Market Structure and Competition in Food Retail: Some Evidences from Brazil

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Abstract – **The paper analyzes competition among supermarkets in Brazil. In contrast to part of the economic literature which suggests that the fast growth of big supermarket chains would destroy independent, medium and small supermarkets, the paper argues that big supermarket chains can coexist with different formats of independent food retailing. As a result, competition in food retail is complex and cannot be described as a simple Darwinian process of market concentration. The analysis is divided in two parts. In the first part, the competition between hypermarkets and supermarkets is examined. Evidences for the district of Sao Paulo, Brazil, suggest that these retailers form separate markets. The second part is focused on neighborhood supermarkets. The results differ from the general belief that independent supermarkets establish higher prices in comparison to big chain supermarkets. The analysis brings to light the *heterogeneity of the competitive fringe* in the oligopoly model of Brazilian retailing.**

Key Words – **Food retail, Supermarkets, Differentiation**

I. Introduction*

Recent literature on supermarkets has emphasized the rapid concentration of food retailing (Reardon, 2004.), the increasing buyer power of supermarket chains (Dobson and Waterson, 1999), and the adoption of private standards (Reardon, 2004; Reardon, Timmer and Berguedé, 2003). The results from this literature seem too linear. The rise of big supermarkets increases their buyer power, allowing them to impose prices and standards on the supply chain, from food processors to farmers. Private standards are complex and costly to accomplish and the result is the exclusion of small food businesses (retailers, processors and farmers), leading to a general process of concentration.

The present paper states that the consequences of the aforementioned process are complex and can result in the preservation of the main characteristic of the less developed countries, i.e. huge heterogeneity[1]. The main flaw of most papers resides in the assumption that supermarket means big chains. Few discussions are made regarding the variety of food retailers' formats.

D'Andrea et al. (2006:661), for instance, state that: "*[a]fter a decade of sustained growth of the 'modern' retail sector in Latin America, smaller scale retailers still supply a significant portion of fast-moving consumer goods to the 'emerging' consumer base or low income segments"*. Farina, Nunes and Monteiro (2005a) argue through a theoretical model and empirical evidences for Brazil that the survival of traditional retailing occurs not only in sophisticated niches (Reardon, 2004) but also in ordinary food products in the poor regions of the metropolitan areas. Even for developed countries, Chen (2003) argues that an important retail trend in the past few decades has been the polarization of store size. *Increasingly, mid-sized general merchandise retailers are squeezed out by large-scale retailers and small specialty stores* (Chen, 2003:613).

This paper explores the coexistence of different kinds of food retailers in Brazil. The main propositions are: (a) the price mechanism of retailers are intricate and may be influenced by a number of different forces; (b) the general category *supermarket* masks the complexity of food retail competition; and (c) despite the general believe that

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[1] It is worth emphasizing that Reardon (2004) does not ignore these aspects, but he chooses to favor the supermarket side of the equation due to the necessity to define an analytical frontier.

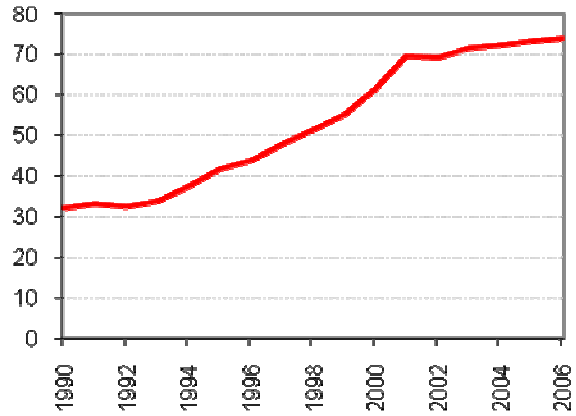
independent supermarkets are less efficient than big chains, the average price of a representative basket of food products at independent stores has been lower than the average price of chain stores.

The paper is organized as follows: 1. Introduction; 2. An overview of the Brazilian food retailing sector; 3. An analysis of small retailing survival; 4. A conceptual model of competition in food retail; 5. Price Competition; 6. Conclusions and questions for further research.

II. FOOD RETAIL STRUCTURE IN BRAZIL

The 90's were characterized by the fast transformation of Brazilian supermarket sector. The control of inflation along with trade liberalization attracted new foreign companies to the national market. On the other hand, economic stabilization also stimulated the expansion of big national supermarket chains. As a result, the number of supermarkets' stores operating in the country experienced substantial growth (Dall´Agnese, 2007).

Graph 1: Number of Supermarkets' stores – Brazil, 1990/2006 (1000 stores).



Source: DALL´AGNESE (2007).

The process of companies' concentration has also intensified. There were 89 M&A operations in the Brazilian supermarket sector from January 1995 to April 2007. The Herfindahl-Hirschman Index has risen from 532 in 1995 to 1052 in 2005; the CR5 has risen from 38 % to 64 % during the same period (table 1).

Table 1: Degree of Concentration: Supermarket Sector – Brazil, 1994 – 2002.

