ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Market Concentration and Food Security in Developing Economies: Supermarket Power and Food Prices in the Brazilian State of Rio Grande do Sul

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ARTICLE INFO

Article history:
Received 12 March 2015
Accepted 28 April 2015
Available online 5 May 2015

Keywords:
Retail sector, Structural change, Concentration index, Price index.

ABSTRACT

Background: In developing countries, a reduction in food prices can promote food security. Conversely, market concentration may have negative impacts on the welfare of consumers, prompting questions about food markets, such as: what are the implications of retail market structures on the price of food? **Objective:** Analyze if the concentration of supermarket sector is associated with the fluctuation of food prices. **Results:** There was a decrease in concentration levels, based on the Herfindahl-Hirschman (HH) index and Concentration Ratio (CR). Even with this reduction, the supermarket sector in Rio Grande do Sul can still be regarded as an oligopoly, because the two largest companies in the supermarket sector earn more than 50% of total sector revenues. There was a positive correlation between market concentration and processed food prices, in which reduced concentration is associated prices reduction. There was a negative correlation for fresh food, which means that even when the market power of the largest companies in the supermarket sector was reduced, the price of that category of food increased or stayed the same. **Conclusion:** Although there is high concentration in the supermarket sector, there is still a lack of evidence that market power negatively affects food security.

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To Cite This Article: Dalla Corte, V.F. Oliveira, S. V. Dewes, H., Market concentration and food security in developing economies: supermarket power and food prices in the Brazilian state of Rio Grande do Sul. ***Aust. J. Basic & Appl. Sci.,*** *9(11): 1-7, 2015*

INTRODUCTION

The relationship established between companies and the institutional environment results in a number of consequences for social welfare, especially regarding health and nutrition. In this study, theoretical constructs were introduced that attempted to elucidate the market relationships and their impact on food security. Scientific research is presented on the market structures of sectors that impact specific areas of social and political development (Scoppola, 2007).

Moreover, in 2005, the Food and Agriculture Organization of the United Nations (FAO) announced a long-term trend in falling agricultural commodity prices and the imminent threat to food security in developing countries (FAO 2005). However, the observed increase in food prices from 2006 to 2008 and from 2010 to 2011 seems to contradict this assessment (Swinnen *et al.*, 2011), prompting new questions about food markets, such as: what is the relationship between retail market structures and the price of food?

The Brazilian supermarket sector underwent a concentration process in the 1990s, due to numerous mergers and acquisitions, the entry of large international corporations (such as the American Wal-Mart and the Portuguese company Jeronimo Martins), and the expansion of existing companies (Carrefour and Cia Brasileira de Distribuição).

The concentration process has caused the sector's market share to remain concentrated in a few companies, each one accounting for much of total sector revenue. According to the Brazilian Supermarket Association, there is a disparity between the type of food store and the share of total sector sales. Hypermarkets account for 6% of the total number of stores and 39% of sector revenues. Convenience stores (small markets) account for 29% of total stores, but only 1% of revenues. Supermarkets account for 65% of stores and 60% of revenues (ABRAS, 2011).

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The increased concentration in the retail food sector may have increased the market power of large networks. In turn, increased bargaining power can generate unwanted vertical impacts. Consequently, market concentration may have negatively affected the welfare of consumers, with an increase in prices resulting from oligopoly power.

This study aims to analyse the structure of the supermarket sector in the Brazilian state of Rio Grande do Sul, focusing mainly on market concentration during the period from 2002 to 2009, and to verify whether a linear relationship exists between market concentration and food prices. Therefore, the study seeks to address the question of how economic access to food, i.e. the extent to which low-income people have access to food, is influenced by the structural dynamics of the supermarket sector.

Retail sector and market structure in Brazil:

The forces of supply and demand result in price and quantity equilibriums in different markets. However, supply and demand have very different effects on each commercial arrangement, as each one has specific characteristics of product technology categories, access, information, taxation, regulation, participation and location in space and time that make it unique. Nevertheless, there are characteristics common to multiple market structures.

Market structures are models that capture the intrinsic aspects of how markets are organised. Every market structure emphasises certain essential aspects of the interaction of supply and demand and rests on certain assumptions and enhancement features that are observed in existing markets, such as the size of firms, product differentiation, market transparency, the objectives of the business and the access of new companies (Gremaud *et al*., 2003).

