) or Dubois and Jodar-Rosell (2008)

Nishida (2008) shows how the hypothetical merger of two supermarket chains cause an increase in the number of establishments in the city center of Okinawa and a decline in the suburbs. According to the author, the reduction in logistics costs would explain this behavior.

Focusing on the articles that analyze the effects of new entry, as we shall see below, most of the literature analyses the case of the U.S. chain Wal-Mart. Basker (2005a) shows how the entry of Wal-Mart generates a creation of 100 jobs during the first year, but the loss of 50 jobs in the next few years by the exit of other retail operators. Similarly, the entry of Wal-Mart has an impact on the wholesale market, since the vertical integration characteristics of this chain leads to a reduction of 20 jobs. Matsa (2009) shows that the entry of Wal-Mart leads to increased competition in service quality, lowering shortfalls by up to 24%. Jia (2008) finds that the entry of Wal-Mart increases the level of competition explaining between 40% and 50% of the exists in the industry, mainly of small stores, while Zhu and Singh (2009) show how the entry of major discount chains (Wal-Mart, Target and Kamrt) occur preferentially near the headquarters (to minimize logistics costs) and markets with a high proportion of families with children and car. Also, they note that the effects of entry depend basically on the spatial differentiation which is heterogeneous depending on the type of competitor.[5]

If we look at the entry effects of Wal-Mart on prices, the first analysis, as far as we are aware, is Basker (2005b). In this study the author found in a sample of 165 cities that the entry of Wal-Mart generates slight but significant decreases in prices in the short term (1.5-3%), with stronger price decreases in the long term (7-13%). The price declines are greater in small cities where the intensity of competition before the entry of Wal-Mart was low. Hausman and Leibteg (2007) also found that the entry of Wal-Mart generates a reduction in equilibrium prices, finding that households saved 25% of expenditure on food. Further, the authors point out that as lower-income families are those with a higher propensity to buy in such supermarkets, savings could be even greater. Finally, Basker and Noel (2009) also found a negative effect on prices of 1%-

[5] See Basker (2007) for a summary of the main effects generated by the entry and expansion of Wal-Mart.

1.2% but it is not homogeneous for all operators. While the effect of the Wal-Mart entry is limited to major supermarket chains (Albertson's, Safeway and Kroger) and does not even reach 0.5%, for discount stores (which compete more directly with Wal-Mart) prices fell by 1.8%. It should be noted that the authors show how the prices of products not sold by Wal-Mart (movie tickets, hairdressers, etc.) did not change, as competition in these products was not increased.

We have also found some studies outside of United States. Lira, Rivero and Vergara (2007) analyze the impact of entry into the main 15 cities in Chile, showing a reduction in the cities average prices between 7 and 11%. Abe and Kawaguchi (2010) observed that the opening of new supermarkets in Japan generated significant decreases in prices of between 0.4 to 3.1% depending on the product. Table 1 summarizes the results of main papers that examined the effect of entry on prices.

TABLE 1. ANALYSIS OF ENTRY'S EFFECTS IN PRICES

Author	Country	Year	Entry's effect on prices
Basker (2005b)	USA	1982-2002	1.5%/3% (s.r.) 7%/13% (l.r.)
Hausman and Leibteg (2007)	USA	1998-2003	25%*
Liria, Rivero and Vergara (2007)	Chile	1998-2004	7%-11%
Basker and Noel (2009)	USA	2001-2004	1%-1.2%
Abe and Kawaguchi (2010)	Japan	2000-2007	0.4%-3.1%

Source: Own elaboration
(s.r.)=Short run. (l.r.)=Long run
*Savings on household spending on food.

From Table 1, as far as we are aware, studies examining the effect on prices for a new operator is reduced and non-existent for the European market.[6] All the studies point to reductions in the equilibrium prices although reductions are moderate. What is not dealt with in the literature is possible pricing reaction of incumbent's prices when the announcement of entry in made and there is

[6] Uusitalo (2004) analyzed in a descriptive way the effect of LIDL's entry in Finland. The author shows how the number of products sold by incumbents increased (products of low and high quality), fixing the price of low quality products near LIDL's prices, and maintain constant the price of high quality products (most of them not sold by LIDL).

uncertainty with respect to entrants' quality offering and subsequently the pricing strategy when entry is effective and uncertainty is resolved.

