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Prices and market structure: an empirical analysis of the supermarket industry in Chile

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This article investigates empirically the relationship between market structure and consumer prices in the supermarket industry in Chile. A panel of monthly data from 16 cities in the period January 1998–September 2006 is used. We find that, the more concentrated the industry in a city, the higher the prices, while the participation of major national chains in cities tends to lower prices. In terms of magnitude, this latter effect prevails over the former. Moreover, the dominant local chain is found to behave differently depending on whether or not one of the national chains is present in the city. Finally, we find that prices rise when a national chain acquires another chain and both were previously in a city (inmerge) while if only one of the two was present (outmerge), prices fall.

Keywords: prices; retail; market structure; concentration

JEL Classification: L11; L81

I. Introduction

This article studies the relationship between the structure of the industry and prices in the Chilean supermarket sector. It focuses specifically on explaining the differences in prices between different cities in the country as a function of differences in the structures of the local industries.

Conceptually, there is no unique relationship between prices and the structure of an industry, because concentration is not synonymous with market power. Concentration may be the result of the greater efficiency of major companies (Demsetz, 1973). Empirical studies seek to understand the situation in each particular case.

Diverse international studies are based on observing differences in behaviour in same industry at different geographic points as this helps isolate the effects of cost and the nature of the overall industry in the country. Lira *et al*. (2007) investigated the effect on food prices of hypermarkets entering cities in Chile. They concluded that such an entry reduces local prices. Asplund and Friberg (2002) examined the food price levels in different locations in Sweden and learned that the relationship between market structure variables and food prices is weak. Nevertheless, higher local concentration of stores, higher regional wholesaler concentration and a smaller market share of large stores are all correlated with higher prices. Focarelli and Panetta (2003)

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studied the effects of mergers in the banking industry on consumer welfare in different local markets and found that mergers benefited them in the long term. Other studies have focused on the effects on some products of concentration in the retail industry. Hyde and Perloff (1998), for instance, found that the meat retailing industry in Australia remains competitive despite an increase in its concentration.

This study works with a panel of monthly data on 16 cities in Chile for the period January 1998–September 2006. The central point of interest in this investigation is the radical evolution of the supermarket industry structure in Chile during this period. In fact, the domestic industry has been characterized by a clear trend toward concentration based on the growth of two major national chains (Lira and Ugarte, 2007). Nationally, in this period the Herfindahl–Hirschmann (HH) index rose from 0.067 to 0.205 while the two major chains increased their combined market share from 20.5% to 62.9%. The large size that they have achieved across the nation came from their strategy of expanding into cities, either by opening new stores or by purchasing other chains. The concentration in the domestic industry has not necessarily meant a concentration of the industries in the cities. On the contrary, the invasion of cities by the major domestic chains has had an unequal effect on the structures of the local industries. Some cities have experienced an increase in concentration, others have tended to deconcentrate, while some have undergone no significant variations in this variable. Since no clear relationship was seen between the expansion of the major chains and the concentration by city, both variables can be separated. As a result, the individual impact of each of these variables on local prices can be measured.

This investigation finds that industry structure has an impact on local prices. An industry concentrating in each city tends to raise local prices while the opposite effect is found regarding the expansion of major chains to cities. The greater the penetration of major chains, the lower the prices. This could be the case, for instance, if national chains, because of their size, have economies of scale that local chains do not have. In terms of magnitude, this latter effect prevails over the former. This article also investigates the behaviour of the leading local chain and finds an interesting situation: if one of the two major national chains is present in this city, then local prices decline as the leading local chain increases its market share, suggesting that in this case, the behaviour of the local chain follows that of major national chains. On the other hand, if none of the national chains is present in the city, then prices increase in that location as the leading local chain increases its market share, indicating that in this case, it makes use of some degree of market power.

We also find that the acquisition of supermarkets by the national chains have a differentiated impact on prices: prices rise when a national chain acquires another chain and both were previously in a city (inmerge) while if only one of the two was present (outmerge), prices fall.

This article is organized in the following way: Section II briefly reviews the literature on market power and economies of scale in the supermarket industry. Section III presents the data, the model and the research methodology. Section IV estimates the price effect of concentration, the presence of the major national chains and the existence of large local chains. The effect of acquisitions on prices is analysed in Section V and the conclusion is provided in Section VI.

II. Economies of Scale and Market Power in the Supermarket Industry

International evidence shows that the progress in information technology has brought about profound changes in the retail industry. It has signified an increase in the industry's productivity and, as a result, new economies of scale have arisen favourable to the growth of the major retail chains.

Fernald and Ramnath (2004) studied productivity by sector in the United States in the 1990s. They found that there was an important acceleration in productivity in that country in the second half of that decade in comparison to the first, going from a growth of 0.91% annually to 2.08%. The sectors with the greatest acceleration in productivity were finance (from 0.44% to 3.39%), retail (from 0.83% to 5.33%) and wholesale trade (from 1.66% to 5.37%). They concluded that the cause of this generalized increase in productivity lay in the progress in information technology and that the sectors that had shown the greatest increases in productivity were the principal users of these advances. Retail, wholesale trade and finance were the main users of information technology. Rivero and Vergara (2006) found similar results for the case of Chile. In fact, growth in the retail sector in the period 1986–2001 was 7.39% and the contribution of Total Factor Productivity (TFP) was 2.7 points, or 36% of all growth in that sector. Like in the rest of the world, this fact was attributed by the authors to the intensive use of new information technology.

