Nº 299
Octubre 2005

Documento de Trabajo

ISSN (edición impresa) **0716-7334**
ISSN (edición electrónica) **0717-7593**

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www.economia.puc.cl

Versión impresa ISSN: 0716-7334
Versión electrónica ISSN: 0717-7593

PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
INSTITUTO DE ECONOMIA

Oficina de Publicaciones
Casilla 76, Correo 17, Santiago
www.economia.puc.cl

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INDEX

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ABSTRACT

One of the most significant developments in the last couple of decades in the retail industry has been the emergence of large supermarkets (hypermarkets). The purpose of this paper is to investigate the effect on prices of the entry of a large supermarket into a given location. We use a panel with data from fifteen cities in Chile for the period 1998:I – 2004:IV. The dependent variable is the price of a bundle of 52 food products in each city relative to Santiago. We find that the entry of a hypermarket to a given city reduces prices in that local market by ten percent. Most interestingly, we also find that half of this effect takes place the year before the supermarket actually opens for business.

Key words: entry, prices, retail.

JEL Classification: L81, L10, L11.

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We are grateful to Rodrigo Cerda, Igal Magendzo, Alejandro Micco, Will Mullins and to participants in seminars at the Catholic University of Chile and at the Central Bank of Chile for valuable comments. Rivero and Vergara gratefully acknowledge financial support from DyS. The views expressed in this paper are those of the authors and are not necessarily reflective of views at DyS.

1. – Introduction

How the entry of new firms affects product prices in the retail sector is a subject that has attracted little empirical analysis. Broadly speaking, existing work has focused on barriers to entry and on the capacity of potential entrants. This paper examines the impact of entry on retail prices in the supermarket sector in Chile.

Inflation has fallen steadily over the last few years in Chile, largely as the result of prudent macroeconomic policy. Nonetheless, disaggregating inflation by item highlights the fact that micro-economic factors have also contributed to this downward trend. By way of example, inflation in the foodstuff, apparel, and domestic appliance sectors – all representative of the retail market as a whole – has been consistently below the average rate. Figure 1 plots a foodstuff consumer price index against the general Consumer Price Index (CPI) from 1998 to 2004: the price of foodstuffs relative to the CPI has fallen by 10% over the period. It is important to note that foodstuffs make up nearly 80% of supermarket sales. Figure 2 presents a price index of goods sold in supermarkets[1] which includes foodstuffs, domestic electrical appliances and apparel, weighted by market share. It illustrates that the drop in supermarket prices relative to the CPI over the period amounts to approximately 14%. It has been suggested that this relative deflation is partly driven by increased competition in the retail sector,[2] as the major supermarket chains have expanded, opening new hypermarket stores throughout Chile. This paper will suggest that this hypermarket expansion has lowered the prices of local products sold by incumbent retailers.

The relative retail price deflation associated with new entrants to local markets is attributable to two main factors. The first is the superior productivity of entrants relative to incumbents, which improves overall industry productivity and is transmitted to consumers through lower prices. The second is the downward pressure on prices generated solely by the increased competition in those local markets where some market power previously existed.

The relationship between productivity improvements and the entry or exit of new firms or plants has been widely studied in the literature, especially in the 1990s. Among the conclusions reached by this literature is the view that a significant proportion of productivity growth is due to firm substitution. Resource re-assignment is vital to the growth of industry productivity, as newer firms adapt to technological change more rapidly than incumbents (Foster et al. 2002). Moreover,

[1] This index was based on the supermarket sales index published by the National Statistics Institute of Chile.
[2] The Central Bank of Chile’s January 2004 Monetary Policy Report notes: “In Chile...several sources indicate that competition has intensified in the commerce sector, with an attendant effect on inflation which is to be seen most clearly in the reduced prices of non-perishable foodstuffs.” “...in the non-perishable foodstuff sector operating margins have fallen steadily since 1998.”

new firms enter the market with the most advanced contemporary technology available, giving them a productivity advantage over incumbents that have yet to incorporate such technology, eventually causing the latter to exit the market (Caballero and Hammour, 1994).

Figure 1: Foodstuff Consumer Price Index and Consumer Price Index 1998-2004

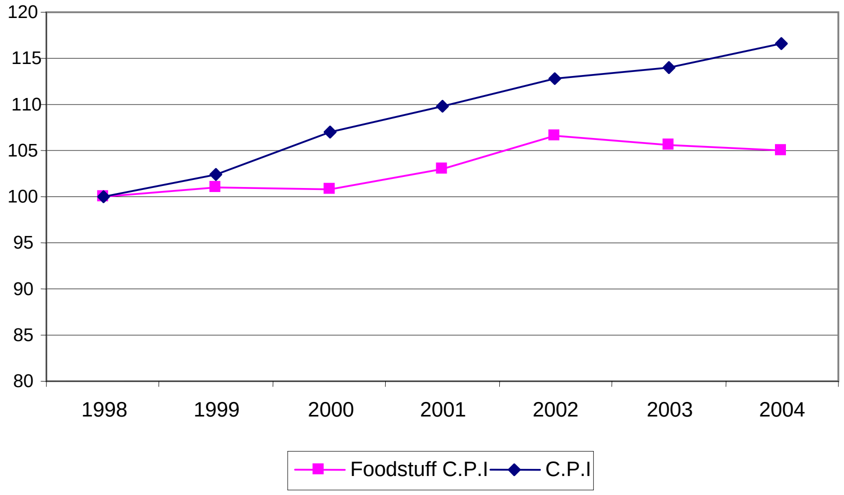
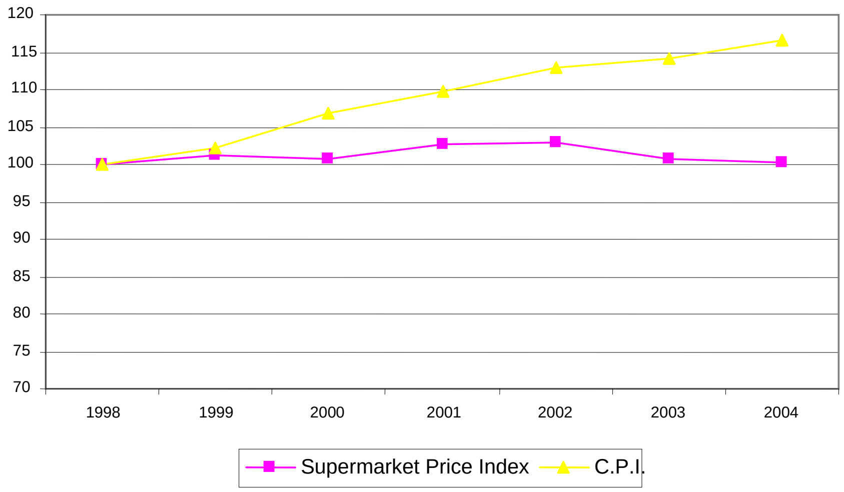