3. The model

We assume a three period model. At time t_0 the entrant announces its entry decision. Since there is a period of time required before actual entry can be made, entry is materialized at t_2. In the interim, at time t_1, the incumbent must decide the price to charge during that period. We assume that due to habit formation or customer fidelity the demand faced by the incumbent firm in t_2 depends on the price charged in t_1. In the second period, entrant and incumbent compete in prices with differentiated products.

We assume there are two types of products: A and B. There is uncertainty as to which products the entrant will offer. Thus, the incumbent firm must make its pricing decision in period 1 without knowing exactly the quality (as measured by the product variety offered by the entrant) that its competitor will offer in period 2. We further assume that entry location is exogenous for reasons that will be discussed further below.

The above assumptions are motivated by the characteristics of the Spanish and specifically the Gran Canaria supermarket industry and the recent entry of LIDL, a German hard discount supermarket, in Gran Canaria. That entry location is exogenous is reasonable in the Spanish context were strict planning regulations limit entry into the pharmaceutical and supermarket industry. For example, in Gran Canaria Island, there are strict limits as to the density of retail and supermarket stores by zones. These limits are base on a maximum number of square meters of store space per population of each zone. At the time LIDL decided to enter the industry in Gran Canaria, only a few municipalities had spare capacity for LIDL to enter without infringing the planning regulations limits. Thus, once entry had been decided it did not have much choice as to its store locations, at least at the municipal level.[7]

[7] Furthermore, since we use a difference in difference estimator, any unobserved municipal characteristic affecting demand or cost are controlled for.

The uncertainty as to the product variety that the entrant will offer is also motivated by the recent LIDL entry in Gran Canaria. Initially, the authorities were unwilling to authorize entry even though in the municipalities that LIDL wanted to enter the planning regulations were not binding. Apparently, the authorities' opposition was motivated by the negative view they had on the opening of hard discount supermarkets, presumably to protect small and medium size incumbents. A legal battle ensued and LIDL won, paving the way for its entry into the island in those municipalities allowed by the planning regulations. However, in order to placate local sensitivities, LIDL announced that it might enter more as a traditional supermarket rather than a hard discount one.[8] Thus, for incumbents there was uncertainty as to the characteristics and product variety that the future entrant would offer.

Habit formation or customer loyalty considerations are introduced because there is evidence that incumbents react to entry much earlier than when entry actually takes place. For example, Lira, Rivero and Vergara (2007) indicate that in Chile incumbent supermarkets reduced prices as much as six months prior to the entry of a new chain of supermarkets in a city. The announcement of entry seems to be sufficient to provoke a reaction by incumbents even though actual competition with the new entrant will occur some months into the future. This reaction can only be rationalized if there is some type of habit formation or customer fidelity relating future demand to current demand and prices.

Thus the model tries to analyze what the incumbent pricing decision would be prior to entry and before uncertainty is resolved and then it's pricing decision once uncertainty is resolved.

In order to have a benchmark, we first develop the pricing decision of the incumbent if there is no entry. In this case, the firm must maximize

$$\pi = \pi_A^1\left(p_A^1\right) + \pi_B^1\left(p_B^1\right) + \delta \cdot \left[\overline{\pi}_A^2\left(p_A^1\right) + \overline{\pi}_B^2\left(p_B^1\right)\right] \tag{0.1}$$

[8] See "LIDL renuncia al descuento duro", Canarias 7, Sunday, April 2, 2006, page 37, or "LIDL entra en Canarias", Monday October 2, 2006, page 14.

where π_j^1 is the profit of the incumbent in period 1 for products $j \in (A,B)$, $\overline{\pi}_j^2$ is the reduce form profit function of period 2, which is a function of period 1 prices and $\delta<1$ is a discount factor.[9] For simplicity we assume that the demand for product A and B are independent and the costs of supplying these products are also independent. First order conditions for this problem are:

$$\frac{\delta\pi}{\delta p_j^1} = \frac{\delta\pi_j^1}{\delta p_j^1}\left(\tilde{p}_j^1\right) + \delta \cdot \frac{\delta\overline{\pi}_j^2}{\delta p_j^1}\left(\tilde{p}_j^1\right) = 0 \qquad (0.2)$$

where $\tilde{p}_j^t$ is the optimal price in each case.