Year	HHI (300 biggest companies)	CR5(%)
1995	532,21	38
1996	455,8	39
1997	471,69	41
1998	663,14	47
1999	957,68	60
2000	1033,59	62
2001	971,74	60
2002	1005,48	59
2003	1161,00	58
2004	1107,00	62
2005	1052,00	64

Source: ABRAS – The Brazilian Supermarket Association

Yet, the concentration process did not represent the disappearance of small and medium retail. As economic stabilization stimulated an increase in frequency of food purchase, consumer's concern regarding the convenience of the purchase has become more important, allowing the survival of smaller neighborhood stores (Farina & Nunes, 2002).

Generally, the number of stores belonging to supermarket chains increased 4.29% between 1994 and 2006. In the same period, the number of traditional stores grew 47%, or 3.97% per year and the number of independent supermarkets grew 90%, or 7.57% per year (table 2). In the same period, the GNP grew 16.4%, equivalent to 2.6% per year. It is worth noting that regional analysis shows significant distinctions. The expansion of supermarket chains has been more intense in the densely populated metropolitan region of Sao Paulo and in States of higher income[2].

With regard to food sales in recent years (2001-2006), supermarket chains present positive rates of expansion. On the other hand, independent supermarkets and traditional stores have negative rates indicating a reduction in its share of food sales. The exception is metropolitan region of Rio de Janeiro: the relative weight of the chains in food sales has reduced (-3.13%) and the

[2] States of Paraná, Santa Catarina and Rio Grande do Sul (South region).

weight of independent supermarkets has advanced (18.86%).

Table 2: Variation – number of stores and share of food sales (1994-2006)

AC Nielsen Regions	Type of store	Variation (% per year)	
		Number of stores (1994-2006)	Food sales (2001-2006)
Brazil	Chain	4,29	2,52
	Independent	7,57	-1,22
	Traditional	3,97	-3,33
Region I	Chain	3,13	4,48
	Independent	10,69	-1,61
	Traditional	5	-4,32
Region II	Chain	6,47	4,98
	Independent	4,49	-1,68
	Traditional	4,1	-2,6
Region III	Chain	4,05	-3,13
	Independent	7,39	18,86
	Traditional	7,61	2,22
Region IV	Chain	11,58	1,5
	Independent	0,71	-4,39
	Traditional	5,74	-0,79
Region V	Chain	3,48	5,12
	Independent	7,53	-2,22
	Traditional	3,44	-4,83
Region VI	Chain	1,44	3,4
	Independent	10,06	-1
	Traditional	0,96	-4,94
Region VII	Chain	14,93	9,65
	Independent	7,21	-3,1
	Traditional	5,07	-5,58

Region I – states of Bahia, Pernambuco, Sergipe, Alagoas, Paraíba, Rio Grande do Norte and Ceará, in Northeast region.

Region II – states of Minas Gerais, Espírito Santo and Rio de Janeiro (excluding the cities of Rio de Janeiro, Niterói, Nova Iquaçu, Duque de Caxias, Nilópolis, São Gonçalo and São João de Meriti).

Region III – Greater Rio de Janeiro (cities of Rio de Janeiro, Niterói, Nova Iquaçu, Duque de Caxias, Nilópolis, São Gonçalo and São João de Meriti).

Region IV – Greater São Paulo

Region V – state of São Paulo, except Greater São Paulo

Region VI – states of Paraná, Santa Catarina and Rio Grande do Sul (South region)

Source: AC Nielsen Census

III. THE SURVIVAL OF SMALL RETAIL

The consequence of the rapid rise of efficient, large supermarket chains was supposed to be market concentration and market power. Downstream consumers would face higher prices as a result of lower competition. Upstream suppliers would face the imposition of private standards and the buyer power, which would lower net margins.

Empirical evidences, however, do not support the theory of disappearance of small retail due to the expansion of large supermarket chains. Farina, Nunes and Monteiro (2005a) offer an explanation for the survival of small retail. The authors call attention to the fact that large supermarkets and small retailers offer their clients different combinations of price and convenience or purchasing costs.

The food retail structure is described as an oligopoly with a competitive fringe. Firms of the dominant nucleus (large supermarket chains) compete via prices according to the Bertrand Model and differentiate little among themselves. The vast differentiation occurs between (a) the supermarket chains and (b) the traditional retail and the independent supermarkets (competitive fringe). For each firm of the dominant nucleus, the demand is highly elastic to prices.

By assumption, purchasing costs of stores of the dominant nucleus are higher than purchasing costs of stores of the competitive fringe. In general, stores of large supermarket chains are less numerous and less spread out than those of the competitive fringe. Furthermore, as long as stores of the dominant nucleus are larger, it is necessary to move greater distances within the store which implies more time spent when shopping. There are also long checkout lines at peak times.

Firms of the dominant nucleus have difficulties in raising prices and extracting a higher surplus from consumers. In the short term, competition among nucleus firms causes the strategy of sustaining high prices to be dominated by the strategy of lowering prices provided that individual firms' demands are highly elastic to prices. In the long term, growth of the competitive fringe challenges the attempt of nucleus firms to coordinate their price policies.

Accordingly, consumers face a tradeoff between prices (lower in supermarkets and hypermarkets) and purchasing

costs (lower in traditional retailers and independent supermarkets). Because consumers have distinct preferences in relation to price and convenience – and even a single consumer can choose different distribution channels in different circumstances – there is space in the market for traditional retailers and for independent self-service stores. Small food retail survives in spite of having higher costs because it offers more convenience to the consumer, i.e. involves purchasing costs to the consumer that are lower than that of the large chains.