The technological advances directly impact the operation of firms in the retail sector. Fernald and

Ramnath (2004) show that the structure of a retail company is dramatically changed by the introduction of information technology to the industry. IT progress results in increased productivity in the retail sector because of greater efficiency in handling inventories and in logistics in general. Through data scanners, cashiers can charge merchandise more quickly and, more importantly yet, there is an instant control of the inventories of each product. So, there is greater productivity on the part of cashiers as well as saved time in inventory management and in placing orders. In addition, on-line contact with suppliers has reduced the new order delivery times. All of this means that there is a significant reduction in the time elapsing between measuring inventories and receiving new merchandise. Ultimately, this technology is able to reduce the optimum levels of inventories that retailers must keep, since the greater speed of information substitutes for them. This reduction in inventories reduces operating costs, hence generating increases in productivity. There are profound implications for the company from the fact that the increase in productivity occurs in inventory management and in the company's logistics. Technological progress in the manner described above signifies economies of scale as they lead to a decreasing average production cost structure, given the significant investment required in fixed costs. This translates into a growth in the optimal size of the company (Holmes, 2001). Nakamura (1997) shows that the number of items offered per store rose from 7800 in the United States in 1970, to 19 612 in 1994. Ellikson (2005) says that in 2004, that figure had surpassed 30 000 items per store, according to information provided by the Food Marketing Institute.

In terms of industry organization, this means a trend towards concentration as the companies that implement these technological changes first will have a cost advantage that will help them displace the others. Therefore, they will gain market share at the cost of the others (Ellikson, 2005).

Another interesting aspect of the impact of technological progress on retail is its effect on the dynamics of the industry. Foster *et al.* (2002) study the dynamics of the retail industry in relation to the technological changes that have occurred in the United States. In most of the industries, the entry and exit of companies is critical in transmitting technological progress, since new companies or plants naturally include the latest advances available at the time they are founded, which helps displace the less efficient ones. So, the substitution of enterprises or plants is one way of including technological change. The authors found that this is particularly important in the retail industry as virtually all of the technological changes are transmitted by new plants or firms while the pre-existing companies are incapable of adapting to them. Substituting plants in this industry is the key. This has heavy implications on the dynamics of the retail industry because major technological changes should be expected when new firms enter the industry.

In the United States, Wal-Mart was a pioneer in adopting the changes in information technology. The McKinsey Global Institute (2001) attributed the aggressive expansion of Wal-Mart largely to this. Wal-Mart expanded radially throughout the country, around its distribution centers, in order to take advantage of economies of scale (Khanna and Tice, 2000). The hypermarket format was used to implement its strategy. Along the same lines, Yoffie and Wang (2002) said that a large part of the hypermarket success stemmed from the early implementation of information technology changes. Wal-Mart has been using the Electronic Data Interchange (EDI) system since the 80's while it implemented the Retail Link in the early 1990 s, a computer system that provides sales information from each store to thousands of suppliers in order to improve merchandise dispatch planning (Bradley *et al.*, 2003).

In the case of Chile, the supermarket industry has lately been concentrating nationally around two major chains, Cencosud and DyS. This concentration occurred because of those chains' expansion to many of the cities in Chile. This was done by opening new stores and acquiring existing ones. While in 1998 these two chains were present together only in Santiago, in 2006 the two of them were present in 12 out of the 16 cities of this study (see Table 1).

Similar to the international experience, a possible explanation behind the expansion of these companies is the emergence of new economies of scale in the industry as a consequence of information technology changes throughout the world in recent years. These economies of scale have enabled them to expand to cities and to continue operating with centralized distribution centers. Those technological advances can be used in handling inventories and logistics in general (Lira and Ugarte, 2007).

Table 2 provides data on the expansion of the major national chains to different cities and both concentration and prices 6 months prior and 6 months after the entry. It is interesting to note that in most cities prices fell and so did concentration. Although this is only casual evidence, it points out that lower concentration as well as the lower costs of the big chains (economies of scale) might have something to do with the decline in prices after the entry.

Table 1. Number of supermarkets and national chains by city

	Number of total chains				Number of national chains				Number of supermarkets			
City	J-1998	S-06	Avg.	SD	J-1998	S-06	Avg.	SD	J-1998	S-06	Avg.	SD
Arica	4	2	4.0	1.5	0	2	1.3	0.6	6	4	6.2	2.4
Iquique	4	4	4.0	0.1	1	2	1.3	0.5	6	9	7.9	1.1
Antofagasta	3	4	4.1	0.5	0	2	1.2	0.6	12	16	14.0	1.2
Copiapó	3	3	4.0	1.4	0	2	0.1	0.5	4	8	6.8	1.3
La Serena	5	4	5.3	1.2	0	2	1.2	0.6	9	7	8.7	1.8
Valparaiso	2	3	2.8	0.6	0	2	0.7	0.9	6	7	6.4	0.8
Rancagua	3	6	5.2	1.2	0	2	1.1	0.8	9	13	11.3	1.5
Talca	5	4	6.2	1.8	1	2	1.3	0.5	7	12	10.8	1.5
Chillán	5	5	5.0	0.0	0	1	0.3	0.5	6	8	6.6	0.8
Concepción	12	10	14.5	2.4	0	2	1.2	0.6	20	20	24.3	4.2
Temuco	8	8	10.1	1.4	1	2	1.3	0.5	13	19	18.3	2.0
Valdivia	7	6	7.1	1.2	0	2	0.8	0.9	7	7	7.9	0.9
Puerto Montt	5	6	5.6	0.8	0	2	0.8	0.9	7	13	9.4	2.0
Coyhaique	2	2	1.9	0.3	0	0	0.0	0.0	2	2	1.9	0.3
Punta Arenas	6	5	7.5	1.4	0	1	0.2	0.4	10	12	12.3	1.8
Santiago	37	25	33.6	10.3	2	2	2.0	0.0	154	194	181.7	10.6