Habit formation or customer fidelity is modeled with the assumption that $\frac{\delta\overline{\pi}_j^2}{\delta p_j^1} < 0$, implying that raising price today, reduces profits tomorrow (for the optimal price tomorrow). This would be the case for example if demand in the second period is positively correlated to demand in the first period.

Under the assumption that $\frac{\delta\overline{\pi}_j^2}{\delta p_j^1} < 0$ for all $\tilde{p}_j^1$, then $\tilde{p}_j^1$ is smaller than the price that maximizes profits in the short run since:

$$\frac{\delta\pi_j^1}{\delta p_j^1}\left(\tilde{p}_j^1\right) > \frac{\delta\pi_j^1}{\delta p_j^1}\left(\tilde{p}_j^1\right) + \delta \cdot \frac{\delta\overline{\pi}_j^2}{\delta p_j^1}\left(\tilde{p}_j^1\right) = 0 .$$

With entry and the uncertainty regarding the entrant's product variety discounted profits in period 1 are given by:

$$\pi = \pi_A^1\left(p_A^1\right) + \delta \cdot \pi d_A^2\left(p_A^1\right) + \delta \cdot \left[\alpha \cdot \overline{\pi}_B^2\left(p_B^1\right) + (1-\alpha) \cdot \pi d_B^2\left(p_B^1\right)\right] \qquad (0.3)$$

where α as the probability that the entrant will enter with only products A and πd_j^2 is the reduced form profits from duopoly competition with the entrant in

[9] In this part we are concerned with the pricing decision on period 1. Therefore, we use the reduced form profit function for period 2, which assumes that prices in this second period are set optimally for each case. Since the firm can change prices rapidly, it does not need to establish prices for period 2 until uncertainty is resolved and it knows the product variety offered by the entrant. We will discuss prices in the second period further below.

the second period for product $j \in (A,B)$. Implicit in this expression is the fact that the incumbent knows that the entrant will compete for sure in products A, but is unsure whether it will also compete in product line B. First order conditions for this problem are:

$$\begin{aligned} \frac{\delta \pi}{\delta p_A^1} &= \frac{\delta \pi_A^1}{\delta p_A^1}\left(\hat{p}_A^1\right) + \delta \cdot \frac{\delta \pi d_A^2}{\delta p_A^1}\left(\hat{p}_A^1\right) = 0 \\ \frac{\delta \pi}{\delta p_B^1} &= \frac{\delta \pi_B^1}{\delta p_B^1}\left(\hat{p}_B^1\right) + \delta \cdot \alpha \cdot \frac{\delta \overline{\pi}_B^2}{\delta p_B^1}\left(\hat{p}_B^1\right) + \delta \cdot (1-\alpha) \cdot \frac{\delta \pi d_B^2}{\delta p_B^1}\left(\hat{p}_B^1\right) = 0 \end{aligned} \tag{0.4}$$

Now it is easy to see that with entry the prices for products A will be lower than without entry if the following condition holds:

$$\frac{\delta \pi d_A^2}{\delta p_A^1} < \frac{\delta \overline{\pi}_A^2}{\delta p_A^1} < 0 \quad \forall\, p_A^2 \Leftrightarrow \hat{p}_A^1 < \tilde{p}_A^1 \tag{0.5}$$

That is, if duopoly profits are more sensitive to period one prices than monopoly profits.

For products B it is easy to see from (0.2) and (0.4) that the condition is exactly the same:

$$\frac{\delta \pi d_B^2}{\delta p_B^1} < \frac{\delta \overline{\pi}_B^2}{\delta p_B^1} < 0 \quad \forall\, p_B^2 \Leftrightarrow \hat{p}_B^1 < \tilde{p}_B^1 \tag{0.6}$$

Thus, under the stated conditions we would expect the incumbent firm to reduce prices for all products once the entrant announces its intention to enter the market but before entry is materialized. However, once uncertainty is resolved, the incumbent will be either facing competition in all products or only in products A. In the first case, it would be expected that prices for products A and B remain constant or fall once entry materializes. This will depend on the dynamic pricing equilibrium of the duopoly compared with the price set by the incumbent in the first period. If the equilibrium is equal to the stage game (static) Nash Equilibrium we would expect prices to decrease since in the first period, the firm had some market power to raise prices above that level.