Figure 2: Supermarket Price index and C.P.I. 1998-2004



The commerce sector – both retail and wholesale – has one of the highest productivity growth rates over the period 1995-2000: Fernald and Ramnath (2004) estimate annual US total factor productivity (TFP) growth at 5.33% in retail, and 5.37% in the wholesale sector, as opposed to an overall average rate of 2.88%. They attribute this to the sector's extensive adoption of information technology, such as checkout till data scanners and EDI (Electronic Data Interchange) interconnected data transmission systems that allow continuous information exchange between distributors and suppliers. These technologies have greatly improved logistic efficiency by cutting the time between stock-taking and the placing of orders with suppliers, and by lowering the amount of time that products are held in stock (Holmes 2001). Vergara and Rivero (2005) report that the commerce sector has led TFP growth in Chile between 1986 and 2001.

Empirical studies for the US indicate that in the manufacturing sector at least one third of productivity increases are transmitted via the substitution of less efficient by more efficient firms over a ten year time span. However, in the retail industry firm turnover is even more significant in this regard, as virtually the entirety of productivity increases are thought to come via entry and exit over the same time horizon. The evidence suggests that within-incumbent-firm restructuring does not generate significant increases in industry productivity. In other words, without the entry of new firms and stores the retail industry would have exhibited no productivity growth (Foster et al. 2002). Fittingly, Jarmin et al. (2003) note that entry and exit of firms in the retail sector is higher than in manufacturing. In addition, the McKinsey Global Institute (2001) attributes much of the adoption of new technology to the aggressive expansion of Wall-Mart stores. Given that new firms and stores enter the market with higher productivity levels due to their superior technology, we should expect prices to fall if the market is competitive enough to ensure that these efficiency gains are at least partially passed on to consumers. The arrival of Wal-Mart stores (a byword for low cost operations thanks to their logistics and distribution innovations) in a city is estimated to be associated with a fall of between 1.5% and 3% in product prices in the short term, and between 7% and 13% in the long term (Basker, 2005a).

Entry by new firms can also push prices down simply by increasing the degree of competition in the market. For this to occur there must be some existing market power, and the entrants must be significant enough to reduce it, increasing competition and lowering prices even if the new firms are not more productive. Empirical evidence from 15 EU countries indicates that there is a negative correlation between the degree of competition within those countries' markets – as measured by gross and net margins – and the average inflation level over extended periods of time (Przybyla and Roma, 2005).

The reaction of incumbent firms to potential and actual entry can be separated into two successive stages: the first, before the decision as to entry has been taken, but where there is a non-zero probability of entry, and the second, potentially before the store has opened for business, but after the decision has been taken and entry is a certainty. Incumbents that enjoy a degree of market power and have information that a potential entrant could enter the market must carefully consider whether to dissuade the entrant by creating some type of barrier to entry. Whether they pursue such a strategy will depend on the costs and benefits attendant to creating such a barrier. If the market is structured such that existing barriers render entry unprofitable, the optimal strategy for incumbents is, naturally, to do nothing. If existing barriers are low making entry a real possibility, then incumbents have to choose between two strategies: to dissuade entry, or to accommodate to it. Which strategy is finally implemented depends on the production capacity of both the incumbent and the entrant, the fixed cost of entry faced by potential entrants, and the extent to which the incumbent can differentiate its products.

In the US, Wal-Mart expanded rapidly, growing from 125 stores in 8 states in 1975 to 2,234 in 50 states in 1996, facing competition from over 69 rival chains. Wal-Mart's favored expansion strategy in an area consisted of establishing a distribution center and early stores nearby, and opening later stores further from this center over time. Moreover, the company inter-connected its store networks by regions as it grew, generating significant scale economies that provided a cost advantage over pre-existing local firms. The Wal-Mart expansion strategy suggests that it has been exogenous to the characteristics of incumbent firms, i.e. the extent to which they could deter entry was of little relevance. Despite this, existing firms responded to entry in a variety of ways, ranging from aggressive increases in investment to no change in investment levels, and even reductions in investment in some cases. The size and profitability of the incumbent were positively associated with the aggressiveness of the response, and discount stores also tended towards such reactions. On the other hand, firms with high levels of debt, or with high inside ownership responded much less aggressively (Khanna and Tice, 2000).

Goolsbee and Syverson (2004) analyze the entry of several major airlines into new flight routes in the US, and measured the response of the incumbents. They conclude that when entry into a route is thought to be very likely, existing carriers lower their prices on that route before entry actually occurs.