Table 2. New hypermarkets entry: average relative price and average relative concentration during the 6-month period before and after entry

			Change in average relative price			Change in average relative concentration		
Date	City	Chain	Before entry	After entry	Change	Before entry	After entry	Change
Nov-98	Antofagasta	DyS	1.08	1.07	−0.21%	2.64	1.84	−30.40%
Nov-98	Concepción	DyS	1.00	1.03	2.78%	0.97	0.80	−17.96%
Dic-98	La Serena	DyS	0.99	0.94	−5.15%	2.94	1.85	−37.13%
Abr-00	Rancagua	Cencosud	1.02	1.03	1.58%	1.79	1.38	−22.72%
Abr-01	Temuco	DyS	1.00	0.98	−1.71%	0.63	0.69	9.69%
May-01	Talca	DyS	0.97	0.89	−8.13%	1.21	1.08	−11.26%
Feb-02	Concepción	DyS	0.94	0.97	3.60%	0.80	0.98	22.51%
Abr-02	Puerto Montt	DyS	1.00	1.00	−0.30%	1.59	1.40	−12.01%
Jun-02	Valdivia	DyS	0.94	0.94	−0.41%	1.83	1.53	−16.40%
Sep-02	Rancagua	DyS	0.94	0.90	−3.97%	1.40	1.13	−19.57%
Ago-03	Rancagua	DyS	0.90	0.99	9.55%	1.22	1.52	24.09%
Nov-03	Valparaíso	DyS	1.00	0.97	−2.70%	3.82	2.01	−47.52%
Ene-04	Arica	DyS	1.00	0.97	−3.59%	1.96	2.12	8.57%
Jul-04	Temuco	DyS	0.95	0.96	1.13%	0.82	0.95	15.35%
Nov-04	Temuco	Cencosud	0.95	0.94	−1.78%	0.93	0.87	−7.05%
Dic-04	Punta Arenas	DyS	1.13	1.09	−3.76%	1.46	1.13	−22.67%
Feb-05	Chillán	Cencosud	0.94	0.95	0.99%	0.94	1.30	38.30%
Oct-05	Copiapó	Cencosud	1.09	1.00	−8.73%	3.30	2.17	−34.21%
Dic-05	Puerto Montt	Cencosud	1.03	0.98	−4.55%	1.07	1.05	−1.46%
Ene-06	Copiapó	DyS	1.06	0.97	−8.51%	3.28	1.32	−59.81%
Feb-06	Antofagasta	Cencosud	1.01	1.01	−0.04%	1.05	0.89	−15.33%
Mar-06	Valparaíso	Cencosud	0.98	0.98	−0.24%	1.60	1.87	16.99%
Jun-06	Talca	DyS	0.98	0.98*	−0.45%*	0.89	1.70*	91.10%*
Jul-06	La Serena	Cencosud	0.96	0.98*	2.29%*	1.32	1.32*	−0.17%*

Note: *Average up to September 2010.

III. Estimation Model, Methodology and Data

This article seeks to evaluate the existing relationship between prices and market structure in the supermarket industry in different cities of Chile. A simple model was used to perform this analysis where the prices are determined by supply and demand variables. The variables are measured in relative terms against Santiago.[1] Therefore, many supply variables are discarded since a large part of the production process and the relevant costs are centralized and, therefore, do not differentially affect prices between different cities. Ergo, the emphasis on supply lies in a variable that describes the particular structure of each local market: market concentration. Hence, to test our hypothesis, we estimate the following equation:

$$P_{it} = \alpha + \delta D_{it} + \phi \cdot C_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (1)$$

where the subindex i denotes the cities ($i = 1, 2, 3, \ldots, 15$) and the subindex t represents the month ($t = 1, 2, 3, \ldots, 105$).

The variables are:

- P_{it} Relative price in city i with respect to Santiago in month t;
- D_{it} Set of demand variables;
- C_{it} Relative concentration index in city i with respect to Santiago in month t;
- μ_i City-specific fixed effect;
- λ_t Temporal fixed effect;
- ε_{it} iid $(0, \sigma^2)$ distributed error term.

The dependent variable (P_{it}) is the price of the bundle of 51 food products[2] in city i relative to its price in Santiago in month t. The monetary value of the bundle in city i is calculated in the following manner: $\sum_{j=1}^{j=51} (P_j^i * B_j^S)^t$, 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 ($j = 1, 2, \ldots, 51$). B_j^s is assumed to be invariant between cities and constant over the sample period; changes in the value of the bundle therefore reflect only changes in the price of goods.

The demand variables include income and unemployment, both relative to Santiago. The income variable is the quotient between the average taxable income in month t in the region in which city i is located and the average taxable income in Santiago in the same month. An increase in this variable reflects that economic income in city i is growing faster than economic income in Santiago. If the market is not perfectly competitive, a greater increase in demand would be reflected by higher relative 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 where city i is located to the unemployment rate in Santiago for the same period. It reflects business cycle conditions in city i *vis-à-vis* the whole country. Under the same hypothetical circumstances that 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 unemployment rate in Santiago, the lower the demand for goods, and thus the lower the relative prices.

We use two measures of concentration (C_{it}) to check whether our results are robust or depend upon the criteria adopted. First, we use the HH index (HH_{it}) and second, the aggregated market share of the two major supermarket chains in a given city ($C2_{it}$).