For products that the entrant does not offer we expect prices to rise after entry. In this case, prices in the second period are set optimally so that:

$$\frac{\delta \pi_B^2}{\delta p_B^2}\left(p_B'^2\right)=0$$

From condition (0.4) it is direct to see that this requires $p_B'^2 > \hat{p}_B^1$. Even if we assume a recursive structure[10], such that the firm maximizes over another two periods, prices will still rise since:

$$\frac{\delta \pi}{\delta p_B^t}=\frac{\delta \pi_B^t}{\delta p_B^t}\left(p_B'^t\right)+\delta\cdot\frac{\delta \overline{\pi}_B^{t+1}}{\delta p_B^t}\left(p_B'^t\right)=0$$
$$>\frac{\delta \pi_B^t}{\delta p_B^t}\left(p_B'^t\right)+\delta\cdot\alpha\cdot\frac{\delta \overline{\pi}_B^{t+1}}{\delta p_B^t}\left(p_B'^t\right)+\delta\cdot(1-\alpha)\cdot\frac{\delta \pi d_B^{t+1}}{\delta p_B^t}\left(p_B'^t\right)$$

The first part of the above condition is the first order condition of the price optimization when there is no competition; the inequality that follows is due to the inequality:

$$\frac{\delta \pi d_B^2}{\delta p_B^1}<\frac{\delta \overline{\pi}_B^2}{\delta p_B^1}<0\,.$$

Thus, what we have shown is that when an entrant announces that it will enter an industry and the incumbent is unsure regarding the product variety that the entrant will offer, it should reduce prices on all goods. However, once entry occurs prices should remain fairly constant or even fall in the product line where the entrant competes with the incumbent, but increase for those products that the incumbent learns that the entrant does not offer.

We explore these predictions using data gathered before and after the entry of LIDL in the supermarket in the Gran Canaria Island.

[10] We have not couched the model in a recursive format, so what follows is not very rigorous. However, a recursive structure would make the model more complex without generating any new insights.

4. Data

Gran Canaria is the most populated island of the Canary Islands (Spain). The stable population is around 800 thousand people but close to 3 million people visit each year (2010 data). Nevertheless, most tourist use tour operators and all-inclusive hotel systems which reduces potential effects on retail supermarket demand.

In order to study the effects of LIDL entry into the Gran Canaria Island, a special survey was designed and applied in two waves for a representative sample of supermarkets. The price for 30 products was collected in each sampled supermarket. The first wave was undertaken on the last week of January 2010 (about 3 weeks before LIDL opened) and the second wave on the last week of April 2010 (2 months after LIDL opened). The survey was undertaken by annonymous intervieweres who registered the price of each good, including branded and non-branded products. The next subsections describe the sample design and some descriptive statistics.

4.1. Sample design

There are 738 supermarkets in Gran Canaria Island (Regional Government Business Census, 2009). We considered all supermarkets located in areas with at least 15,000 inhabitants (688 supermarkets and malls). Thus, we have excluded around 10% of the universe of supermarkets. However, supermarkets in tourist areas were included in the sampling universe.

Stratified random sampling by supermarket size was used in the survey design. Table 1 shows the size distribution of supermarkets and the sample considered for each category. Almost all supermarkets with more than 1,000 m^2 were surveyed.

TABLE 2: SIZE DISTRIBUTION OF SUPERMARKETS AND SAMPLE SIZE (GRAN CANARIA ISLAND)

Size	Number of supermarkets	Sample	Percentage of supermarkets analyzed
Less than 120 m^2	341	41	12%
Between 120 and 399 m^2	208	23	11%
Between 400 and 999 m^2	68	6	8.8%
More than 1000 m^2	51	49	96%
Total	668	119	18%

Source: Own elaboration based on Official Business Census made by the Regional Government.