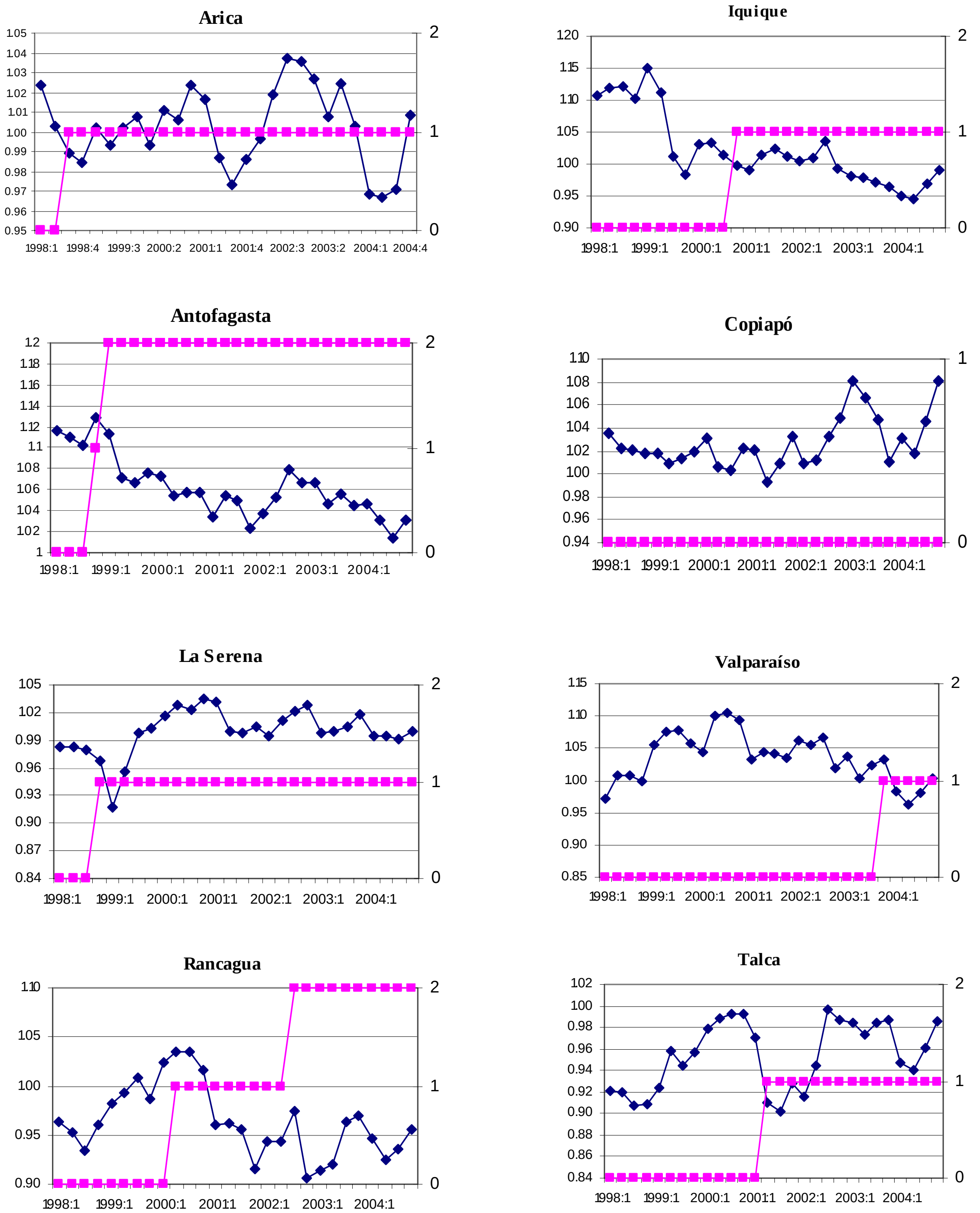
Once entry is confirmed, the reactions of incumbent firms can be classified as positive, negative or neutral according to whether they increase, decrease or maintain their marketing budgets respectively. When the reaction is positive firms make use of their most effective marketing tools – such as advertising and price reductions – to attempt to increase their market share by engendering long term loyalty in their clients (Gatignon et al., 1989). Dickson and Urbany (1994) note that firms in the retail industry tend to respond to entry by aggressively cutting prices, suggesting that this is the most effective marketing tactic available to these firms in terms of the consumer response it generates. In the case of the pharmaceuticals industry, Ellison and Fisher (2000) report that in medium sized markets, in the year before a drug loses patent protection the producing firm increases the number of presentations given by drug reps to doctors as a way of protecting its market from the entry of generic drugs. Basker (2005b) finds that in some cases the fact that Wal-Mart decides to enter a locality coincides with the exit of other distributors. This is because Wal-Mart often buys the stores of its competitors or because an incumbent decides to exit the market even before Wal-Mart opens for business, an example of a negative response by an existing firm to the threat of entry.