Once considering that the alternative of raising prices results in loss of market-share, the large supermarket chains seek cost-reducing innovations whether in the process of controlling merchandise flows, or in the negotiations with suppliers. On condition that the other firms of the nucleus do not copy the innovation, the pioneers can realize economic profit or reduce the prices to the consumer, winning market-shares from their direct competitors.

To evaluate prices practiced in different retail stores, Monteiro (2005) analyzed historic price series for the Municipal district of Sao Paulo, Brazil. The price information does not support the hypothesis that supermarkets manage higher prices in comparison to traditional retailers. Among the analyzed products, not a single case was found in which supermarkets set higher prices than traditional retail.

IV. Differentiation in food retail

Farina, Nunes and Monteiro (2005a) consider only two groups of retailers: supermarkets in the nucleus of the food market and traditional retail in the fringe. Nevertheless, recent studies suggest relevant distinctions between supermarket chains and independent supermarkets (Dall'Agnese, 2007; Monteiro, 2007); and between hypermarkets and supermarkets (Monteiro, 2007). We stress here some issues concerning the complex differentiation in food retail. [3]

Retail stores can be divided into four categories: hypermarkets, chain supermarkets, independent supermarkets and traditional retailers. Although there is a substantial differentiation within the groups, one may ponder that differences among groups are more important. It is assumed that supermarkets offer the same variety of food products in comparison to hypermarkets. Hypermarkets, in contrast, also commercialize a wider set of durable goods (e.g. computers and TV sets).

The table below presents some basic attributes that characterize transactions between retailer and consumers. There are three intensity levels (high, average and low) for each attribute in each retailer category.

Table 3: Attributes of transactions with final consumers in food retail

	Hypermarket	**Supermarket chain**	**Independent supermarket**	**Traditional retail**
Capillarity	Low	Medium - High	High	High
Product mix diversity	High	High	Medium	Low
Time spent in purchasing	High	Medium	Medium	Low
Payment easiness	High	High	Medium	Low
Customization of Product	Low	Low	Low	High
Impersonality	High	High	Medium	Low
Purchasing environment	Medium	High	Medium - Low	High-Medium-Low
Product standards	High	High	High-Medium	High-Medium-Low
Price	Low	Medium	Low	High

Source: Farina, Nunes and Monteiro (2005b)

Capillarity means the presence of stores in the consumer's neighborhood and its diffusion in the urban space. Product mix diversity is related to the number of products and brands available to costumers. Payment easiness refers to the acceptance of different means of payment besides cash (e.g. credit cards, debt cards, bank checks). Customization of product is the ability to shape products according to consumers' will (size, colors, meat cuts). Impersonality is negatively related to customer's acquaintance with owners or stores' employees. The customer can, for example, believe that a clerk sales the best products to known, assiduous people and the worst ones to unknown, sporadic buyers. Purchasing environment includes facilities offered to customers,

[3] This section is based on Farina, Nunes and Monteiro (2005b).

temperature and light in the store, cleanliness, displays and visual orientation.

Competitive game in the food retail encompasses two stages. In the first stage, retailers decide where the stores of each kind will be located. In the second stage, when number and characteristics of stores are given, retailers compete in price, services and the environment in which the consumer accomplishes the purchases.

Big chains generally include hypermarkets, supermarkets and convenience stores. As a result, firms have the capacity of exploring (i) the consumers' propensity in paying for different attributes and (ii) the economies of scale and scope associated with centralized systems of distribution and purchase. Hypermarkets present smaller marginal costs in comparison to other kinds of store due to scale and scope economies, smaller level of convenience and factors related to urban location. Hypermarkets compete to each other generally via prices. Supermarkets, on the other hand, are located in urban areas (neighborhoods) and offer convenience and good environment. Supermarkets' costs and prices are higher in comparison to hypermarkets'.

Independent supermarkets are also located in neighborhoods. Some costs are higher in comparison to chain supermarkets due to the absence of economies of scale, but other costs are smaller such as marketing costs.

The traditional retail is the most heterogeneous type of store. Average costs probably are larger than in other formats. This kind of retailer presents the nearest store to the household.

Supposing two or more hypermarkets disputing consumers in one given area, it is plausible that such firms establish a Bertrand's Game. In this case, price is equivalent to the marginal cost. On the other hand, chain supermarkets are price makers since they offer differentiated goods and additional services. Independent supermarkets follow the chain leaders, tying its prices to their rivals'. Traditional retailers behave as price takers in a price leadership model.

Consumers consider the net utility of goods (utility minus purchase costs) in each store. An individual whose preferences present usual properties (convexity, continuity, etc.) allocates his income in products of stores of distinct kinds. The consumer reaches the balance when the marginal utility is alike in each retailer's category. Thus, different categories are compatible.

Market equilibrium is achieved when prices in each category reflect the differences in net utilities. Differences in prices for the same product can coexist, being efficient in the presence of heterogeneous individuals. Consequently, the consumer behavior is important for the explanation of the survival of convenience stores and independent supermarkets. However, is not enough. Chains are able to reproduce some of the characteristics of small retailers while keeping cost advantages related to economies of scale and scope.

