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Prices and Market Structure: An Empirical Analysis of the Supermarket Industry in Chile

Loreto Lira
Magdalena Ugarte
Rodrigo Vergara

PRICES AND MARKET STRUCTURE: AN EMPIRICAL ANALYSIS OF THE SUPERMARKET INDUSTRY IN CHILE*

Loreto Lira,[a] Magdalena Ugarte[b] and Rodrigo Vergara[c]

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ABSTRACT

This paper 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 was used. It was found that the more concentrated the industry is in a city, the higher the prices, while the participation of major national chains in cities tends to lower prices. Moreover, the dominant local chain was found to behave differently depending on whether or not one of the national chains was 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

JEL Classification: L11, L81

[a] Economics Department, Universidad de los Andes. Santiago, Chile. e mail: llira@uandes.cl
[b] Economics Department, Universidad de los Andes. Santiago, Chile. e mail: mugarte@uandes.cl
[b] Economics Department, Pontificia Universidad Católica de Chile. Santiago, Chile. e mail: rvergara@faceapuc.cl

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I. Introduction

This paper studies the relationship between the structure of the industry and prices in the supermarket sector of Chile. It concentrates specifically on explaining how many of the differences in prices between different cities in the country are due to 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 behavior in one same industry at different geographic points as this helps isolate the effects of cost and the nature of the global industry in the country. Lira, Rivero and Vergara (2007) investigate the effect of hypermarkets entering cities in Chile on food prices. 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 lower market share of large stores are all correlated with higher prices. Focarelli and Panetta (2003) studied the effects of mergers in the bank industry on consumer wellbeing in different local markets and found that mergers benefited them in the long term.

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 fact that during this period, the supermarket industry structure in Chile evolved radically. 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 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 throughout the nation came from their strategy of expanding to 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 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 not undergone any 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 prices. In terms of magnitude, this latter effect prevails over the former. This paper also investigates the behavior 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 behavior 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 acquisitions of supermarkets made by the national chains have an 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 paper 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 effect of concentration, the presence of the major national chains and the existence of large local chains on prices. The effect of acquisitions on prices is analyzed 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 favorable to the growth of the major retail chains.

Fernald and Ramnath (2004) studied sectorial productivity in the United States in the 90's. 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 this information

technology. 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 to 2001 was 7.39% and the contribution of the 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 et al. (2004) say that the structure of a retail company is dramatically changed by the introduction of information technology to the industry. IT progress results in increases in productivity in the retail sector because of the 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 a greater productivity on the part of cashiers as well as savings on time in inventory management, resulting in savings on time 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 producing increases in productivity. There are profound implications for the company by 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) says that the number of items offered per store rose from 7,800 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 Food Marketing Institute.

In terms of industry organization, this means a trend towards concentration as the companies that first implement these technological changes 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, op. cit.).

Another interesting aspect of the impact of technological progress on retail is its effect on the dynamics of the industry. Foster, Haltiwanger and Krizan (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 key to produce the transmission of technological progress, since new companies or plants automatically 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 key. This has heavy implications on the dynamics of the retail industry because there should be a major technological change 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 those technological changes. 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 90's, a computer system that provides sales information from each store to thousands of suppliers in order to improve merchandise dispatch planning (Ghemawat P., Mark K., Bradley S., 2003).

In the case of Chile, the supermarket industry has lately been concentrating nationally around two major chains, Cencosud and DyS. The 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.

Similar to the international experience, the main reason behind the expansion of these companies was the emergence of new economies of scale in the industry as a consequence of information technology changes throughout the world in recent years. Theses of 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, op.cit.).

III. Estimation Model, Methodology and Data

This paper seeks to evaluate the relationship existing 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 the 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 estimated 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……15) and the subindex t represents the month (t = 1, 2, 3……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 $\left(0, \sigma^2\right)$ distributed error term.

[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., op.cit.).

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,…,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 the 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 is 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 Herfindahl–Hirschmann Index

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

(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 data was on the cities of: 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 Managers (taxable income series), annual reports and public information on the main supermarket chains in Chile and information that these chains provided (market share by city, new stores and acquisition of stores or chains).

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 for the period under consideration. Thus, these 51 goods constitute our bundle, and all are sold by supermarkets. The Family Budget Survey 1996-7 provides the weighting for these goods in the budget of a representative consumer.[4]

IV. Results

To begin, the base equation was estimated using the HH index as the concentration indicator. We estimated our panel data using a random-effect method. The Hausman test indicated that the random effect estimation cannot be rejected, denoting orthogonality between the city-fixed effect and the explanatory variables. The values from the Hausman

[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.
[4] See Appendix 1 for both the goods and the weighting of these goods in our bundle.

tests are provided in Appendix 2.[5] The unit root test was also performed, which confirmed that the variables used are stationary (the test values are presented in Appendix 3[6]).

The results are presented in Table 1. Equation 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. Local unemployment appears to be statistically significant, with a negative sign, as expected. Income is statistically not significant.