In this approach, the predominant market structure affects the performance and profitability of companies and the industry in which they operate. According to concepts derived from theories of Industrial Organization (IO), the more concentrated a market is, the greater the possibility of a tacit coalition between the companies for joint profit maximisation, resulting in monopolistic practices, which negatively impact society (Mason, 1939).

In general, the highest welfare gains to consumers come from competitive markets that enhance competition, particularly via price. Furthermore, the public has an incentive to favour the implementation of regulatory mechanisms that ensure free competition (Kuper and Hasenclever, 2002).

From an operational perspective, the market concentration can be evaluated through knowledge of the proportion of total production or sales earned by a limited number of companies operating in a particular industry. Therefore, the degree of concentration determines whether a particular industry is characterised as a monopoly or an oligopoly market (Gremaud *et al*., 2003).

By evaluating prominent Brazilian retail sector, it is possible see that the dynamics of the distribution sector have precipitated structural changes in the consolidation of modern retailing. These changes are the result of currency stability, openness of the economy and the new consumption habits of the population. The process is characterised by significant changes in the productive base, represented by the increased interdependence between segments and the high level of competitiveness within the sector (FGV, 2003).

In Brazil, prior to the 1970s, most retailing was handled by family-managed, small-scale, specialised food stores. Beginning in the 1970s, the trend toward supermarkets intensified in large cities, while small-scale stores prevailed in small towns. During the 1980s, supermarkets increased their presence in both large cities and small towns, though in small towns, most investment was still conducted by Brazilian companies and local entrepreneurs (Aguiar, 2009).

The flow of Foreign Direct Investment (FDI) in the retail sector increased substantially after 1994 when the Brazilian government developed an economic plan (Real Plan) combining inflation control and an opening of the domestic economy. Consequently, foreign retail chains began to enter the Brazilian market (Aguiar and Silva, 2002).

In short, the sharp changes that have occurred in retail organisation have affected market strategies and the performance of the Brazilian food system since the beginning of the 1990s. Market concentration and internationalisation have prompted changes not only in market configuration but also in the way the Brazilian food marketing system operates (Aguiar, 2009).

Accordingly, the retail sector in Brazil, especially the supermarket segment, displays a trend that is common in developed countries, wherein a few companies dominate the concentration of sales. Figure 1 displays the concentration of sales in the supermarket sector in the years 2003 and 2008. The sales of this sector amounted to approximately US$ 84 billion in 2008, with the 20 largest retailers earning 52% of total sales and the 50 largest earning 58% (ABRAS, 2009).

Miele *et al*. (2010) emphasise that the level of concentration in Brazil is relatively low compared to countries like France, Holland and Spain, where sales of the four largest retailers in 2008 accounted for 63%, 66% and 62%, respectively.

In 2010, supermarket sales totalled US$ 107 billion, accounting for 5.5% of Brazilian Gross Domestic Product (GDP) (ABRAS, 2011). It is observed that sales expanded by 7.7% in the period from 2009 to 2010; significant growth resulted from consumers' greater access to credit and the increased income of Brazilian workers (ABRAS, 2012).

Despite the increase in market concentration, Machado (2002) notes that the intense competition among retailers, new consumer behavioural habits and the adoption of new business strategies have caused an increase in sales of modern retail goods to the Brazilian population. Moreover, the strategies implemented to enable the sharing of business transaction risks with other agents and partners can ensure a central position for retailers to control their own supply chains.

Similarly, a study by the Fundação Getúlio Vargas (FGV, 2003) shows that the major networks segment experienced significant changes in recent decades and that the most important trends in retailing include equity restructuring, organisational innovations and automation technologies, which have resulted in a greater number of outlets and the expansion of stores with large sales areas. In short, it is expected that these companies' strategies will be based on offering high-quality goods while maintaining low operational costs and high labour productivity levels.

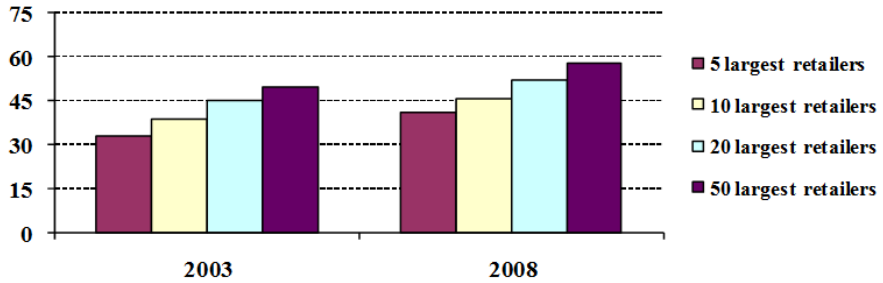

Fig. 1: Concentration of sales in the Brazilian supermarket sector (in %) for the 5, 10, 20 and 50 largest retailers (ABRAS 2011).