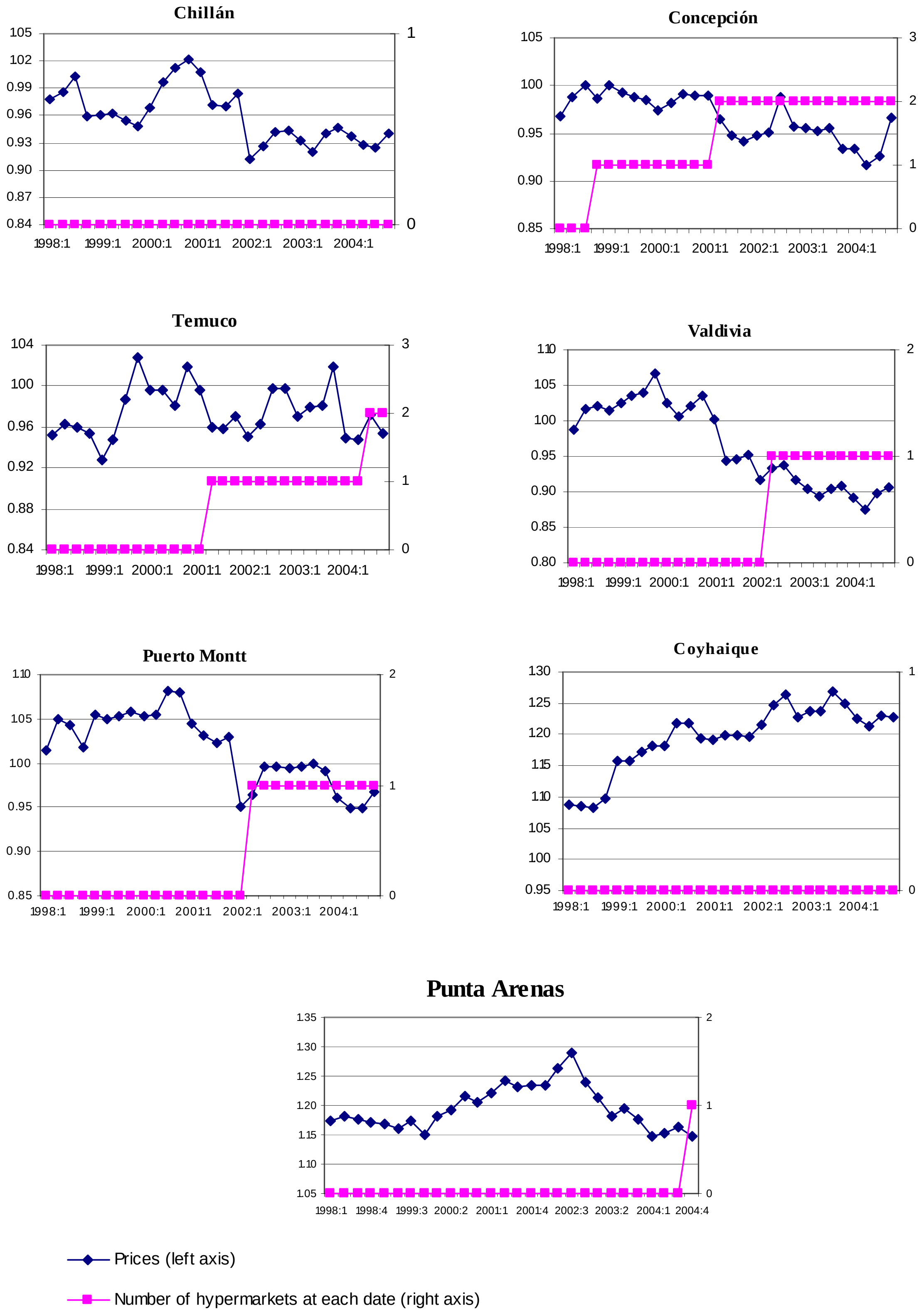
This article examines the impact on prices caused by the establishment of major supermarket chains in 15 Chilean cities. The panels of Figure 3 illustrate the price of a bundle of goods relative to Santiago prices,[3] and the timing of the launch of a new supermarket in that city. A first look at the data shows that price fell in 9 of the 12 cities where a new supermarket was established, even before the new supermarket(s) opened for business. More specifically, the price reduction begins about a year before a supermarket opens, which coincides with the start of construction work on the new store. Such behavior suggests that existing firms react positively once the entry decision has been taken, and not before. Of further interest is the fact that during the new supermarket's first quarter prices kept falling in 10 of the 12 cities examined. Finally, prices rebound after the entrant supermarket's launch, but not to the extent that they recover all lost ground: prices stay lower than they were before entry. This pattern is attributable to increased competition, improved average local industry productivity levels or some combination of the two. This paper does not quantify the impact of each of these explanations.

This article is organized as follows: section 2 describes methodology and data, section 3 presents our results, and section 4 tackles the problem of potential simultaneity. The latter refers to the potential endogeneity of entry: the fact that on the one hand the relative price of goods in a city will be affected by the entry of supermarkets, while on the other, the decision to place supermarkets in a city may depend to some extent on the relative price of goods in that city. Although there is debate in the literature as to whether this is a real problem, as some evidence suggests that entry tends to be exogenous,[4] section 4 nonetheless examines whether the results change when instrumental variables are used to correct for this potential simultaneity. Section 5 concludes.

[3] Details as to how this variable was constructed are provided below.
[4] Khanna & Tice (op.cit.).

Figure 3: The price of a bundle of goods by city relative to the price in Santiago.




Chillán
Concepción
Temuco
Valdivia
Puerto Montt
Coyhaique
Punta Arenas
Prices (left axis)
Number of hypermarkets at each date (right axis)

2.- Data and Methodology

2.1.- Data

The period of the analysis is 1998:I to 2004:IV. The price data by city was obtained from the Chilean National Statistics Institute's (INE) price yearbooks. The price yearbooks report average monthly prices for 95 foodstuffs in 16 Chilean cities,[5] but only 52 are in all the price yearbooks for the period under consideration. Thus, these 52 goods make up our bundle, and all are sold by supermarkets (see Appendix 1 for details). The Family Budget Survey 1996-7 provides the weighting for these goods in the budget of a representative consumer (also in Appendix 1).

The information on new supermarkets was obtained from the ACNielsen 2004 Retail Census, which includes location (city), inauguration date and number of checkout tills per store. The data on regional product and unemployment were obtained from the National Statistics Institute (INE).

2.2.-Methodology

To test our hypothesis we estimated the following equation:

$$\frac{C_{it}}{C_{St}} = \alpha_0 + X_{it}^{'}\beta + S_{it}^{'}\gamma + \mu_i + \lambda_t + \nu_{it} \qquad (1)$$

Subscript i denotes the city (i = 1,2…15) and subscript t denotes the quarter, with t going from 1998: I to 2004: IV.