Some descriptive statistics are presented in Table 2. Supermarkets sampled have on average 6 cash registers and 40% of them have parking. The population surrounding retailers is on average equal to 1,271 in a radius of 250 meters from each store, increasing to 25,774 when the radius is expanded to 1,500 meters.[11]

As regards the potential effects of LIDL, less than 1% of incumbent supermarkets analyzed have a LIDL closer than 250 meters. In a 1,500 meter radius, 13% of incumbent supermarkets have a LIDL nearby. The average minimum distance to a LIDL in our sample is 12,535 meters and products sold by all supermarkets (both LIDL and others) are 64% of our sample.

[11] All distances obtained are Euclidean ones. These have been calculated with Matlab codes, available upon request to authors. Also population has been obtained assuming an uniform distribution within cities. In fact, we have used detailed data on levels lower than cities (*núcleos poblacionales* in Spanish Statistical nomenclature) by ArcGis software.

TABLE 3: DESCRIPTIVE STATISTICS

Variable	Average	S.D.	Minimun	Maximun
Number of cash registers	5.8	8.3	1	60
Parking	0.4	-	0	1
Unbranded product	0.33	-	0	1
Population at 250 meters	1,271	1,235	2	5,160
Population at 500 meters	4,365	4,088	17	18,438
Population at 1500 meters	25,774	27,281	744	116,852
Lidl in 250 meters	0.008	0.09	0	1
Lidl in 500 meters	0.03	0.18	0	1
Lidl in 1500 meters	0.13	0.33	0	1
Minimun distance to a Lidl	12,535	8,570	0	28,621
Products sold by Lidl	0.64	-	0	1

Source: Own elaboration. S.D. is Standard Deviation.

As regards the products surveyed in each supermarket, a consumer basket of 30 ítems was considered, characterized not only by brand but also by size.[12] For some ítems prices for both branded and unbranded were registered.

4.2. Descriptive analysis of entry

With the above data an initial descriptive analysis of the data was undertaken. A quadratic relationship between the logarithm of the change in prices of different products (before and after entry) and distance to a LIDL establishment was fitted on the data. The results can be seen in Table 4.

As seen in this table we have divided the sample into two major product groups. Products sold by LIDL on the one hand, and on other products not sold by the entrant. As shown, the relationship between the change in the price of

[12] The products are: rice, cornflakes, spaghetti, noodles, gofio, white bread, chicken breast, beef, ham, canned tuna, eggs, milk, yogurt, banana, olive oil (big and small), water, lentils, potatoes, beer, cola, coffee, rum, chocolate, sugar, salt, tooth paste, mop, and detergent.

the goods and the distance to a supermarket LIDL is radically different between both groups of products.