The information used corresponds to monthly data on 16 cities for the period from January 1998 to September 2006. The cities are: Arica, Iquique, Antofagasta, Copiapó, La Serena, Valparaíso, Rancagua, Talca, Chillán, Concepción, Temuco, Valdivia, Puerto Montt, Coyhaique, Punta Arenas and Santiago. The data were generated from information from the National Statistics Institute, the Superintendency of Pension Fund Administrators (taxable income series), annual reports and public information on the main supermarket chains in Chile and information that the chains themselves provided (market share by city, new stores and acquisition of stores or chains). These latter data was cross-checked with aggregate information obtained from the National Association of Supermarkets in order to confirm the reliability of the figures.

The price data by city were obtained from the Chilean National Statistics Institute's (INE) price yearbooks.[3] The price yearbooks report average monthly prices for 95 foods in 16 Chilean cities, but only 51 are in all the price yearbooks of the period under consideration. Thus, these 51 goods constitute our bundle, and all are sold by supermarkets.

[1] Santiago is used as the baseline because it is, by far, the largest city in Chile (with 40% of the population and 47% of the economic activity) and because by 1998, Santiago already possessed many hypermarkets, suggesting that the effects of hypermarket entry were long since assimilated (Lira *et al*., 2007). A summary statistics table is presented in Appendix 1, containing information on the mean, median, SD and the number of observations of all variables used in the econometric analysis.

[2] These are the goods for which there is price information in the Chilean National Statistics Institute.

[3] The National Statistics Institute collects and calculates the national rate of inflation. In the case of Chile, these figures are highly reliable and easily verifiable.

Table 3. Estimations by random effects

Dependent variable: relative price Independent variables	1	2	3	4	5
Relative income	0.083 (0.033)**	0.087 (0.033)***	0.087 (0.033)***	0.099 (0.032)***	0.114 (0.032)***
Relative unemployment	−0.009 (0.006)	−0.011 (0.006)*	−0.013 (0.006)**	−0.008 (0.006)	−0.011 (0.005)**
Relative Herfindahl index	0.022 (0.002)***	0.017 (0.002)***	0.019 (0.002)***	0.014 (0.002)***	0.015 (0.002)***
Relative expansion of mayor national chains		−0.029 (0.004)***	−0.035 (0.004)***	−0.014 (0.005)***	−0.015 (0.004)***
Relative share of the dominant firm on the local market			−0.002 (0.001)***		
Relative share of dominant firm on the local market (if no major chains participate on that market)				0.003 (0.000)***	
Relative share of dominant firm on the local market (if major companies participate on that market)					−0.006 (0.001)***
Constant	0.901 (0.032)***	0.926 (0.032)***	0.941 (0.032)***	0.901 (0.032)***	0.914 (0.031)***
Observations	1575	1575	1575	1575	1575
Cities	15	15	15	15	15
R^2 Within	0.1918	0.2150	0.1837	0.2150	0.2723
R^2 Between	0.3384	0.4961	0.4565	0.4961	0.5048
R^2 Overall	0.2708	0.3588	0.3048	0.3588	0.4017

Notes: SEs are given within parentheses.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

The Family Budget Survey 1996–1997 provides the weighting for these goods in the budget of a representative consumer.[4]

IV. Results

The base equation was estimated using the HH index as the concentration indicator.[5] We estimated our panel data using a random-effect method. The Hausman test indicated that the random-effect estimate cannot be rejected, denoting orthogonality between the city-fixed effect and the explanatory variables. The values from the Hausman tests are provided in Appendix 3.[6] The unit root test was also performed, which confirmed that the variables used are stationary (the test values are presented in Appendix 4).[7]

The results are presented in Table 3. Regression 1 shows that the local concentration in each city as compared to Santiago, measured using the HH index, has a positive and statistically significant impact on local prices. In other words, the local concentration would be associated with market power in the corresponding city. Income appears to be statistically

[4] See Appendix 2 for both the goods and the weighting of these goods in our bundle.
[5] When the variable HH_{it} is replaced by $C2_{it}$, the results obtained are very similar to those obtained with the HH index. In fact, both measures of concentration are statistically significant and have a positive impact on prices. This reveals that the results for local concentration are robust to the particular variable used to measure it. Given the little difference in results and the greater conceptual value of the HH index, the choice was made to continue using this variable in successive equations.
[6] Appendix 3 summarizes the results of the Hausman test for all regressions made later in the article.
[7] Includes the unit root test of the other variables used later on.

significant, with a positive sign, as expected. Local unemployment is statistically not significant.

However, concentration is just one part of the story on prices in this industry. Indeed, prior literature (Lira *et al*., 2007; Díaz *et al*., 2008) shows that the major chains entering cities has been accompanied by substantial price drops for goods that supermarkets sell. This fact must be included in the analysis.

Therefore, in order to be able to fully understand the way in which the supermarket industry behaves by city, it is important to include the fact that the major national chains (DyS and Cencosud) have been implementing an aggressive expansion to cities in recent years, via acquisitions or new supermarkets. Accordingly, the question to be asked is what role do the major national chains play in determining local prices by city? It is also interesting to determine whether the major national chains behave the same as, or differently from, the major local chains.