The dependent variable $(\frac{C_{it}}{C_{St}})$ is the price of the bundle in city i relative to its price in Santiago in the tth quarter of the period under consideration. The monetary value of the bundle (C_{it}) is calculated in the following manner: $\sum_{j=1}^{j=52}(P_j^i * B_j^S)^t$, where P_j^i is the price of good j in city i and B_j^s is the amount consumed of good j in Santiago (j=1,2,…,52). B_j^s is assumed to be invariant between cities and constant over the sample period, such that changes in the value of the bundle only reflect changes in the price of goods. We use the relative prices of city i and Santiago. Santiago

[5] The cities are Arica, Iquique, Antofagasta, Copiapó, La Serena, Valparaíso, Santiago, Rancagua, Talca, Chillán, Concepción, Temuco, Valdivia, Puerto Montt, Coyhaique and Punta Arenas.

is used as the baseline because it is by far the largest city in Chile (with 40 percent of the population and 47 percent of economic activity) and because by 1998 Santiago already possessed many hypermarkets, suggesting that the effects of hypermarket entry were long since assimilated.

X_{it} is a set of demand variables, including income and employment. The income variable is the ratio of an index of the economic activity (INACER[6]) of the region where city i is located in quarter t,[7] and an index of the national economic activity in the same quarter. An increase in this variable reflects that the economic activity in city i is growing faster than it is at a national level. If the market is not perfectly competitive, a larger increase in demand would be reflected in higher prices in city i. In such a case we would expect a positive coefficient for this variable. The unemployment variable is the ratio of the unemployment rate in the region which city i is located in and the unemployment rate at a national level for the same period. It reflects business cycle conditions in city i vis à vis the whole country. Under the same hypothetical circumstances we considered for income above, we would expect the unemployment coefficient to be negative, as the higher the unemployment rate in a city relative to the national unemployment rate, the lower the demand for goods, and thus the lower the prices.

S_{it} is a set of variables capturing the entry of hypermarkets in a city. Of the 15 cities reviewed, 4 experienced entry at the beginning of our study period, 6 experienced entry between 2000 and 2003, and entry occurred near the end of the period in 2. Lead variables (Hypermarket$_{t+i}$) , were used to capture the potential price effects of the future entry of a hypermarket. These variables aim to determine whether the future entry of a hypermarket affects prices, which would suggest strategic behavior on the part of incumbents with the aim of either deterring entry or adapting to the new market conditions once the entry is unavoidable. The variable Hypermarket 2 is a dummy variable that equals 1 when there are two or more hypermarkets in city i at time t, and is zero when these conditions do not apply. Nonetheless, only 4 of the 15 cities experienced the entry of a second supermarket, which makes the estimates of this coefficient less robust.

Finally, μ_i is a city-specific fixed effect, λ_t is a temporal fixed effect, and ν_{it} is an iid (0, σ_ν^2) distributed error term.

[6] INACER stands for Index of regional economic activity. The source is INE.
[7] There are no either GDP or unemployment data by city.

3.- Results

Equation (1) was estimated using the GLS random effects method, and the city-specific fixed effects (μ_i) were examined for correlation with the explanatory variables (X_{it} and S_{it}), using the Hausman Test. The Hausman Test failed to reject the null hypothesis of no such correlation, thus validating estimation via the GLS random effects method, which provides the only consistent and efficient estimate available. Unit root tests were run confirming that the variables considered are stationary (see Appendix 2).

Tables 1 and 2 present estimation results. As a first approximation, the estimates in Table 1 suggest that the entry of a hypermarket has a negative impact on the price path of the bundle in a given city. Regression 1 in Table 1 shows that entry is statistically significant, has a negative coefficient, and that it lowers prices by four percent[8] in the quarter of entry relative to Santiago prices. The relative income variable has the expected sign and it is statistically significant while relative unemployment is not statistically significant.

Table 1: Estimates using the Random Effects model

Dependent variable: cost of bundle $_{it}$ / cost of bundle $_{St}$

Variable	1	2	3	4
Hypermarket , t	-0.041** (-7.24)	-0.042** (-7.44)	-0.040** (-7.08)	-0.041** (-7.14)
Hypermarket 2 , t	-	-	-	-0.022** (-2.72)
Relative Income	0.032* (1.92)	0.034** (2.04)	-	0.031* (1.84)
Unemployment	-0.009 (-0.75)	-	-0.011 (-0.95)	-0.009 (-0.77)
R^2 overall	0.2574	0.2417	0.1994	0.2244
R^2 within	0.2556	0.2551	0.2506	0.2680
R^2 between	0.3716	0.3405	0.2464	0.2527
No of data points	420	420	420	420
Groups	15	15	15	15

T statistic in parentheses

** indicates statistical significance at the 5% level and * at the 10% level

[8] As the independent variable is a ratio close to one its change can be approximated as a percentage variation.

Regressions 2 and 3 are variations on the specification of the model. The coefficient and the statistical significance of the Hypermarket variable remain very similar to that in regression 1. In short, the magnitude of the effect of entry is similar under all three specifications.

Regression 4 incorporates the Hypermarket 2 variable, and reports a negative and significant coefficient estimate. It indicates that the entry of a second hypermarket reduces the price of the bundle but by a lower magnitude than the entry of the first store. The fact that there are only 4 cities in which this occurs must be borne in mind, as it implies that the estimate is less robust, which is why it is not included in later estimations.

The estimates in Table 2 add the leads of the entry variable (Hypermarket $_{t+i}$). These estimates aim to evaluate whether the entry of a hypermarket into the future provokes a price reaction on the part of the incumbents before the new store opens for business. Specifically, these variables aim to capture a potential pre-emptive price reduction policy by incumbents before the entry decision is taken and/or once the entry decision has been taken but the new store has not yet opened for business.