Aguiar (2009) suggests that Brazilian retailers have not raised prices, despite the high level of market concentration. However, using less aggregated performance indicators, Cunha and

Machado (2003) verified that after an increase in retail concentration in Belo Horizonte (the state capital of Minas Gerais and sixth largest city in Brazil), prices in the largest supermarket chains were higher than the prices charged by middle- and small-sized supermarkets.

Thus, this research will analyse the associations between market concentration and prices in Rio Grande do Sul, which has one of the four largest state GDPs in Brazil and more than 10 million inhabitants.

Data and Methods:

The structure of the retail sector was evaluated according to market concentration. The data used in the analysis were obtained from reports of the Brazilian Association of Supermarkets (ABRAS) and the Gaucho Association of Supermarkets (AGAS). From these data, the Concentration Ratio (CR) and Herfindahl-Hirschman (HH) indices were calculated and compared to total revenues of companies in the period from 2002 to 2009.

The measurement of concentration provides the empirical evidence necessary for assessing the status of competition in a market; it is also used for intertemporal comparisons that allow us to examine the supply-side market dynamics. Kon (1994) argues that the most commonly used measures are the CR and HH. The CR measures the proportion of industry ownership of the k largest firms, taking the chosen indicator as basis. The CR calculation is given by Equation 1:

$$CR(k) = \sum_{i=1}^{k} Pi \quad (1)$$

Where:

k = number of major companies that are part of the calculation

Pi = percentage share of the i company in the market

This measure is easy to interpret and indicates the market share (concentration) of the k largest companies that compose the industry, the maximum being 100% (monopoly). The HH index is defined as the sum of the squares of the percentage shares of each company in relation to the total size of the industry. This index considers all businesses in the industry and is calculated as shown below given by Equation 2:

$$HH = \sum_{i=1}^{n} Pi^2 \quad (2)$$

Where:

n: number of firms in the industry and market participants

Pi: percentage share of the i company in the market

This index takes the maximum value of 10,000 (if Pi is in %) where there is only one company in the industry (monopoly). The index assumes its lowest value (10,000 / n) when firms have equal participation in the market. The value of HH increases as the gap between the companies within the industry rises, thus presenting a good indicator of the market situation. It should be noted that firm size is considered by squaring Pi, such that smaller companies contribute less in proportion to the value of the index. Thus, the higher the index, the more

concentrated the market, implying less competition between companies.

Regarding market concentration, the criterion adopted by the United States Department of Justice (USDOJ, 1997) is that the market is not concentrated when the index value is below HH 1,000; it has moderate concentration between 1,000 and 1800, and is highly concentrated when it reaches a value exceeding 1,800.

The association between the degree of concentration and food prices was calculated using the correlation between the structure and the price index, released by the Center for Economic Studies and Research (IEPE, 2011). The total value (ALIMENT) and its divisions by food category were considered for the calculations. Categories included manufactured (IND - wheat flour, biscuits, ham, sugar, and others), semi-finished (SEMI - meats, whole milk and others) and fresh products (IN NAT - potato, onion, tomato and others).

Whereas the data used in this paper correspond to numerical variables, the statistics can be used to verify whether an association between the variables exists. To measure this association, the correlation coefficient, which measures the degree of covariation between two variables, was calculated. The degree of association varied in a range of $-1 \leq r \leq 1$. Large coefficients indicate a high covariation and a strong relationship, while values close to zero indicate a weak correlation.

As the method allows for the analysis of numerical variables, the calculation of the correlation coefficient was the method chosen to make the necessary inferences pertaining to the present study. The SPSS software was used for the correlation coefficient calculations, which showed the statistical significance or non-significance of the analysed variables. According to Hair *et al*. (2005), the significance is the probability of rejecting the null hypothesis when it is true. In this work, the probability considered to be statistically significant was <0.05, which means that there are fewer than 5 chances in 100 of rejecting a true null hypothesis.