Hence, a new variable capturing the share of the two leading national supermarket chains (E_{it}) is added, obtaining Equation 2:

$$P_{it} = \alpha + \delta \cdot D_{it} + \phi \cdot HH_{it} + \gamma E_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Note that while E_{it}, which we call expansion, measures the share of the two leading national chains in city i in month t, (HH_{it}) is a measure of concentration in the respective cities, irrespective of who the participants are. The new equation (with E_{it}) was also estimated using random-effect method, given the results of the Hausman test. The variable E_{it} is also stationary. Estimation of Equation 2, shows that the share of the two major national chains (DyS and Cencosud) in each city has a negative effect on local prices. The coefficient is statistically significant. This means that the expansion of the major supermarket chains to cities has the effect of reducing the prices of goods that are sold in supermarkets while concentration increases prices. This evidence is consistent with the evidence found by Lira *et al*. (2007) and Asplund and Friberg (2002).

There could be two reasons why the expansion of major national chains to cities reduces local prices. The first is that the expansion of these chains to cities may be nothing but a deconcentration of the local industries as the number of local players rises and the industry deconcentrates as a result. If this were the case, what would ultimately be occurring is that the expansion variable would be a measure of deconcentration, something like the inverse of the *HH* variable used in the previous regressions. Hence, in this case, it would be natural for the coefficient to be negative since it is simply another way of looking at the same thing.[8] The second possible cause has to do with the economies of scale of the major domestic chains. These chains use huge distribution centers that supply many cities simultaneously. Information technology has meant significant savings in logistics so they have been able to reduce optimal inventories. The major chains have thus attained new economies of scale in inventory management which have, by the effect of competition, reduced prices of goods to consumers. So in the second explanation, the negative coefficient of the expansion variable is due to the arrival of a major national retailer to a city that brings with it a more efficient inventory management (new economies of scale) or lower costs, which helps reduce prices. In regression 2 the coefficients of both variables *HH* and expansion (*E*) have the expected sign and are statistically significant. Moreover, both are seen to remain virtually unchanged as compared to the cases in which they are run separately.[9] This indicates that the expansion variable is not the inverse of the *HH* variable, but rather a different variable that might be capturing the effect of economies of scale of the major domestic chains. Therefore, our result cannot reject the theory of the transmission of lower costs by the major national chains to cities to which they expand.

An exercise: the behaviour of the main local chain

An additional exercise was conducted to attain a greater understanding of the behaviour of the supermarket industry. This exercise consisted of studying the behaviour of the main local chain. *A priori*, it could be expected that the main local firm has certain degree of market power over local prices, which would be consistent with the positive coefficient of the local concentration variable in previous regressions. An additional variable was thus added to the above equation, namely the relative share (in sales) of the dominant firm in the local market ($C1L$). The new Equation 3 is the following:

$$P_{it} = \alpha + \delta \cdot D_{it} + \phi \cdot HH_{it} + \gamma \cdot E_{it} + \omega \cdot C1L_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

The results of the estimation using a random-effect method are presented in regression (3) of Table 3. The coefficient of the share of the major local firm is found to be negative and statistically significant, while the concentration and expansion variables for

[8] Gómez-Lobo and González (2007) argue along these lines.

[9] In regression 1 of Table 3 only the concentration variable is included. We also run the regression with only the share of the two national chains and the coefficient is very similar to that reported in regression 2 (and it is also statistically significant).

the major chains continue to have the same sign, magnitude and statistical significance. As explained above, it may seem counterintuitive that the share of the major local chain has a negative coefficient. In fact, consistently with the positive local concentration sign (*HH*), one would tend to think that the major local firm will also raise prices as its market share increases, which does not occur. One potential reason for this unexpected outcome is that this variable has dissimilar effects, depending on whether or not major national firms are present in the city where it dominates. It could thus be thought that in those cities where the major national chains do not do business, the major local supermarket takes advantage of its position and its market power. On the other hand, in cities where those chains are present, the major local firm must adapt to a more competitive environment and behave differently, following the path that is forged by the major domestic chains and lowering its prices.

In order to prove this potential duality in behaviour of the variable representing the relative share of the dominant firm on the local market ($C1L_{it}$), it is separated into two different variables. Indeed, since it cannot be determined from Equation 3 whether the behaviour of the local dominant firm is different when there is no competition from the major national chains as compared to the situation when at least one is there to compete, a new variable, $DC1L_{it}$, is constructed. It adopts the value $C1L_{it}$ if the major national chains do not participate on that market (i.e. if E_{it} is equal to zero), and zero when they do ($E_{it} > 0$). Equation 4 in Table 3 adds this new variable. The estimation was made using a random-effect panel.

This time the sign is positive and statistically significant, which is the expected result because it indicates that there is a powerful local firm that does not feel threatened by nationally operated chains and takes advantage of its greater market power to raise prices. Its effect goes in the same direction as the concentration variable and tends to strengthen its effect on prices.

In order to corroborate this result, a new variable ($CC1L_{it}$) was created that measures the share attained by a local firm when there is only one of the major supermarket chains in that market. Therefore, this variable has a zero value when $E_{it} = 0$ and the value of $C1L_{it}$ if $E_{it} > 0$, i.e. if at least one of the major chains is present in that city.

The results are shown in Equation 5 of Table 3. The regression was run using random effects. The results corroborate the effect found in the previous regression. The share of the main local chain has a negative sign and is statistically significant when it operates in a market where at least one of the major national chains is present. This result suggests that the main local chain does not behave in just one way in response to competition. If the major national chains are present, then the dominant local firm adopts their behaviour and reduces prices. If they are not, then it uses the market power attained by its dominant position and raises prices. In the end, these regressions confirm that the major national chains cause price reductions in cities where they are present that are not related solely to the fact that they might be deconcentrating the industry (which may be true for certain specific cities).