The variable HH_{it} is replaced by $C2_{it}$ in equation 2 of the same table. The $C2_{it}$ variable is stationary, like the other variables used. The results obtained after running the regression with C2 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 price. This reveals that the results for local concentration are robust and independent of the particular measurement. Unemployment continues to be negative and has a high statistical significance.

[5] Appendix 2 summarizes the results of the Hausman test for all regressions made later in the paper.
[6] Includes the unit root test of the other variables used later on.

Table 1

Estimations by random effects

Dependent Variable: Relative Price

Independent Variables	1	2
Relative Income	0.083 (0.033)**	0.082 (0.035)**
Relative Unemployment	-0.009 (0.006)	-0.009 (0.006)
Relative Herfindahl Index	0.022 (0.002)***	
Market share of the two leading chains in each city		0.017 (0.006)***
Constant	0.901 (0.032)***	0.916 (0.035)***
Observations	1575	1575
Cities	15	15
R^2 Within	0.1918	0.1347
R^2 Between	0.3384	0.3429
R^2 Overall	0.2708	0.2135

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Given the little difference in results and the greater conceptual value of the Herfindahl–Hirschmann index, the choice was made to continue using the variable in successive equations.

The regressions in Table 1 indicate that concentration has a positive and statistically significant impact on price. Nonetheless, concentration is just one part of the story on prices in this industry. Indeed, prior literature (Lira et al., op. cit.; 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.

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, either via acquisitions, mergers or new supermarkets. Therefore, 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.

The relative market concentration variable is substituted in regression 1 of Table 2 by one that measures the expansion or share attained by the two leading national supermarket chains in the respective city (E_{it}), namely:

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

Note that while E_{it} , which we call expansion, measures the share of the two leading national chains in city i in month t, the two measurements used above ($C2_{it}$ and HH_{it}) are measures of concentration in the respective cities, regardless of who the participants are. The new equation (with E_{it}) was also estimated using random effect method, given the results of the respective Hausman test. The variable E_{it} is also stationary.

The results of the estimation of equation (2) are presented in regression 1 of Table 2. The share of the two major national chains (DyS and Cencosud) in each city is found to have 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. The evidence is consistent with the evidence found by Lira et. al. (op. cit.).

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.[7] 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 on 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 order to determine whether the expansion of major chains is just a deconcentration of the industry or there are other factors involved in the effect on prices (economies of scale), a new regression was run that contained both variables simultaneously: Concentration (HH_{it}) and expansion (E_{it}). The results of the estimation

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

with a random effect panel are shown in regression 2 of Table 2. On the one hand, the coefficients for both variables HH and expansion (E) are seen to remain virtually unchanged as compared to the cases in which they were run separately; and on the other hand, those variables maintain their high statistical significance. This indicates that the expansion variable is not the inverse of the HH variable, but rather a different variable that captures the effect of economies of scale of the major domestic chains. Therefore, our result validates the theory on the transmission of economies of scale of the major national chains to cities to which they expand.

Table 2

Estimations by random effects

Dependent Variable: Relative Price

Independent Variables	1	2
Relative Income	0.081 (0.033)**	0.087 (0.033)***
Relative Unemployment	-0.012 (0.006)**	-0.011 (0.006)*
Relative expansion of mayor national chains	-0.041 (0.004)***	-0.029 (0.004)***
Relative Herfindahl Index		0.017 (0.002)***
Constant	0.965 (0.032)***	0.926 (0.032)***
Observations	1575	1575
Cities	15	15
R^2 Within	0.1837	0.2150
R^2 Between	0.4565	0.4961
R^2 Overall	0.3048	0.3588

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

An exercise: The behavior of the main local chain

An additional exercise was conducted to attain a greater understanding of the behavior of the supermarket industry. This exercise consisted of studying the behavior 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 on the local market ($C1L$). The new regression (3) is the following:

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

The results of the estimation using a random effect method are presented in regression 1 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 the major chains continue to have the same sign, magnitude and statistical significance. As explained above, it may seem to be counterintuitive that the share of the major local chain has a negative coefficient. In fact, consistent with the positive local concentration sign (HH), one would tend to think that the major local firm would 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 behavior of the variable representing the relative share of the dominant firm on the local market ($C1L_{it}$), it is separated into two different variables since it cannot be determined from equation (3) whether the behavior 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 thus constructed that adopts the value of $C1L_{it}$ if the major national chains do not participate on that market (i.e. if E_{it} is equal to zero), and of zero when they do ($E_{it} > 0$). Equation 2 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.