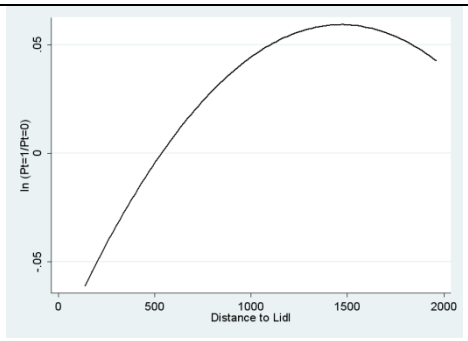
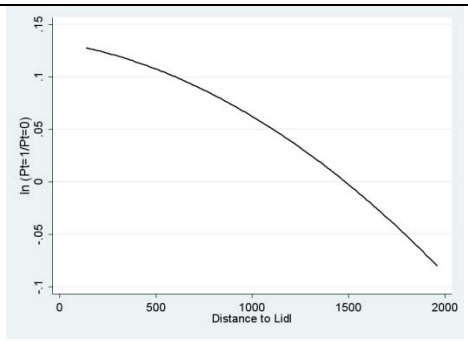
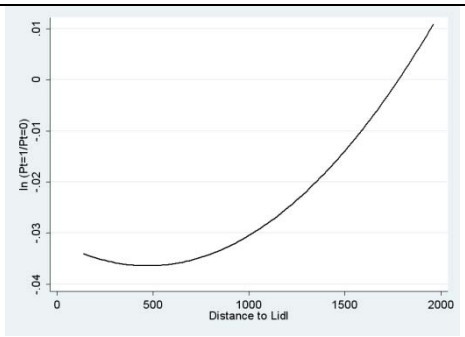
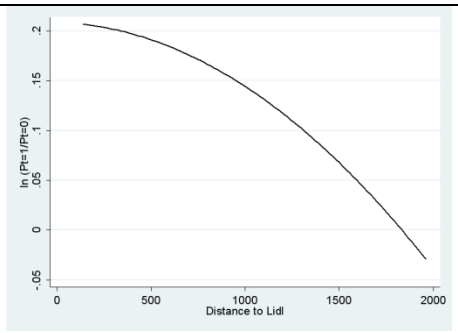
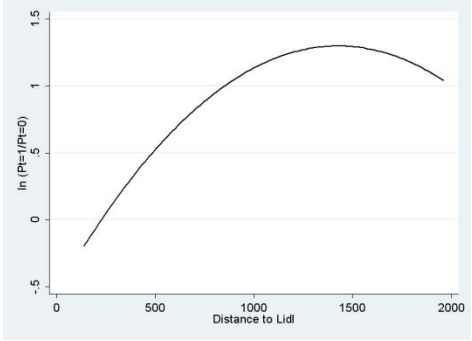
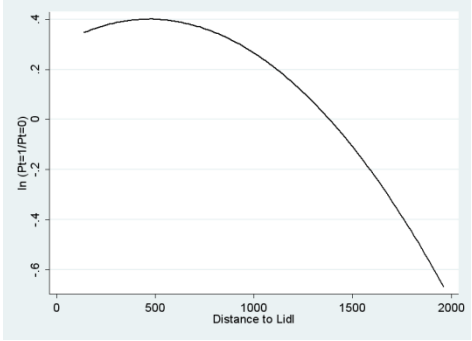
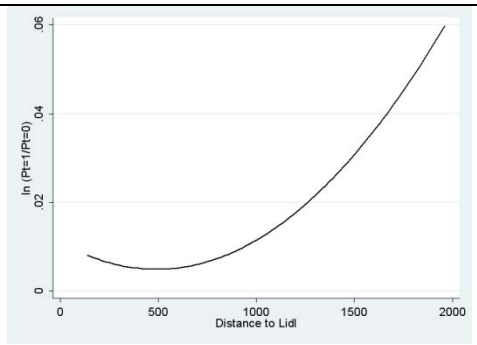
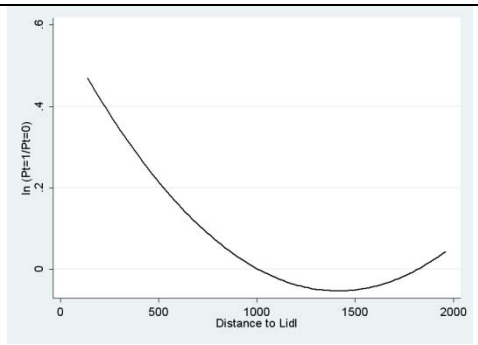
In the case of products sold by LIDL we can see product prices virtually unchanged or even fall near LIDL supermarket, but increase for supermarkets that are far from the new entrant. On average prices of products sold by LIDL were lowered near the entrant, while those supermarkets located further away (1500 meters or more) increase prices for these products.

In addition to showing the average change over all products, we also present the relationship of a set of specific products sold by LIDL: rice, beef and beer. The results are very similar. For example, in the case of rice in supermarkets near to LIDL the price decreased after entry, while further away supermarkets increased the price of this product. In the case of beef and beer, supermarkets near LIDL did not increase the price of these products, while those further away did increase prices. Therefore, for products sold by LIDL prices in the supermarkets near the new entrant remained constant or decrease slightly, while in supermarkets further away they increased.

For products that LIDL does not sell the relationship is completely different. As we can see the average change in prices of products not sold by LIDL is much higher near the LIDL supermarkets than in more distant supermarkets. While the supermarkets near LIDL significantly increased prices, supermarket further than 1,500 meters or more kept prices constant or even reduced them. As in the previous case, Table 4 also presents the relationship for a set of products not sold by LIDL that clearly show this behavior: Cornflakes, potatoes and rum.

In summary, the graphical analysis seems to show that prices for products sold by LIDL at nearby supermarkets remained constant or decrease slightly after entry, while prices increased for the same products in supermarkets further away. For the products not sold by LIDL nearby supermarkets increased price significantly, while supermarkets 1,500 meters or more further away kept prices constant or even decreased them. The correlations showed in the graphical analysis could have other explanations than the entry of LIDL. For example the possible existence of supply or demand shocks. Therefore, to find a more robust relationship an econometric approach is needed.