As can be seen from Table 2, the estimate of the contemporaneous effect of hypermarket entry on prices remains negative and statistically significant on adding the leads of the entry variable. However, the magnitude of the effect falls by 50 percent. Specifically, regressions 1, 2, 3, 4 and 5 in Table 2 incorporate the future entry one, two, three, four, and five periods ahead respectively. These regressions estimate that entry generates a contemporaneous relative price reduction of between 2.0 and 2.4 percent, and also that price reductions occur up to a year before effective, open-for-business entry. These price reductions before the new hypermarket opens for business are cumulatively of similar magnitude to the contemporaneous price reductions, and the sum of the two is slightly greater than the magnitude of the fall in price estimated in Table 1. It is worth noting that variables that capture entry that will occur 5 or more quarters in the future are not statistically significant (see equation 5 in Table 2). As the construction of a new hypermarket takes approximately 4 quarters, this suggests that incumbent firms react by lowering prices when they see concrete evidence of entry: the start of building work. These results seem to indicate that incumbents do not react prior to the definitive entry decision, which could be because the entry takes them by surprise, rendering them unable to effect a deterrence policy, or because it is optimal for them to accommodate entry. The positive reaction by incumbents once entry is confirmed – as evidenced by the price reductions once the entrant begins construction work on its new store – points to an attempt to increase or maintain market share through augmented client loyalty.

The fact that lower prices persist after entry is effected is attributable to a mix of industry productivity increases and increased competition in local markets. The contribution of each of these factors is beyond the scope of this article.

Table 2: Estimates using the Random Effects model

Dependent variable: cost of bundle $_{it}$ / cost of bundle $_{St}$

Variable	1	2	3	4	5	6	7
Hypermarket, t	-0.020** (-2.04)	-0.021** (-2.11)	-0.022** (-2.25)	-0.024** (-2.45)	-0.024** (-2.52)	-0.027** (-3.51)	-
Hypermarket, t+1	-0.0026** (-2.58)	-0.010 (-0.75)	-0.010 (-0.76)	-0.01 (-0.78)	-0.010 (-0.78)	-0.005 (-1.25)	-
Hypermarket, t+2	-	-0.019* (-1.91)	0.001 (0.08)	0.001 (0.09)	0.001 (0.09)	0.003 (-0.46)	-
Hypermarket, t+3	-	-	-0.023** (-2.30)	0.004 (0.31)	0.005 (0.31)	-0.004 (-1.19)	-
Hypermarket, t+4	-	-	-	-0.032** (-2.78)	-0.025* (-1.94)	-0.026** (-3.18)	-0.026** (-5.74)
Hypermarket, t+5	-	-	-	-	-0.008 (-0.97)	-	-
Price t-1	-	-	-	-	-	-	0.530** (13.28)
Relative Income	0.026 (1.57)	0.024 (1.43)	0.025 (1.51)	0.022 (1.37)	0.023 (1.40)	0.019 (1.17)	0.006 (-0.45)
Unemployment	-0.009 (-0.77)	-0.012 (-0.93)	-0.012 (-1.00)	-0.009 (-0.78)	-0.009 (-0.86)	-0.007 (-0.62)	0.011 (1.05)
R^2 overall	0.2830	0.2646	0.2762	0.2788	0.2864	0.2688	-
R^2 within	0.2682	0.2749	0.2844	0.2981	0.2994	0.2973	-
R^2 between	0.3394	0.3289	0.3263	0.3140	0.3199	0.2985	-
No of data points	420	420	420	420	420	420	390
Groups	15	15	15	15	15	15	15

T statistic in parentheses

** indicates statistical significance at the 5% level and * at the 10% level

A point worth considering is that the coefficient estimates in equations 1 to 5 in Table 2 may be inaccurate if, as is likely, the entry variables are highly correlated, suggesting multi-colinearity. A possible solution to this problem is to use the estimation method known as the Almon polynomial.

The Almon polynomial provides a flexible way to reduce parameterization that is used frequently when lagged variables are involved. In this case the leads variables (Hypermarket $_{t+1 \dots t+4}$) can be viewed as lagged variables such that Hypermarket $_{t+1}$ is equivalent to a variable lagged one period, and Hypermarket $_{t+2}$ is equivalent to one lagged two periods. The parameters accompanying these variables are termed δ_0, δ_1, δ_2, δ_3 and δ_4, and it is assumed that these coefficients can be approximated by the function:

$$f(i) = \alpha_0 + \alpha_1 i + \alpha_2 i^2 + ... + \alpha_n i^n$$

where

$$\delta_0 = f(0) = \alpha_0$$

$$\delta_1 = f(1) = \alpha_0 + \alpha_1 + \alpha_2 + ... + \alpha_n$$

$$\delta_2 = f(2) = \alpha_0 + 2\alpha_1 + 4\alpha_2 + ... + 2^n \alpha_n$$

$$\delta_3 = f(3) = \alpha_0 + 3\alpha_1 + 9\alpha_2 + ... + 3^n \alpha_n$$

$$\delta_4 = f(4) = \alpha_0 + 4\alpha_1 + 16\alpha_2 + ... + 4^n \alpha_n$$

$f(i)$ is then substituted into equation (1) and the coefficients α_0, α_1, $\alpha_2 \dots \alpha_n$ are estimated. Given the significance of the parameters (α_0, α_1, $\alpha_2 \dots \alpha_n$) the coefficients of the correlated regressors can be approximated by a second degree polynomial.[9] Finally, using the estimates of α_0, α_1, and α_2 the coefficients δ_0, δ_1, δ_2, δ_3 and δ_4 were backed out.

Regression 6 in Table 2 makes use of the Almon method. The result indicates that the entry of a hypermarket lowers the price of the bundle relative to the Santiago price by 2.7 percent in the quarter in which the entrant opens for business. In addition, entry reduces prices four quarters before the new store inauguration date, and the magnitude of this effect is similar to the price drop in the quarter the new store is opened.

Finally, regression 7 in Table 2 is a variant of the model specification that allows us to check our results: a dynamic panel that includes as an independent variable the dependent variable lagged one period. Hypermarket $_{t+4}$ is used as the entry variable, so that the effect on prices in the short run corresponds to the effect in the fourth quarter before entry, and the long run effect is the total effect that takes place from that moment on. This specification is more restricted than the preceding ones, as it assumes that the marginal effect diminishes over time, something that is not necessarily the case when the entry variables are included separately. The results from this estimation using the Arellano and Bond (1991) methodology are similar to those reported above: entry generates a price reduction of 2.6 percent in the year before the entrant opens for business.