Concentration of supermarket sector and food prices:

An analysis of the indicators shows that the two largest companies control an extensive portion of the retail sector. In 2009, despite a negative trend, the companies held 50% of total revenues in the regional supermarket sector (CR2 of approximately 50% - Figure 2). The largest company has 32.9% of the market share, and the second-largest owns 17.8%. Adding two more companies to the calculation of the concentration ratio (CR4), it is observed that the market share of these four largest firms is above 60% from 2002 to 2009.

Based on the results, the CR8 (the eight largest companies) was demonstrated to have captured approximately 70% of total revenues in this sector. The HH index was used as a complementary method to determine sector concentration, and the results can be observed in Figure 3.

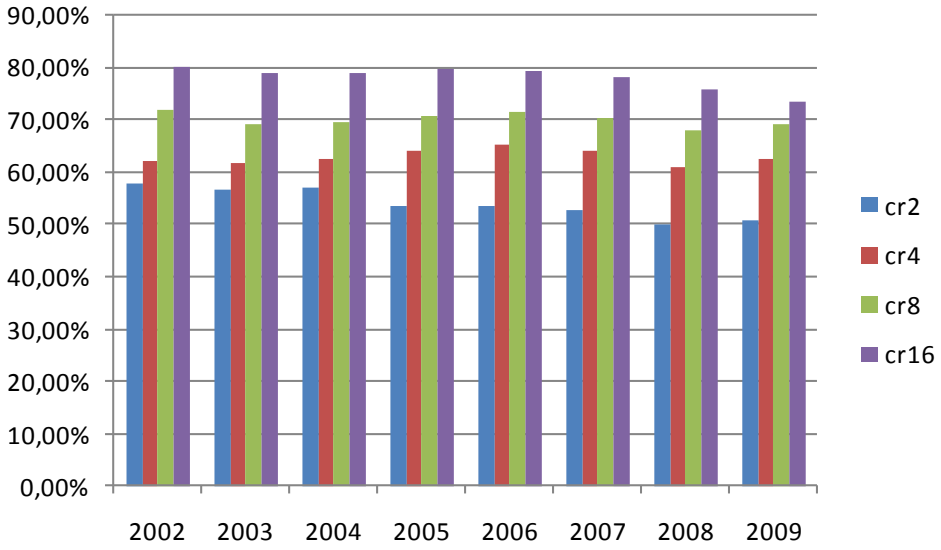

Fig. 2: Concentration Ratio (CR)* of supermarket-sector companies.
*Note: % of the revenues of the two (CR2), four (CR4), eight (CR8) and sixteen (CR16) largest companies in terms of total revenues in the retail sector. The higher the value, the more concentrated is the market.

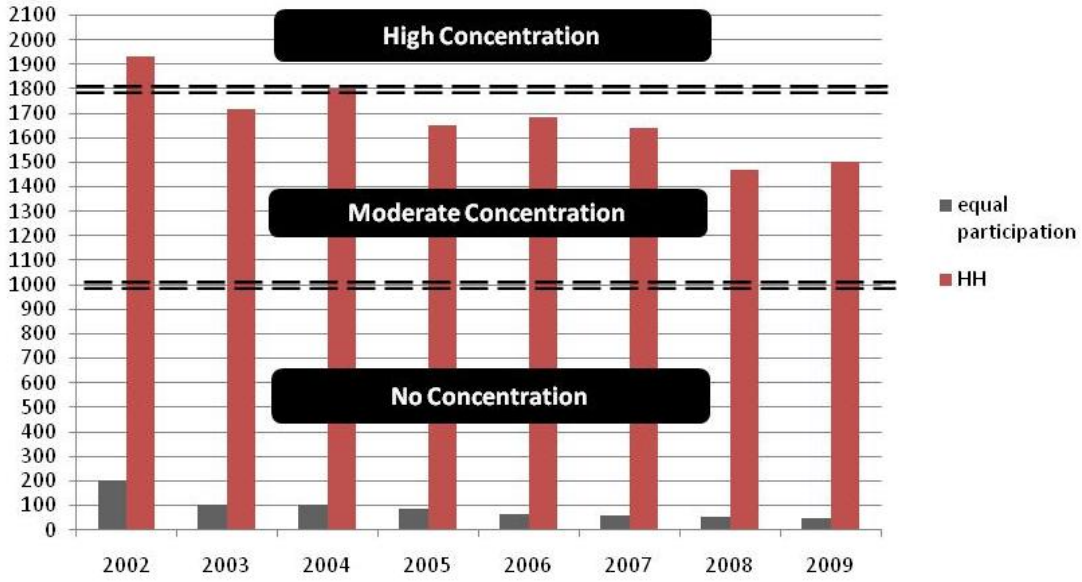

Fig. 3: Herfindahl-Hirschman (HH)* concentration index of the supermarket sector.
*Note: HH measures the concentration of the market considering all companies in the sector; higher values indicate more concentrated markets.