TABLE 4. FIT QUADRATIC EQUATIONS.

Products sold by Lidl	Products not sold by Lidl
Average of products	Average of products
	
Rice	Cornflakes
	
Beef	Potatoes
	
Beer	Rum
	

Source: Own elaboration

5. Empirical strategy and estimations

As a preliminary analysis we first present some tabulation of the data in the tables shown below. First prices for all goods were normalized by the average price for the same good prior to entry. The first tabulations show the average price over all goods, classified according to whether the product was eventually sold by LIDL or not and whether there is a LIDL less than 0.5 kilometers away.

TABLE 5: PRICE INDEX (NORMALIZED) BEFORE ENTRY

		Is there a LIDL less than 0.5 kms?	
		No	Yes
Is this product sold by LIDL?	No	1.008391	0.9562631
	Yes	1.005289	0.9715162

Source: Own elaboration

Thus, for example, on average normalized prices were 1.0083 for products not sold by LIDL and in supermarkets further than 0.5 kilometers away before entry.[13] We can see from Table 5 that in supermarkets further away from the entrant, prices were slightly above average for all products. However, for supermarkets close to the new entrant, prices are below average (below 1) prior to entry for all products, both those sold and eventually not sold by LIDL.

Although this last result lends some support for the idea that prior to entry supermarkets close to entrants lowered all of their prices, we cannot be too emphatic since unobserved local demand or cost conditions could also influece the price levels in each area. More robust is the comparison between the price tabulation prior to entry and the tabulations after entry, which are shown in Table 6 below.

[13] This average is not exactly equal to one because each price was normalized by the price of that good for all supermarkets prior to entry.

TABLE 6: PRICE INDEX (NORMALIZED) AFTER ENTRY

		Is there a LIDL less than 0.5 kms?	
		No	Yes
Is this product sold by LIDL?	No	0.9888174	1.02726
	Yes	1.033544	1.019316

Source: Own elaboration

We can see that in supermarkets far away from entrants, prices fell on average by almost 2% for products not sold by the entrant (from 1.008 to 0.989). The equivalente prices rose for the case of supermarkets close to an entrant, from 0.956 to 1.027, an increase of over 7%.

The same did not occur for prices of goods sold by the entrant. In this case, prices rose by almost 3% in supermarkets not close to the entrant and by almost 5% in supermarkets close to the entrant. These two figures are not very different or at least not as different as the case for products not sold by LIDL.

We can summarize the results of these tabulation as indicating that a) supermarkets close to the new entrants had lower prices for all goods just prior to entry compared to supermarkets further away, although this could be due to unobservable cost or demand effects, and b) after entry supermarkets close to new entrants raised prices on those products not sold by the new entrant. The same price behaviour was not observed for these goods in supermarkets further away.

In order to test whether these differences are statistically significant we estimate econometrically the following price change equation:

$$\ln\left(p_{ij}^{1}\right) - \ln\left(p_{ij}^{0}\right) = \beta_0 + \beta_1 \text{Productnotsoldby Lidl}_i + \beta_2 \text{LidlinXmeters}_j +$$
$$+ \beta_3 \text{Prod*Lidlin}_{ij} + \beta_4 \text{PopulationinXmeters}_j + \sum_{h=1}^{11} \beta_h \text{City} + \sum_{l=1}^{5} \beta_l \text{Supermsize}_j$$

where p_{ij}^1 is the price of the product i at supermarket j in period 1 and p_{ij}^0 is the price of the product i at supermarket j in period 0. By taking the difference in log prices we are controlling for posible unobserved effects at the local level. *Product not sold by Lidl* is a binary variable that takes value 1 if the product i is not sold by the entrant. *Lidl in X meters* is a variable that counts the number of LIDL stores that supermarket j has in X meters (depending on the specification X can vary from 500 to 1,950 meters). The variable *Prod*Lidlin* is the interaction between the two latter variables. *Population in X meters* is the population surrounded supermarket j in a radius of X meters (from 500 to 1950 meters). Finally the variables *City* and *Supermsize* are fixed effects by geographical and size of supermarket (by square meters of supermarket), respectively.