[9] Initially, n was assumed to be 6, then 5 and successively lower until n=2 was arrived at.

Moreover, the estimate indicates that the long run effect of entry is a fall in price amounting to 5.5 percent, similar in magnitude to the combined effect of the contemporaneous and forward entry variables estimated in regression 6, Table 2. The standard tests for dynamic panels were run and they confirm the robustness of the estimation (see Appendix 3).

It could be argued that there might be some mean reversion after the entry of large hypermarkets. For instance, if large supermarkets raise prices once they have successfully entered the market we should see prices reversing (at least partially) their previous fall. To test for this effect we included several lags of the entry variable in the regressions. If there were some kind of mean reversion the coefficients of the lags would be positive and statistically significant. The coefficients of the lags were non-significant suggesting the absence of this effect.[10]

4.- Potential Simultaneity

The results reported above provide evidence suggesting that the future entry of a hypermarket generates an anticipated (before the new store opens for business) price drop by incumbents, as well as further price reductions when the entrant opens for business. However, it is prudent to consider the possibility that the variables that determine whether entry occurs are not completely exogenous, in the sense that, for example, a high pre-entry price for the bundle in a given city could make a potential entrant more likely to decide to enter the market. In such a case the entry variable could be correlated with the error term in the preceding estimates, making the estimates inconsistent in the random effects model.

Thus, if the probability of entry into a given city rises with the initial price of the bundle relative to Santiago[11] – i.e there is simultaneity – the coefficient estimates above are likely to be overestimated. In terms of the model we can define the following equations:

[10] When we introduced several lags the coefficient of the contemporaneous entry in some cases loses significance, possibly due to the presence of multicolinearity.

[11] We assume that when a firm decides to open a hypermarket in a given city, it projects the price of the bundle relative to its price in Santiago for the quarter in which it will open for business, and the firm makes the decision to enter on the basis of that predicted bundle price. This appears more plausible if the long lag between the decision to enter and the launch of the new store is taken into account: a site must be found and purchased, building permits must be obtained, and the hypermarket itself must be built. Thus, this article assumes that the expected price of the bundle is equal to the value of the bundle at time t .i.e. that firms correctly anticipate the bundle price.

$$\frac{C_{it}}{C_{St}} = \alpha_0 + X_{it}^{'}\beta + S_{it}^{'}\gamma + \mu_i + \lambda_t + \nu_{it} \qquad (2)$$

$$S_{it} = \phi_0 + X_{it}^{'}\rho + (\frac{E(C_{it})}{E(C_{St})})'\delta + Z_{,t}{}'\tau + \mu_i + \lambda_t + \nu_{it} \qquad (3)$$

where $\gamma<0$, $\delta>0$ and X_{it} and Z_{it} are exogenous variables. We assume that $E(C_{it}) = C_{it}$ and that $E(C_{St}) = C_{St}$.

If equation (2) is estimated directly, the parameter of interest (β), will be overestimated. To resolve this simultaneity problem a two stage estimation process is required. The first stage makes use of a model where the potentially endogenous variable is related to the explanatory variables and a set of instruments (equation (3)). Probit estimation is used and an estimated probability of hypermarket entry into a given city is obtained. The second stage then makes use of this estimated probability as a regressor in the structural equation (2). The key to this estimation method lies in choosing instrumental variables (IV) that are correlated with entry, but not with the residual of equation (2), allowing separate identification of equation (3).

To find these instrumental variables we assume that a firm maximizes its expected profits when taking its entry decision. A variable that is clearly related to the potential profits of opening a new hypermarket is the size of the market: greater market size implies greater volumes and thus larger income streams. A variable that is correlated to the size of a given city's market is its population. This variable is a potentially good instrument, as cities with larger population generally have more hypermarkets (as these have greater sales volumes). However, we have no a priori reason to expect cities with large population to have relative bundle prices either higher or lower than a city with a smaller population.

If we examine the relationship between entry of a hypermarket and population it seems clear that there is positive correlation between both variables. In Table 3 we present for every year in the period 1998-2004 the sizes of the populations of cities with and without supermarkets. In all years cities with hypermarkets have larger populations, and in most of the years the difference is statistically significant.

Thus, an observable relationship exists between the population of a city and the entry of a hypermarket. On the other hand, there is no a priori reason to think that population is correlated with the error term of equation (2). Given this, we use population as instrumental variable in the random effects equations.

Table 3: Average population of cities with and without hypermarket

Year	With hypermarket	Without hypermarket	Difference statistically significant at
1998	200,265	169,570	X
1999	202,542	172,007	X
2000	204,779	167,620	10%
2001	211,435	154,354	10%
2002	202,024	157,171	10%
2003	213,032	124,095	1%
2004	208,656	123,174	5%
1998-2004	207,079	163,751	1%

The estimates of the model using random effects and instrumental variables are presented in Table 4. The estimated hypermarket coefficient remains both negative and statistically significant, for example, regression 1 in Table 3 shows that hypermarket entry generates a 5.9 percent reduction in the price of the bundle relative to its Santiago price. The coefficient indicating the price effect of entry increases in absolute value relative to the estimate obtained from (1), confirming that the simultaneity problem generates an underestimate of the price effect if left unresolved. Income is statistically significant in some regressions while unemployment is not.

Regressions 2 and 3 illustrate that the estimated hypermarket variable is robust to specification changes: its magnitude is almost identical to that obtained from regression 1.

As in the preceding section, regression 4 of Table 4 makes use of future-entry variables so as to capture the anticipated effects that entry may generate. The estimate confirms our previous results in that hypermarket entry has both an anticipated and a contemporaneous effect on prices. The sum of both is a reduction of about 10 percent in prices, almost twice as much as our estimate ignoring simultaneity. As in the previous estimates the anticipated effect is of the same magnitude as the contemporaneous effect.