Table 3

Estimations by random effects

Dependent Variable: Relative Price

Independent Variables	1	2
Relative Income	0.087 (0.033)***	0.099 (0.032)***
Relative Unemployment	-0.013 (0.006)**	-0.008 (0.006)
Relative expansion of mayor national chains	-0.035 (0.004)***	-0.014 (0.005)***
Relative Herfindahl Index	0.019 (0.002)***	0.014 (0.002)***
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)***
Constant	0.941 (0.032)***	0.901 (0.032)***
Observations	1575	1575
Cities	15	15
R^2 Within	0.2226	0.2348
R^2 Between	0.4191	0.5498
R^2 Overall	0.3222	0.4085

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

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 on 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 are present in that city.

The results are shown in Table 4. 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 on a market where at least one of the major national chains is present. This result suggests that the main local chain does not behave just one way in response to competition. If the major national chains are present, then the dominant local firm adopts their behavior 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).

Table 4

Estimation by random effects

Dependent Variable: Relative Price

Independent Variables	1
Relative Income	0.114 (0.032)***
Relative Unemployment	-0.011 (0.005)**
Relative expansion of mayor national chains	-0.015 (0.004)***
Relative Herfindahl Index	0.015 (0.002)***
Relative share of dominant firm on the local market (if major companies participate on that market)	-0.006 (0.001)***
Constant	0.914 (0.031)***
Observations	1575
Cities	15
R^2 Within	0.2723
R^2 Between	0.5048
R^2 Overall	0.4017

Standard errors in parentheses

***Significant at 1% ** significant at 5% *significant at 10%

V. Major national chains: acquisitions and entry

According to our results, since the expansion of the major chains to cities is the market structure variable that predominates in price behavior, 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 from the new hypermarkets entering cities and the one obtained by purchasing existing chains or supermarkets. The purpose is to detect whether there is any difference in price behavior 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 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 on the market or when both are there, and a value of one when there is just one of the two participating on that market) while $D2E_{it}$ is a dummy that adopts a value of 1 when both national chains operates on the city, and zero otherwise.

The AC_{it} acquisition dummy captures the inmerge operations and adopts a value of 1 when there is a purchase of a local chain 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 zero when, at the time of

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 in the city are merged by 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 1 of the 2 chains involved in the transaction is present in a city and zero 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 just 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.

As a result, the equation to be estimated is:

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

Table 5 shows the results of the estimation of equation (4) with a random effect method (see Appendix 2). 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 operates 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 on the market prior to 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 behavior 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.

Table 5

Estimation by random effects

Independent Variables	1
Relative Income	0.116 (0.031)***
Relative Unemployment	-0.011 (0.006)**
Relative Herfindahl Index	0.017 (0.002)***
1 chain entry dummy	-0.029 (0.006)***
2 chains entry 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

Standard error between parenthesis.
***Significant at 1% ** significant at 5% *significant at 10%

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 theses cities, but also by the acquisition of other chains. The purpose of this paper 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 the different cities relative to the price of the same bundle for Santiago.

This paper 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 the higher concentration increases prices, but that the expansion of the major national chains reduces those prices. The reason why the expansion of the national chains to different cities 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 effect produced by the higher concentration of the market. The reason for this behavior 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 lowers prices.

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 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 are already present in the city. If only one chain was operating in the city before the acquisition, then prices fall after the acquisition takes place. The explanation for this result is that the new supermarket has lower costs (because of greater economies of scale). 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 new larger firm.

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Appendix 1: 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 (175g)	0.33
11	Eggs 12 uds.	0.30
12	Rice, grade 2 (kg)	0.29
13	Spaguetti Nº5 (400g)	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 (250g)	0.20
19	Pisco 35% alcohol (750cc)	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 (170g)	0.18
26	Pork chops (kg)	0.16

	Selected foodstuffs (unit of measurement)	Consumption weighting
27	Osobuco (beef) (10kg)	0.16
28	Onions, new or long life (kg)	0.16
29	Milan lettuce (1)	0.16
30	Tomatoe sauce (250g jar)	0.16
31	Hass Avocados (kg)	0.14
32	Veal sausages (20)	0.13
33	Jelly (250g)	0.13
34	Unseasoned pork ribs (kg)	0.12
35	Normal flour (500 kg)	0.12
36	Teabags (20)	0.11
37	Satandard tea (250g)	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 (184g)	0.07
44	Milk additive (400g)	0.06
45	Tinned peaches (590g)	0.05
46	Medium white cabbage (1)	0.05
47	Lentils 5mm (kg)	0.04
48	Garlic (3 units)	0.04
49	Tinned horse-eye jack (fish) (425g)	0.04
50	Table salt with added iodine (kg)	0.03
51	Crushed oats (400g)	0.03
	Total selected bundle	13.82

Appendix 2: Hausman Tests

	Test	p-Value
Table 1		
Ecuation 1	4.36	0.2254
Ecuation 2	4.22	0.2389
Table 2		
Ecuation 1	3.06	0.3829
Ecuation 2	3.73	0.4435
Table 3		
Ecuation 1	4.47	0.4837
Ecuation 2	2.00	0.8498
Table 4		
Ecuation 1	2.85	0.7234
Table 5		
Ecuation 1	17.27	0.3027

Appendix 3: 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