V. Price competition in the food retail

A. *Hypermarkets and Supermarkets*

Let's consider the analytical framework introduced in section IV. Specifically consider that a consumer i is interested in purchasing a bundle of food products and can choose between two equivalent bundles, the first sold exclusively in the hypermarket (H) and the other available just in the supermarket (S). To buy in each store the consumer incurs in different *purchasing costs*: τ_H (purchasing cost in the hypermarket) and τ_S (purchasing cost in the supermarket). Such costs are constant, independent of the quantity purchased and different among consumers because of differences in the distances between the consumer's residence and the stores and/or differences in the preferences.

Consumer i solves the following maximization problem:

$$U_i = q_H^i + q_V^i - \Phi(\tau_H^i; \tau_S^i)$$
$$p_H q_H^i + p_V q_V^i \leq m^i$$

Where $\Phi : \tau_j^i \rightarrow q_j$, $\Phi' > 0$, is a function that translates purchasing costs into equivalent quantity of goods, i.e. the quantity that let consumer indifferent between H and S.

Following Farina, Nunes and Monteiro (2005a), the consumer will be indifferent if the net utilities in the two stores are equal, i.e. if the difference in the quantity that can be purchased in the two stores compensates exactly

the additional disutility corresponding to the difference in the purchasing costs.

The model inspires some hypothesis: (i) if purchasing costs are the same, $\tau_H^i = \tau_S^i, \forall i$, prices will be equivalent and the competition process will select the stores with the lowest cost; (ii) if stores present different levels of convenience, prices will establish a stable relationship which expresses the difference in purchasing costs perceived by consumers.

We analyze empirical evidences through a database made available by *Fundação Instituto de Pesquisas Econômicas – Foundation Institute of Economic Researches (FIPE)*. The Foundation elaborates the Consumer Price Index (IPC-FIPE) which measures the prices' variation in the Municipal district of Sao Paulo, the Brazilian biggest city.

Following Wen (2001), we consider that supermarkets do not simple apply a markup on unitary costs. Supermarkets establish its prices considering both the discrimination opportunities among products and the competitor's reaction regarding prices and quality levels. In order to account for such aspect, we performed calculations of price indexes for a bundle of representative products. Each product in the bundle received a specific weight according to a Family Budget Survey (POF[4]). The obtained prices express the value of a unity basket compose of products in the same proportion found in the whole sample of the Survey.

The database encompasses 22 products [5] whose prices where collected in 11 hypermarkets and 28 medium and large supermarkets' stores. [6] Each product, in each store, is characterized by a price series that extends from January 2001 to March 2006. [7]

The empirical evidence does not support the hypothesis that supermarket's prices are higher than hypermarket's prices (graph 2). The data also indicates that the price difference is not constant (graph 3). The bundles' average value is R$ 3.6 and the average price difference is just R$ 0.06.

If retailers are differentiated regarding its purchasing costs, the price difference in the long-run will be stable and express the differences in consumers' convenience perception. On the other hand, if purchasing costs are alike, retailers will operate in a competitive market. Under any condition, one expects the price series to cointegrate. The existence of a cointegration vector would suggest a long-run relationship between the variables. A cointegration vector $[1;-1]$ would corroborate the hypothesis of perfect competition between supermarkets and hypermarkets; other types of cointegration vectors would express the value that consumers attach to the different levels of convenience offered by the different retailers.

Yet, the performance of cointegration tests indicates that price series do not establish a long-run relationship. [8] *The absence of cointegration may suggest that hypermarkets and supermarkets compete in distinct markets. Consumers may consider the shopping experience in supermarkets different from the shopping experience in hypermarkets.*

[4] '*Pesquisa de Orçamentos Familiares'*: Family Budget Survey for the Metropolitan Area of the State of Sao Paulo

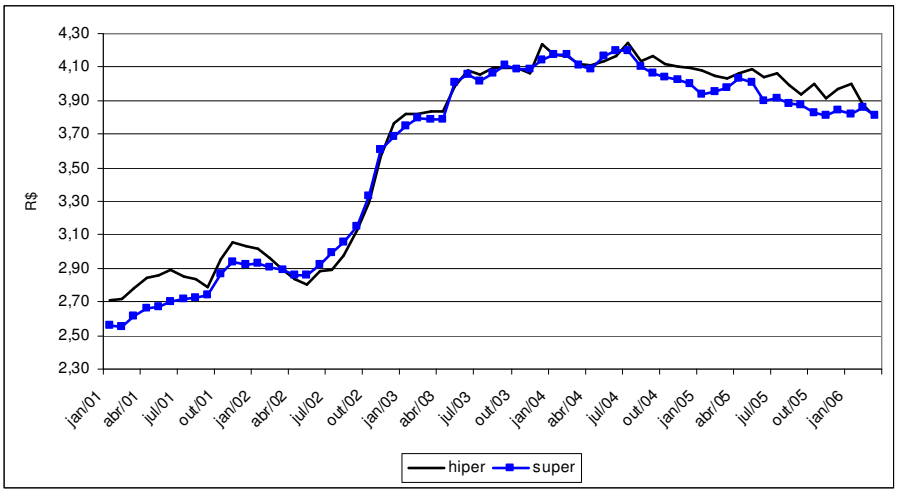
[5] Sandwich cookie (weight 0,029), cream cracker (0,01), custard (001), tomato sauce (0,011), sugar (0,042), rice (0,127), wheat flour (0,009), beans (0,066), chuck (beef) (0,066), rump (beef) (0,059), chicken (0,127), chocolate milk mix (0,013), coffee (0,07), milk UHT (0,129), butter (0,033), sliced bread (0,022), ham (0,011), mozzarella cheese (0,023), banana (0,05), potato (0,041), onion (0,02), tomato (0,032).