When considering the market shares of all companies, a reduction in concentration levels (from a high concentration to a moderate concentration according to the criteria of USDOJ, 1997) is observed despite the high levels of CR2 concentration. The index values for HH also showed far from equal participation in the market. However, both indexes revealed a decrease in concentration levels during the final years of the study.

To verify whether the price of food is associated with oscillations in supermarket sector concentration, the test of correlation was made between market concentration and the consumer price index, prepared by the Centre Studies and Economic Research (IEPE, 2011), according to Table 1, which presents the correlation values.

Table 1: Association between concentration and food prices (the higher the value the greater the association).

	cr2	cr4	cr8	cr16	HH	ALIMENT	IND	SEMI	IN NAT
cr2	1,000								
cr4	-0,140	1,000							
cr8	0,410	0,616	1,000						
cr16	0,762	0,435	0,813	1,000					
HH	0,945	-0,010	0,638	0,817	1,000				
ALIMENT[1]	0,174	-0,467	0,223	-0,056	0,353	1,000			
IND[2]	0,407	0,346	0,472	0,263	**0,596****	0,934	1,000		
SEMI[3]	-0,067	-0,348	0,079	-0,281	0,088	0,889	0,735	1,000	
IN NAT[4]	-0,163	-0,610	-0,319	-0,490	**-0,684****	0,691	0,456	0,577	1,000

Note:
**Statistically significant at the 0.05 level and representative for the study
1ALIMENT-the total value of the index without divisions by food categories
2IND- processed products (flour, biscuits, ham, sugar and others)
3 SEMI-semi-finished products (meat, milk, natural and others)
4INNAT-fresh products (potato, onion, tomato and others)

Significant positive associations occurred between changes in the HH rate and fluctuations in food prices. A reduction in the concentration of the supermarket sector was associated with a reduction in the prices of processed foods (IND). For fresh food (IN NAT), there is a negative association between concentration and food prices, i.e. a reduction in concentration is not associated with a reduction in price. This phenomenon might be related to the specific nature of fresh food, which is produced seasonally and has display and storage restrictions because of its perishability.

Conclusions:

Based on the analysis, retailers have not exerted market power in Rio Grande do Sul, despite the high

level of market concentration. In addition, there was a decrease in concentration levels over time, based on the Herfindahl-Hirschman index and Concentration Ratio. Even with this decrease, the supermarket sector in Rio Grande do Sul can still be regarded as an oligopoly, because the two largest companies hold more than 50% of total sector revenues. By linking market concentration to the total price index, no statistically significant association was shown. However, when market concentration was correlated with specific categories of food, major differences were observed between the concentration and the price of processed and fresh products.

Although we have not detected causal effects between the level of market concentration (CR) and price level, the linear association can indicate the existence of positive relations between processed food prices and sector concentration (HH – when all the companies are involved in the analysis). For processed foods, there was a positive association between a reduction of the HH index and a decrease in prices. For fresh food, the correlation is negative, which means that even when the largest companies in the supermarket sector experienced reduced market power, the price of fresh food remained the same or even increased. Accordingly, it is possible that the determinate of fresh food prices does not depend on market structure, but rather on factors that are directly associated with agriculture supply, climate and other considerations.

In developing countries, a reduction in food prices can promote food security. In the case of Brazil, food expenditures totalled 27.8% of the income of individuals earning less than US$ 442 per month, which represent 39.4% of the population (IBGE, 2011). Thus, actions should be taken that would allow greater economic access to food markets, which would help minimise the food insecurity.

While there is high retail concentration in the food market, the negative effects of market power on food security are not verifiable. Even though further tests are needed to support the causality between market concentration in retail and food prices, an increase in competition among the food industries is observed, which may result in the decrease of prices, thereby generating greater food security.

ACKNOWLEDGMENT

This research was supported by: Fundação Meridional.

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