V. Major National Chains: Acquisitions and Entry

According to our results, since the expansion of the major chains to cities is the key in the local price's behaviour, it is interesting to study it in further detail. One possibility is to open it up according to the way in which that expansion has occurred, i.e. by making a distinction between the greater share attained by the new hypermarkets entering cities and that obtained by purchasing existing chains or supermarkets. The objective is to detect whether there is any difference in price behaviour between both strategies.

For these purposes, the expansion of national chains is replaced in our previous equation by series of variables that are intended to show those disaggregated effects. Two entry dummies, $D1E_{it}$ and $D2E_{it}$, are added as well as two acquisition dummies, AC_{it} and AS_{it}. The variable $D1E_{it}$ captures the case when there is just one national chain that begins to operate with a hypermarket in the city (it adopts a value of zero when none of the two major national chains is present in the market or when both are there, and a value of one when there is just one of the two participating in that market) while $D2E_{it}$ is a dummy that adopts a value of 1 when both national chains operate in the city, and 0 otherwise.

The AC_{it} acquisition dummy captures the inmerge operations and adopts a value of 1 when a local chain is purchased by a national chain that is already present in the city, i.e. both chains involved in the acquisition are present in the city at the time of the acquisition. Therefore, from that moment on, the number of participants is reduced by 1 (by the chain acquired). The variable adopts the value of 0 when, at the time of the acquisition, there is just one or none of the chains involved in the transaction in the city. This value remains the same over time as of that moment. The idea behind this variable is to capture what happens with prices when two chains already existing

Table 4. Relative prices before and after the acquisition of Santa Isabel/Las Brisas by Cencosud in cities where at least one of the involved chains was present

Panel A: Acquisition of Santa Isabel by Cencosud

	Average price*			Market share (June 2003)	
City	Before entry	After entry	Change	Santa Isabel	Cencosud
Arica	1.01	1.00	−0.004	0.17	0.00
Iquique	1.00	0.99	−0.017	0.11	0.00
La Serena	1.00	1.01	0.015	0.03	0.00
Valparaíso	1.01	1.00	−0.007	0.89	0.00
Rancagua	0.90	0.98	0.099	0.13	0.32
Chillán	0.93	0.95	0.024	0.31	0.00
Concepción	0.96	0.95	−0.011	0.15	0.00
Temuco	0.99	1.00	0.015	0.17	0.00
Valdivia	0.91	0.91	−0.001	0.05	0.00
Puerto Montt	1.04	1.02	−0.017	0.05	0.00

Panel B: Acquisition of Las Brisas by Cencosud

	Average price*			Market share (April 2004)	
	Before entry	After entry	Change	Las Brisas	Cencosud
Arica	0.99	0.99	0.001	0.12	0.16
Iquique	0.98	0.98	0.007	0.00	0.09
Antofagasta	1.00	1.00	0.002	0.02	0.00
La Serena	1.01	1.01	−0.006	0.05	0.04
Valparaíso	0.99	0.97	−0.020	0.00	0.61
Rancagua	0.99	0.98	−0.016	0.00	0.46
Talca	0.98	0.97	−0.005	0.06	0.00
Chillán	0.95	0.95	−0.006	0.00	0.42
Concepción	0.95	0.96	0.009	0.07	0.26
Temuco	0.98	0.95	−0.028	0.06	0.16
Valdivia	0.91	0.90	−0.005	0.00	0.07
Puerto Montt	1.00	0.98	−0.017	0.07	0.05

Note: *Considers 6 months prior to the acquisition and 6 months after the acquisition, respectively.

in the city are merged via an acquisition, apart from the effect caused by the increase in concentration.

The AS_{it} acquisition dummy takes into account the outmerge transactions and adopts a value of 1 when just one of the two chains involved in the transaction is present in a city and 0 otherwise. The variable remains the same over time. A review of the acquisitions that took place in Chile in the period of time studied reveals that only two are worthy of analysis. One is the purchase of Santa Isabel by Jumbo (now Cencosud) in July 2003 and the second is the purchase of Las Brisas, also by Cencosud, in April 2004. The remaining acquisitions that took place in the industry in this period are minor and were not, therefore, considered in this study. Table 4 shows relative prices before and after the acquisition of Santa Isabel and Las Brisas by Cencosud in cities where at least one of both chains was present before the acquisition. As can be seen from this table, these acquisitions involved numerous cities, hence many observations for our estimations.

As a result, the equation to be estimated is

$$P_{it} = \alpha + \delta \cdot D_{it} + \phi \cdot HH_{it} + \chi \cdot D1E_{it} + \eta \cdot D2E_{it} + \kappa \cdot AC_{it} + \theta \cdot AS_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

Table 5 shows the results of the estimation of Equation 4 with a random-effect method (see Appendix 3). The concentration variable (HH) continues to have the same signs and statistical significance, which reflects how robust the results are. The entry 1 dummy, which captures the entry of a major national chain when there is none present, has a negative sign and is statistically significant. Prices fall even further when the first hypermarket of the second national chain enters (meaning both operate in the city), i.e. competition intensifies (entry 2 dummy). The coefficients of the concentration and entry variables show that overall the entry effect dominates, thus reducing prices.