[6] Medium supermarket refers to a store with 8 to 20 check-outs; large supermarket refers to a store with 21 to 30 check-outs.

[7] Each product brand was considered distinctly in such a manner that the final product selection implies that the same brands exist in all stores. This prevents that price differences among brands influence the analysis. The price series for a particular product represents the arithmetic mean of the brands.

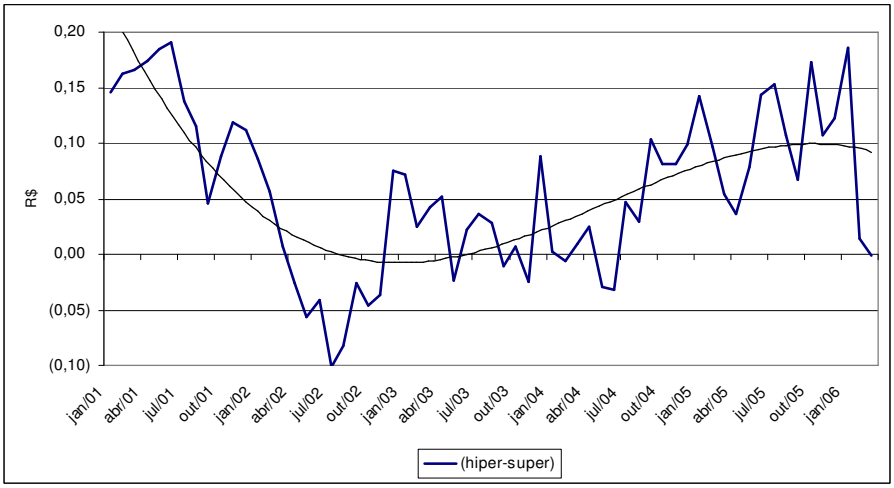
[8] Both series are non-stationary according to Dichey-Pantula Test and Augmented Dickey-Fuller Test (see appendix). Cointegration tests were accomplished through the Johansen Procedure. The test was performed considering a model without deterministic terms and a VAR of order 3. For the null hypothesis of no cointegration, the Eigenvalue is 0.1196 which relates to a trace statistic of 9.213. The critical value (5% significance) is 12.32.

Graph 2: Hypermarkets and Supermarkets – Price evolution (R$) – Bundle of products –Municipal district of Sao Paulo, jan/2001 to march/2006.



Source: FIPE, elaborated by the authors

Graph 3: Price Difference: Hypermarket and Supermarket – Bundle of products –Municipal district of Sao Paulo, jan/2001 to march/2006.



Source: FIPE, elaborated by the authors

B. Chain Supermarkets vs. Independent Firms

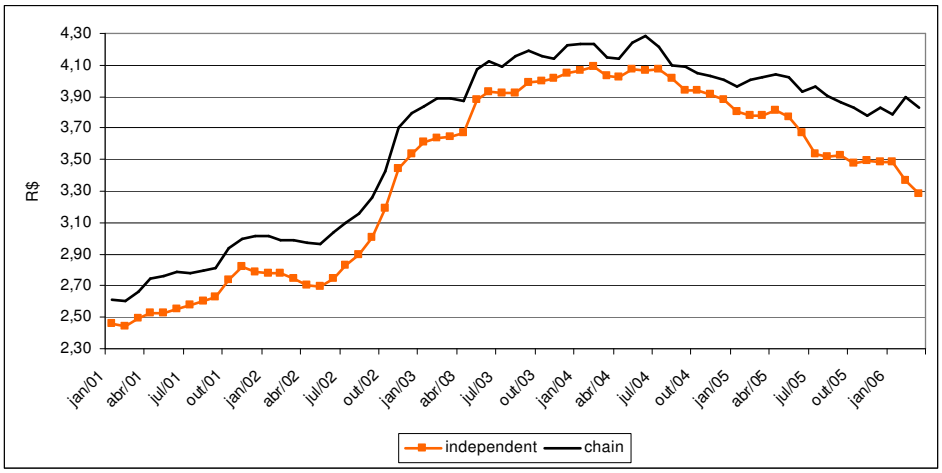
We now center our attention on the price mechanism of chain supermarkets and independent firms. Independent firms are made of 4 or less supermarket stores under the same name (flag). The prices for chain supermarkets and independent stores are shown in graph 4. The data originates from the same database presented in the previous section.

The data reveals that *independent supermarkets set smaller prices during the whole period*. [9] This result

[9] Cointegration analysis shows that price series do not establish a long-run equilibrium.

comes as a puzzle. On the one hand, general belief reports that chain supermarkets set smaller prices in comparison to independent stores due to larger efficiency. On the other hand, considering that *purchasing costs* are equivalent between chain supermarkets and independent stores, the retailer that sets higher prices should disappear in the long term due to competition pressure. In both cases the available evidences do not sustain the conventional thesis. One can evoke some explanations that help us to comprehend these phenomena. We briefly discuss some potential explanations.