Finally, regression 5 makes use of the Almon polynomial in the estimation. The results once again make clear that the entry of a hypermarket lowers the relative price of the bundle in the year preceding its launch. This estimate provides support for both the magnitude of the estimated effects and for the fact that the anticipated effect makes up a half of the total effect.

Table 4: Estimates with the Random Effects model and instrumental variables

Dependent variable: cost of bundle $_{it}$ / cost of bundle $_{St}$

Variable	1	2	3	4	5
Hypermarket, t	-0.059** (-3.67)	-0.062** (-.3.97)	-0.056** (-3.49)	-0.052** (-1.90)	-0.054** (-2.98)
Hypermarket, t+1	-	-	-	-0.005 (-0.20)	-0.007 (-0.91)
Hypermarket, t+2	-	-	-	0.008 (0.38)	0.010 (-1.03)
Hypermarket, t+3	-	-	-	-0.010 (-0.44)	-0.001 (-0.18)
Hypermarket, t+4	-	-	-	-0.050* (-1.68)	-0.042** (-2.23)
Hypermarket, t+5	-	-	-	0.012 (0.52)	-
Relative Income	0.029* (1.64)	0.031* (1.80)	-	0.029 (1.40)	0.029 (1.50)
Unemployment	-0.011 (-0.87)	-	-0.013 (-1.10)	-0.014 (-1.01)	-0.014 (-1.03)
R^2 overall	0.1738	0.1627	0.1270	0.2001	0.2039
R^2 within	0.1873	0.1861	0.1830	0.1494	0.1458
R^2 between	0.3272	0.3478	0.2067	0.257	0.2681
No of data points	420	420	420	345	360
Groups	15	15	15	15	15

T statistic in parentheses

** indicates statistical significance at the 5% level and * at the 10% level

5.- Conclusions

Our main conclusion is that the entry of new hypermarkets into cities generates in a fall in the local price of a bundle of foodstuffs relative to the Santiago price. The empirical results indicate that this price reduction begins to occur up to a year before a new hypermarket opens for business. The combined effect of the pre-entry and entry-contemporaneous price reductions is a fall of about 10 percent in the relative price of the bundle. Given that building a hypermarket takes about a year, our results suggest that incumbent firms react only when the entry decision has been taken and not before. This also indicates that these firms have chosen to accommodate entry as there is no evidence of price reductions designed to deter entry before the decision has been taken (i.e. before store construction begins). However, the fact that price reductions by incumbents precede the launch of new hypermarkets suggest that these firms employ a price reduction strategy aimed at either increasing their market share, or defending it by increasing client loyalty.

The lower prices generated by entry persist over time. Potential explanations for these price reductions are that entrants increase competition in local markets, that they increase overall industry productivity, or some combination of the two. This article does not quantify the relative importance of these two rationales.

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Appendix 1: The bundle of foodstuffs

Selected foodstuffs (unit of measurement)		Consumption weighting
1	Standard Bread (kg)	2.31
2	Standard Bread (no packaging, kg)	0.20
3	Rice, grade 2 (kg)	0.29
4	Normal flour (500 kg)	0.12
5	Crushed oats (400g)	0.03
6	Spaghetti Nº5 (400g)	0.25
7	Rump roast (beef) (kg)	0.10
8	Beef (kg)	0.19
9	Lean beef sirloin (kg)	0.24
10	Brisket (beef)(kg)	0.22
11	Osobuco (beef) 10 kg	0.89
12	Pork chops (kg)	0.16
13	Unseasoned pork ribs (kg)	0.12
14	Whole prepared chicken (kg)	0.47
15	Tinned horse-eye jack (fish) (425g)	0.04
16	Tinned tuna (184g)	0.07
17	Boiled ham (kg)	0.23
18	Veal sausages (20)	0.13
19	Eggs 12 uds	0.30
20	Milk (lt)	0.6
21	Powdered milk (1 kg)	0.34
22	Whipped yoghurt (175g)	0.33
23	Vegetable oil (lt)	0.37
24	Margarine (250g)	0.20
25	Hass Avocados (kg)	0.14
26	Long life tomatoes (kg)	0.48
27	Lemons (kg)	0.08
28	Apples (kg)**	0.18
29	Oranges (kg)	0.19
30	Bananas (kg)	0.18
31	Tinned peaches (590 kg)	0.05
32	Tinned peas (310g)*	0.03
33	Potatoes (kg)	0.62
34	Garlic (3 units)	0.04
35	Onions, new or long life (kg)	0.16
36	Milan lettuce (1)	0.16
37	Medium white cabbage (1)	0.05
38	Carrots (bundle)	0.10
39	Lentils 5mm (kg)	0.04
40	White beans (kg)	0.08
41	Tomato sauce (250g jar)	0.16
42	Sugar (kg)	0.37
43	Jelly (250g)	0.13
44	Table salt with added iodine (kg)	0.03
45	Coffee (170g)	0.18
46	Milk additive (400g)	0.06
47	Standard tea (250g)	0.10
48	Teabags (20)	0.11
49	Carbonated soft drink (2 lt)	1.80
50	White wine (lt)	0.19
51	Mineral water, carbonated (1.6 lt)	0.09
52	Pisco 35% alcohol (750cc)	0.19
Total selected bundle		14.17

Appendix 2: Unit Root Test

	Maddala-Wu p-value	Levin-Lin p-value
Cost of bundle	0.0266	0.0020
Relative Income	0.0000	0.0000
Unemployment	0.0000	0.0000

Appendix 3: Test for autocorrelation and the Sargan test of over-identifying restrictions

	test	p-value
Sargan Test	314.85*	0.4758
Serial Correlation order 1	-7.42**	0.0000
Serial Correlation order 2	-1.39**	0.1632

* χ^2

** Z