The effect of acquisitions is seen to be different if both chains are doing business in the market prior to

Table 5. Estimation by random effects

Independent variables	
Relative income	0.116 (0.031)***
Relative unemployment	−0.011 (0.006)**
Relative Herfindahl index	0.017 (0.002)***
Entry 1 dummy	−0.029 (0.006)***
Entry 2 dummy	−0.024 (0.003)***
Acquisition with chains present: inmerge	0.018 (0.005)***
Acquisition with just one chain present: outmerge	−0.008 (0.004)*
Constant	0.898 (0.029)**
Observations	1575
Cities	15
R^2 Within	0.2238
R^2 Between	0.5500
R^2 Overall	0.3943

Notes: SEs are given within parentheses.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

the transaction than if just one is. Prices fall if just one chain was present in the city at the time the acquisition was made while they rise if both were present. The behaviour of the outmerge variable is interesting since the only reason for prices to fall after the transaction is that now the same company that was formerly present is experiencing lower costs. These lower costs must come either from the creation of economies of scale generated by the acquisition or the transmission of lower operating costs of the buyer. The inmerge dummy, on its part, has a positive and statistically significant coefficient that is explained by the greater power on the local market created by the transaction, which is not captured entirely by the concentration variable.

VI. Conclusions

The last decade has seen profound changes in the supermarket industry in Chile. The two largest national chains have expanded all over the country and are reaching new cities every year. This expansion has taken place mostly by opening new stores in these cities, but also by acquiring other chains. The purpose of this article has been to study the effect of these changes on the prices of goods sold by supermarkets. We use a panel with data on 16 cities over the period January 1998–September 2006. Our dependent variable is the price of a bundle of food products in different cities relative to the price of the same bundle for Santiago.

This article studies the effect of the changes that have occurred in the structure of the supermarket industry in Chile on the prices of the goods sold by this sector. We find that higher concentration increases prices, but the expansion of the major national chains reduces them. A possible reason why the expansion of the national chains to a city has a negative effect on prices is that there are scale economies based on the use of information technologies by the largest players in this industry. In particular, this has allowed them to operate with centralized distribution centers, which has translated into lower costs and lower prices to consumers.

When we introduce the share of the major local supermarket chain into the analysis, we find that the effect of this variable on prices depends on whether there is a major national chain in that city. If there is no national player, then the local leader increases its prices as its share in the market goes up. This is an additional effect to the one produced by the higher concentration of the market. The reason for this behaviour is simply the use of its greater market power. However, when there is a national player in the city, the local leader cannot raise its prices. Instead, it simply follows the lead of the national chain and marks prices down.

Finally, we investigated the differentiated effects of a national chain entering a city by opening a new supermarket or by buying an existing one. The entry of a national chain to a city by opening a new supermarket, lowers prices. When the second chain enters, prices fall even further. However, when a national supermarket chain acquires a local chain, the effect on prices will depend on whether both chains were already present in the city. If only one chain was operating in the city before the acquisition, then prices will fall after the acquisition takes place. A possible explanation for this result is that the new supermarket has lower costs. However, if both chains were operating in the city before the acquisition, then prices in that city will increase. In this case, the effect of greater market power (not captured by the concentration variable) more than offsets the effect of the lower costs of the larger newcomer.

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Appendix 1. Descriptive statistics

City	Statistic	Real price of bundle	Real salary, thousands of CLP	Unemployment	Herfindahl-Hirshman index	Aggregate share of Cencosud and DyS	Market share of the largest local chain in each city*	Combined market share of the two largest chains in each city
Arica	Mean	1118	391	9.0	0.39	0.60	0.17	0.72
	Median	1108	414	9.1	0.31	0.47	0.23	0.61
	SD	46	50	2.0	0.13	0.30	0.13	0.20
	No. Obs.	105	105	105	105	105	105	105
Iquique	Mean	1134	359	9.0	0.30	0.42	0.31	0.69
	Median	1104	372	9.1	0.30	0.43	0.30	0.71
	SD	71	49	2.0	0.02	0.07	0.05	0.06
	No. Obs.	105	105	105	105	105	105	105
Antofagasta	Mean	1130	522	7.9	0.36	0.38	0.40	0.78
	Median	1116	552	8.5	0.35	0.42	0.37	0.80
	SD	62	54	2.0	0.05	0.13	0.09	0.07
	No. Obs.	105	105	105	105	105	105	105
Copiapó	Mean	1156	427	9.1	0.55	0.04	0.63	0.91
	Median	1149	443	9.2	0.42	0.00	0.52	0.91
	SD	38	51	1.8	0.24	0.12	0.21	0.08
	No. Obs.	105	105	105	105	105	105	105
La Serena	Mean	1097	359	7.8	0.41	0.44	0.46	0.87
	Median	1094	374	7.6	0.41	0.49	0.43	0.88
	SD	33	51	1.7	0.05	0.16	0.10	0.03
	No. Obs.	105	105	105	105	105	105	105
Valparaiso	Mean	1137	362	10.9	0.78	0.34	0.05	0.97
	Median	1131	377	11.0	0.94	0.00	0.03	0.99
	SD	61	51	1.9	0.21	0.44	0.03	0.04
	No. Obs.	105	105	105	105	105	105	105
Rancagua	Mean	1084	335	6.5	0.33	0.42	0.31	0.74
	Median	1096	340	5.9	0.32	0.38	0.33	0.74
	SD	63	50	2.5	0.06	0.31	0.17	0.09
	No. Obs.	105	105	105	105	105	105	105
Talca	Mean	1061	302	9.2	0.28	0.36	0.32	0.66
	Median	1058	307	8.8	0.25	0.34	0.30	0.64
	SD	52	51	3.3	0.06	0.14	0.09	0.08
	No. Obs.	105	105	105	105	105	105	105
Chillán	Mean	1073	359	9.6	0.28	0.18	0.18	0.62
	Median	1067	373	9.5	0.25	0.00	0.18	0.60
	SD	48	51	1.3	0.07	0.25	0.02	0.09
	No. Obs.	105	105	105	105	105	105	105
Concepción	Mean	1083	359	9.6	0.22	0.41	0.21	0.56
	Median	1059	373	9.5	0.20	0.36	0.22	0.56
	SD	51	51	1.3	0.05	0.21	0.04	0.08
	No. Obs.	105	105	105	105	105	105	105