Graph 4: Chain Supermarkets and Independent Stores – Prices (R$) – Bundle of products – Municipal district of Sao Paulo, jan./2001 to march/2006.



Source: FIPE, elaborated by the authors.

Asymmetric information. Consumers may consider the accomplishment of an extensive price research too costly. As a result, firms have an incentive to set higher prices in comparison to its rivals because consumers ignore prices set in other stores. Alternatively, consumers may be confused due to frequent price promotions. Calicchio et ally (2007) investigate the effects of supermarkets' frequent price promotions on consumers' price perception for a group of cities in Latin America. The authors find a negative relationship between promotional activity and price perception accuracy. They also verify that price perception accuracy is considerably smaller in the Municipal district of Sao Paulo in comparison to other Latin-American cities.

Even supposing that asymmetric information add to the explanation of price differences, a question remains: why independent stores do not replicate the price strategy of chain supermarkets provided that consumers face asymmetric information?

Reputation. Loertscher and Schneider (2007) investigate chain stores' incentives of charging higher prices. The authors assume that consumers must incur search and experimentation costs whenever visiting a store for the first time. If consumers change their location, they have to engage in new searches (i.e. incur in search costs) unless some firms from the previous location are also present in the new location. Search costs can be mitigated if chain stores are present in both locations. Accordingly, chain stores are capable of setting higher prices in comparison to independent stores. The price difference derives from the differentiation in search costs.

Tax evasion. Independent supermarkets may engage in tax evasion. Firms may understate revenues in order to get advantages of small business tax regimes. Employers may whether avoid the registration of some of his employees or register employees with a smaller salary than that indeed paid so that less social contributions have to be paid. Tax evasion enables firms to set smaller prices because costs are reduced.

Although this explanation may seem appealing, it is not absolute. Price differences cannot be entirely explained by means of tax evasion. According to D'Andrea et ally (2006) "[C]omplete evasion of these taxes is unlikely even in countries with higher prevalence of "informality." For one, large companies and multi-national manufacturers – who sell formally – still supply the majority of consumer products in Latin America. When these companies sell through intermediaries, tax compliance tends to "travel" along the value chain since middlemen have strong incentives to also sell formally and recover VAT credits. Moreover, many of these companies are trying to sell direct to small retailers introducing tax formality to a large portion of small retailers' sales. Secondly, in some countries, government agencies are improving capabilities and small retailers perceive a higher probability of being caught."

Cost structure. Chain supermarkets and independent stores differ on cost structure. Big supermarket chains engage in expensive marketing activities and operate distribution centers. Although distribution centers are regarded as an important competitive advantage due to economies of scale, it relates to construction and operation costs. On the other hand, independent supermarkets do not incur in costs associated with distribution centers and its marketing expenses are considerably smaller – generally restricted to local promotions.

Vertical incentives. Chen (2003) offers an explanation to the survival of distinct retail formats. The objective of Chen's model is to examine the countervailing power hypothesis using a theoretical model that captures the main ingredients of Galbraith (1952)'s arguments as well as some of the important features of the retail industry, mainly nonlinear contracts. Galbraith (1952) argued that countervailing power would be socially desirable because economic power on one side of the market begets countervailing power on the other side.

Chen (2003) assumes a monopoly in the supplier sector and a dominant firm with fringe in the retail industry. Retail price is set by the dominant retailer, while the fringe retailers are price-takers. The model works as follow: A rise in the power of the dominant retailer reduces the share of joint profits accruing to the supplier. In an attempt to make up for lower profits earned from the dominant retailer, the supplier boosts sales to fringe retailers by lowering their wholesale price. The fall in the cost of fringe retailers shifts their supply curve to the right, leading to a lower retail price. Therefore, the fall in retail price is the result not of a dominant retailer passing on cost savings to consumers but of a supplier trying to offset the reduction in profits caused by the rise in countervailing power.

Although Chen (2003) does not provide an explanation for price differences in the retail sector, the author uncovers important aspects of the food industry which can be applied to the analysis of price strategy.

In order to gain some insight regarding the competition between chain supermarkets and independent stores, we accomplish a simple econometric analysis. Our intent is not to formally test all arguments presented above.

Based on the assumption that competition between neighborhood supermarkets is locally defined [10], we examine disaggregated data associated with shops in close proximity. Data will be organized as a pooling. Each cross-section unit represents a sub-area of a region (neighborhood). The equation to be estimated is:

$$dif_{it} = X_{it}^{'}.\pi_1 + Z_i^{'}.\pi_2 + \varepsilon_{it}$$

Where dif_{it} is the difference between the bundle's price of a chain supermarket and of an independent store, X_{it} is a matrix of k regressores and Z_i is a matrix containing a constant term and a set of specific variables for each unit of cross-section. The subscribers i and t refer respectively to location (neighborhood) and time.

We treat dif_{it} as independent cross-sections. Although this assumption is apparently strong, one should note that (i) prices set by chain supermarkets have an uniform component (which is common to all stores of the same flag) and a specific component (which is peculiar to the location of the shop), the assumption implies that, to some degree, the price's specific component dominates the uniform component; (ii) we assume the independence of the *price difference*, not the independence of the prices.

Data used in the estimation is equivalent to that presented in Graph 4. There are only two differences.