The idea behind this specification is to compare growth rates of prices in areas close to the new LIDL stores (captured by the *lidlinXmeters* variable) with those further away (control group) and depending on whether the product is or is not sold by the new entrant. The coefficient on the interaction of the these two variables will indicate whether there is a different behaviour of prices of goods sold by the new entrant compared to those not sold by the new entrant.

The population, city and supermarket size variables are included to control for any cost shock or behavioral heterogeneity that may have affected different zones and store types.[14]

Alternatively, we could have specified a difference in difference model for each product separately. This can be done by estimating an equation for the price level (or log prices) of each good in each supermarket on a time dummy indicating whether the observation was for a price before or after the entry of LIDL, whether the observation was taken in a supermarket close to the area where a LIDL store opened, and the interaction of these two variables. Then we could have compared the parameter value of this interaction term for each product and see whether they differ on average between products sold by LIDL and products not sold by the new entrant.

[14] The results are almost identical if these variables are excluded from the regression.

However, our specification has several advantages. First, not all products are sold by each supermarket and estimating a product by product equation results in poor estimates due to the small number of observations for some goods. Second, our specification allows us to directly identify the different effects of LIDL entry on products sold and not sold by the new entrant without having to do a complementary analysis of results.

The results of estimating the model are presented in Table 7. The Table shows that the interaction parameter is negative and statistically significant when X is equal to and greater than 500 meters. This coefficient indicates that for those products not sold by LIDL the growth in prices was larger for supermarkets with an entrant closeby compared to supermarkets further away. Furthermore, this effect decreases as we consider supermarkest further away from the new entrants. Past 1,550 meters there is no further discernible effect.

TABLE 7: ESTIMATION OF CHANGE IN PRICES $\ln\left(p_{ij}^{1}/p_{ij}^{0}\right)$

Distance (meters)	Product not sold by LIDL	LIDL near in X meters	Interaction	Constant
500	0.043***	-0.031	0.125**	-0.033
750	0.037**	0.015	0.126**	-0.033
1000	0.039**	0.008	0.086**	-0.035
1250	0.039**	-0.011	0.059**	-0.035
1500	0.039**	-0.003	0.056*	-0.039
1750	0.042**	-0.008	0.036	-0.034
1950	0.043**	-0.009	0.032	-0.034
Number observations	2631	R^2 (Average)	0.019	

Note 1: *** 1%, ** 5%, *10% significance test. All estimations include population, size of supermarket and fixed effects by city, which are not included in this table.
Note 2: All estimations are jointly significatives.

These results indicate that supermarkest close to a new entrant increased prices significantly on those products not sold by LIDL after entry, while similar supermarkets further away did not increase the prices on these goods. We interpret these results as confirming our prior expectations that supermarkets close to new entrants may have reacted to the entry announcement by lowering prices on all goods and then, once entry occurs they raise prices on the goods that the new entrant does not sell. This effect would not be present for the same goods in supermarkets further away.

6. Conclusions

In this paper we have shown that there is some evidence that prices for goods prior to entry by a new supermarket chain were initially lower in supermarkets close to the future entrant compared to supermarkets further away for all goods. Unfortunately, since we do not have prices prior to the entry announcement and because there may be unobserved local effects that explain price differences between entry and no entry areas, we cannot be too emphatic regarding this evidence. However, for the goods eventually not sold by the entrant, prices rose by close to 9% after entry. The same did not occur for goods sold by the entrant. In this case, price increased by a similar amount in supermarkets close to the entrant compared to supermarkets further away.

We rationalize these results by providing a simple model of entry under uncertainty as to the product variety that would be offered by the entrant. Also, habit formation or consumer loyalty is assumed in the demand structure. With this model it is shown that supermarkets close to an entrant should lower prices on all goods prior to entry and then raise prices on those goods that are ex–post observed not to be sold by the entrant.

This paper also confirms that 1.5 kilometers seems to be a reasonable cut-off point to define a relevant market around a supermarket. Firms within this perimeter seem to compete (although with varying degrees of intensity depending on the exact distance between them) and beyond this distance do not seem to have an interaction. This same distance (1.5 kms) was used by Abe and Kawaguchi (2010) in their study of the effects of new entry on pricing in the Japanese supermarket industry.

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