Temuco	Mean	1069	328	6.9	0.19	0.24	0.26	0.51
	Median	1066	337	6.9	0.17	0.20	0.24	0.47
	SD	37	54	1.6	0.05	0.23	0.07	0.10
	No. Obs.	105	105	105	105	105	105	105
Valdivia	Mean	1066	336	5.8	0.31	0.15	0.43	0.69
	Median	1039	348	6.0	0.29	0.00	0.46	0.68
	SD	81	53	1.1	0.05	0.16	0.11	0.07
	No. Obs.	105	105	105	105	105	105	105
Puerto Monttt	Mean	1131	336	5.8	0.31	0.24	0.41	0.72
	Median	1130	348	6.0	0.30	0.34	0.39	0.72
	SD	46	53	1.1	0.03	0.25	0.08	0.04
	No. Obs.	105	105	105	105	105	105	105
Coyhaique	Mean	1242	378	4.9	0.61	0.00	0.71	1.00
	Median	1242	397	4.8	0.56	0.00	0.67	1.00
	SD	50	57	1.3	0.12	0.00	0.10	0.00
	No. Obs.	105	105	105	105	105	105	105
Punta Arenas	Mean	1241	416	6.4	0.26	0.07	0.34	0.60
	Median	1246	441	6.3	0.22	0.00	0.28	0.54
	SD	43	50	1.4	0.08	0.14	0.12	0.16
	No. Obs.	105	105	105	105	105	105	105
Santiago	Mean	1107	425	8.7	0.23	0.60	0.07	0.60
	Median	1095	450	8.7	0.21	0.56	0.07	0.56
	SD	33	51	1.3	0.04	0.09	0.01	0.09
	No. Obs.	105	105	105	105	105	105	105
Total	Mean	1121	375	7.9	0.36	0.31	0.33	0.73
	Median	1109	374	8.1	0.31	0.34	0.31	0.72
	Min	919	231	2.2	0.13	0.00	0.00	0.37
	Max	1328	595	19.0	1.00	1.00	1.00	1.00
	SD	75	73	2.4	0.18	0.28	0.20	0.17
	No. Obs.	1680	1680	1680	1680	1680	1680	1680

Note: * Excluding Cencosud and DyS.

Appendix 2. The bundle of foodstuffs

Selected foodstuffs (unit of measurement)		Consumption weighting
1	Standard Bread (kg)	2.31
2	Carbonated soft drink (2 lt)	1.80
3	Brisket (beef) (kg)	0.89
4	Potatoes (kg)	0.62
5	Milk (lt)	0.60
6	Whole prepared chicken (kg)	0.47
7	Vegetable oil (lt)	0.37
8	Sugar (kg)	0.37
9	Powdered milk (1 kg)	0.34
10	Whipped yoghurt (175 g)	0.33
11	Eggs 12 uds.	0.30
12	Rice, grade 2 (kg)	0.29
13	Spaguetti N°5 (400 g)	0.25
14	Beef (kg)	0.24
15	Boiled ham (kg)	0.23
16	Lean beef sirloin (kg)	0.22
17	Standard Bread (no packaging, kg)	0.20
18	Margarine (250 g)	0.20
19	Pisco 35% alcohol (750 cc)	0.19
20	White wine (lt)	0.19
21	Oranges (kg)	0.19
22	Rump roast (beef) (kg)	0.19
23	Apples (kg)	0.18
24	Bananas (kg)	0.18
25	Coffee (170 g)	0.18
26	Pork chops (kg)	0.16
27	Osobuco (beef) (10 kg)	0.16
28	Onions, new or long life (kg)	0.16
29	Milan lettuce (1)	0.16
30	Tomatoe sauce (250 g jar)	0.16
31	Hass Avocados (kg)	0.14
32	Veal sausages (20)	0.13
33	Jelly (250 g)	0.13
34	Unseasoned pork ribs (kg)	0.12
35	Normal flour (500 kg)	0.12
36	Teabags (20)	0.11
37	Standard tea (250 g)	0.10
38	Salted Butter (kg)	0.10
39	Carrots (bundle)	0.10
40	Mineral water, carbonated (1.6 lt)	0.09
41	White beans (kg)	0.08
42	Lemons (kg)	0.08
43	Tinned tuna (184 g)	0.07
44	Milk additive (400 g)	0.06
45	Tinned peaches (590 g)	0.05
46	Medium white cabbage (1)	0.05
47	Lentils 5 mm (kg)	0.04
48	Garlic (3 units)	0.04
49	Tinned horse-eye jack (fish) (425 g)	0.04
50	Table salt with added iodine (kg)	0.03
51	Crushed oats (400 g)	0.03
	Total selected bundle	13.82

Appendix 3. Hausman tests

	Test	*p*-value
Table 3		
Equation 1	4.36	0.2254
Equation 2	3.73	0.4435
Equation 3	4.47	0.4837
Equation 4	2.00	0.8498
Equation 5	2.85	0.7234
Table 5		
Equation 1	17.27	0.3027

Appendix 4. Unit root tests

	Im–Pesaran–Shin *p*-value	Maddala–Wu Prob > χ^2
Relative prices	0.009	0.0222
Relative income	0.000	0.0533
Relative unemployment	0.000	0.0000
Relative HH index	0.008	0.0078
Relative local C2	0.045	0.0317
Relative expansion	0.068	0.0659
Relative local C1	0.008	0.0093