[10] Calicchio et al. (2007:52) state that: "Even including the few households that own cars, nearly 80 percent of Brazilians traveled less than 15 minutes on their most recent shopping trip — about one kilometer by foot or five kilometers by car. These habits mean that a retailer can hope to attract households only within a radius of two or so kilometers (applying a weighted average)."

First, the degree of information aggregation: in Graph 4 we analyzed the average price for several stores, now we examine prices for pairs of stores. Second, data extend from March 2002 to December 2006. Bundles were built on a strictly analogous manner to that described in subsection A.

The availability of data coupled with the assumption of local competition reduced to five the number of districts analyzed. In each district only one chain supermarket and one independent store were studied. Table 4 indicates the analyzed districts, the income sextile in which it is classified and the distance between the chain supermarket and the independent store. For each store the value of the bundle was calculated. Subsequently, the price difference between the bundle of the chain supermarket and that of the independent supermarket was calculated for each district.

Table 4: Districts – income sextile and distance (km)

District	Income sextile	Distance between the chain supermarket and the independent store (km)
Carrão	3º sextile	1,1
Casa verde	3º sextile	3
Jaçanã	4º sextile	1,3
Tremembé	3º sextile	0,7
Vila Mariana	1º sextile	2,4

The model estimation involves four explanatory variables: traveling cost, income, buyer power and distance. Traveling cost is the real price for petrol (fuel) in Sao Paulo. Data were provided by FIPE. One should note that the use of the price of petrol as a proxy for traveling costs is not free from criticism. By using the average price, the variations in price between neighborhoods are not taken in account and it is implicitly assumed that the number of vehicles in each location is equivalent. These assumptions are particularly strong when considering the variability of income among districts. Moreover, traveling costs are associated with the level of traffic in a given area. This feature can be partially captured by the specific effects of each unit of cross-section.

The variable income was built from two distinct sources: the Brazilian Institute of Geography and Statistics (IBGE) and SEADE Foundation. It is a series of average wage per district.

The variable buyer power refers to the ratio of the Consumer Price Index (CPI) for food goods and the Wholesale Price Index for food goods. The ratio attempts to capture part of the buyer power exercised by the retail industry. This proxy variable is limited in several ways. The ratio is built without any consideration of time gaps between the rates, i.e. it is supposed that the impact of industry on retail is immediate. [11] On the other hand, the relationship between industry's market power and retail's buyer power could be constant over the sample and the time.

The variable distance corresponds to the distance between the chain supermarket and the independent store as reported in table 4.

For the pooled estimation, we consider that the conditional mean is a common function within the groups and analyze the heterogeneity in terms of differences in variances. The presence of heterocedasticity encourages the use of a generalized regression model (Generalized Least Squares - GLS), since the estimation by Ordinary Least Squares (OLS) generates biased estimators for the variance of the parameters. Specifically, we assume no correlation between time periods and heterocedasticity between units of cross-section. Formally,

$$E\left(\varepsilon_{it}.\varepsilon_{it} \mid X_i\right) = \delta_i^2$$
$$E\left(\varepsilon_{is}.\varepsilon_{jt} \mid X_i\right) = 0; \forall i, j, s, t; i \neq j; s \neq t$$

An additional aspect to be considered relates to the inclusion of individual effects to the model. The lack of fixed effects in a model may produce biased and inconsistent estimators because of the omission of relevant variables.

The results of the estimations are presented in Table 5. We performed four estimations: OLS, OLS employing White correction for the variance, Feasible GLS (FGLS) and Fixed Effects.

The results suggest that variation in traveling cost plays a significant and positive effect on price difference. Moreover, the term of interaction between changes in traveling costs and distance presents a negative and significant effect. Thus, for a sufficiently small distance,

[11] When estimating the model using different gaps for the ratio, the results were not changed.

Table 5: Estimation

Dependent variable	Price difference	**Observations per *cross-section*:**	57	
Sample (adjusted)	04/2002 - 12/2006	**Total observations**	285	
(t-statistic)				
	OLS	**OLS (White correction)**	**FGLS**	**Fixed Effects**
Δ(Traveling cost)	3,84	3,84	**7,3**	**8,06**
	-0,825	-1,64	(2,25) *	(2,67) *
Distance	**0,048**	**0,048**	**0,067**	
	(1,81) **	(1,84) **	(2,27) *	
Δ(Traveling cost). Distance	**-5,97**	**-5,97**	**-7,3**	**-7,54**
	(-3,00) *	(-3,85) *	(-3,60) *	(-3,83) *
Δ(Income)	-0,007	-0,007	**-0,0007**	**-0,00072**
	(-0,776)	(-0,67)	(-0,92)	(-1,02)
Buyer Power	-0,1	-0,1	-0,076	-0,089
	(-0,525)	(-0,36)	(-0,46)	(-0,60)
Constant	0,33	0,33	0,26	
	-1,36	-0,98	-1,26	
Const_Carrão				**0,46**
				(2,55) *
Const_Cverde				**0,42**
				(2,25) *
Const_Jaçanã				**0,28**
				-1,57
Const_Tremembe				0,26
				-1,43
Const_Vmariana				**0,48**
				(2,63) *
R^2	0,0936	0,0936	0,142	0,329
Standard error regression	0,2734	0,2734	0,2719	0,262
Sum squared resids	20,8663	20,8663	20,6347	19,002
F-statistic	5,7671	5,7671	9,2478	16,931
P(F-statistic)	0	0	0	0

* 5% significance

** 10% significance

the difference in prices rises when traveling cost increases. However, from a given distance the price difference tends to decrease.

When interpreting the results, one should bear in mind the inherent limitations of database. The researchers do not know if there are other shops next to the analyzed supermarkets. Since competition is locally defined, the greater the distance between two stores, the higher the probability of existence of other stores, which compete with the analyzed supermarkets. Accordingly, two distant supermarkets may face competition from other stores and it can generate incentives for the convergence in prices.

Analyzing the same issue in another perspective, we estimate the price difference only as a function of distance (Table 5). We obtain evidence that the price difference is a quadratic function of distance. This result may be viewed in graph 5 which compares the average price difference and distance. [12]

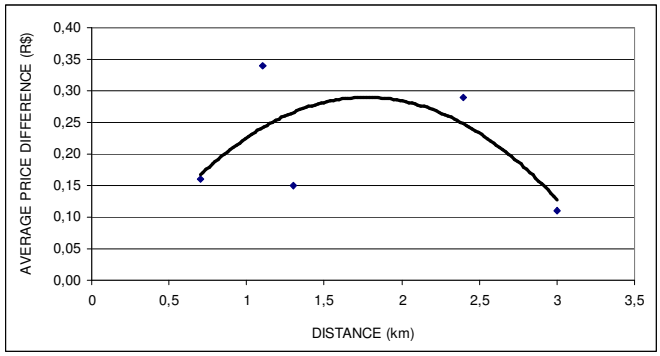
The fixed effects attempt to capture specific characteristics to each cross-section. The estimation suggests that fixed effects are positive to all districts, i.e. intrinsic elements to each pair of stores have a positive effect on price difference.

Table 5: Estimation – price difference as a function of distance

Dependent variable: Price difference Sample (adjusted): 04/2002 - 12/2006 Observations per unit of *cross-section*: 58 Total observations: 290 *(t –statistic)*	
distance	0,30 *(14,90) **
(distance)²	-0,085 *(-8,16) **
R²	0,1033
Standard Error of regression	0,2824
Sum squared resid	22,982
F-statistic	33,21
P(F-statistic)	0,00
* 5% significance	

[12] It is worth noting that although the analysis identifies a given behavior of the difference in prices, it is unknown if price series are actually higher in comparison to the level that would be reached under conditions of perfect competition.

Graph 5: Average price difference and distance



VI. CONCLUSIONS AND QUESTIONS FOR FURTHER RESEARCH

Great part of the economic literature supposes that the fast growth of big supermarket chains is unavoidably associated with market concentration and market power. Supermarket chains increase its market share *because* there is a reduction in the number of other retail formats – especially independent supermarkets and traditional stores. The main proposition of this research is that the consequences of the concentration process in food retail are complex and can result in huge heterogeneity of retail formats.

We first consider that hypermarkets and supermarkets compete in the attraction of consumers. Evidences for the municipal district of Sao Paulo, however, indicate that prices set by both types of stores do not establish long term equilibrium. This result suggests that retail formats compete in distinct markets. Such conclusion may perform potential impacts on antitrust analysis.

The investigation also reveals that chain supermarkets establish higher prices in comparison to independent stores. This result comes as a puzzle. Examining arguments that explain such price difference, we conclude that there is not a single factor that contributes to its determination. When analyzing data for the municipal district of Sao Paulo, we find that the distance between stores may play an important role in prices' dynamic.

In general, the analysis brings to light the complexity of competitive dynamics in food retail. Once the Brazilian retail sector is characterized as an oligopoly with competitive fringe (where the nucleus embodies big chains and the fringe is represented by traditional retail and independent supermarkets), the analysis emphasizes the *heterogeneity of the fringe*: while traditional retail establishes higher prices in comparison to that set by big chains, independent supermarkets establish smaller prices. Future research should explore this price diversity.

Looking for a more comprehensive view of retail competition, future research should also investigate the price behavior of a wider set of products, which could embody not just food products.

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APPENDIX: Unit Root Tests

	DICKEY – PANTULA			AUGMENTED DICKEY–FULLER		
Series	**1st Stage**	**2nd Stage**		**Model**	**Lags[1]**	**t-statistic**
		1° coeficient	**2° coeficient**			
HIPERMARKET	-5,06 *	-5,11 *	0,864	-	1	0,864
SUPERMARKET	-4,43 *	-4,55 *	1,04	-	1	1,043

* Rejection of Ho at the significance level of 5%.

[1] Schwarz Criterion for a maximum of 11 lags.

Dickey-Pantula Test

1st Stage refers to t-statistic associated to coefficient β1 of the equation:

$$\Delta^2 y_t = \beta_1 . \Delta\ y_{t-1} + \sum \Delta^2 y_{t-1} + e_t$$; et = white noise.

In relation to 2nd Stage, 1st coefficient and 2nd coefficient refer, respectively, to t-statistics of coefficients α1 and α2 of the equation:

$$\Delta^2 y_t = \alpha_1 . \Delta\ y_{t-1} + \alpha_2 . y_{t-1} + \sum \Delta^2 y_{t-1} + \mu_t$$; μt = white noise.