Oligopolistic behavior of Brazilian Gas Stations

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Resumo

Este artigo propõe analisar a competição no mercado de combustíveis (gasolina) no Brasil partindo da hipótese de que uma menor dispersão dos preços de combustíveis dos postos de um município, associada à maior margem bruta dos mesmos, é indício de práticas anticompetitivas, isto é, de formação de cartéis. Essa relação foi estudada tanto em nível nacional como em nível regional. Comprovada esta relação, e dada à estrutura vertical de contratos estabelecidos entre distribuidores e revendedores de gasolina, investiga-se detalhadamente, a relação entre a lucratividade dos postos e suas características, entre elas: tipo de bandeira; dados referentes à localização (vias principais, com proximidade de concorrentes, etc); e prestação de outros serviços (lojas de conveniência). Os resultados indicam que margens maiores (lucros) estão associadas a postos localizados próximos a supermercados, com lojas de conveniência e estacionamentos. Margens menores foram encontradas para postos de bandeira branca.

Palavras-chave: gasolina, margem, dispersão de preços, cartel.

Abstract

The goal of this paper is to examine the competition in the fuel market in Brazil based on the assumption that the lower dispersion on fuels prices, together with higher gross margin, is evidence of anti-competitive practices, i.e. formation of cartels. Shown this relationship, and given the vertical structure of contracts between wholesaler and retailers of gasoline, we investigate the relationship between the profitability of gas stations and their characteristics, including, among other variables, brand; location (if in large avenues, proximity of competitors, etc.); provision of other services (convenience stores, etc). The results showed that unbranded stations tend to present lower margins, proximity to supermarkets, the existence of convenience stores and parking lot tend increase the margins. The results also showed that the price dispersion is related to the distance from the capital and the seller’s density.

Key words: fuel market, price dispersion, cartel.
1. Introduction

In Brazil, even in the big cities, with large number of competitors, gas station owner and their unions are frequent targets of investigations of cartels practices. In the Secretariat of Economic Rights (Secretaria de Direito Econômico - SDE), of the Ministry of Justice, the reports of cartel behavior in the fuel retail market are responsible for a third of the total complaints received, with current inquiries of approximately 130 processes of cartels practices by gas stations (www.mj.gov.br/sde/). Since 2006, SDE has incorporated an economic methodology, developed by the SEAE (Secretaria de Acompanhamento Econômico), to identify if there a cartel is acting in a specific market, and takes a closer look only after observing: (i) the time evolution of the retail’s margins at the county level; (ii) the correlation between the retail’s margins and the variability of the retail’s prices; and (iii) the correlation between the county and state margins.

Examples of such cartels are those of João Pessoa-Recife and Londrina. In the first case, in May of 2007, SDE, in cooperation with the SEAE, Federal Police and Ministério Público, deployed a joint operation in these two cities (João Pessoa and Recife) to obtain evidences of cartel formation in the retail fuel market. In August of 2007, it was Londrina’s turn, with the coordinated action of the SDE, SEAE and State Law Enforcement making it possible to collect evidence against the cartel acting in the region.

Another known example is the one Lajes (SC), the "Cartel of Lajes", which it was characterized by an organization formed by several gas stations acting to defraud the market through the setting of the fuels prices with the aid, and coordination, of the SINDIPETRO/SC (Union of the Retailing of Oil Derivatives). CADE points out this case as emblematic, since it confirms the importance of the partnership between the CADE and the Ministério Público in defense of the economic order, already observed in other cases such as "Cartel of the gas station of Florianópolis" and "The gas station’s cartel of Belo Horizonte".

The goal of this paper is to exam the existence of factors that would indicate the use of anti-competitive practices in the Brazilian fuel (gasoline) market. In particular, we are concerned with the relationship between retail margins and price dispersion and also, with the impact of unbranded retailers (those without an exclusive contract with a specific distributor) and retail margins. A negative relationship between retail margins and price dispersion can be
an indication of anti-competitive: station would collude to reduce competition, set prices and increase margins.¹

Such behavior does not, however, guarantees the causality of the dispersion on the profitability. A investigation in more details of the profitability by gas station, with individual data on its characteristics, including, variables on localization (main avenue, proximity of competitors, etc.), existence of other services (convenience store, etc.), allows us to take a better look at the effect of the vertical contracts on the profits, in same line of that made Shepard (1993).²

The remaining of this paper is divided four sections. Section 2, a reviews some recent paper written about the topic for the Brazilian market; section 3 displays a description of the vertical contractual structure and its effect on prices and profits in the gasoline market; section 4 presents the data, the econometric approach and the results; the final section presents the main conclusions.

2. A quick review of the literature in Brazil

Although a strong topic of among those who own a car a must pay for the fuel and among the regulatory authorities, studies on price formation and cartel behavior a quit rare in Brazil.³ Marjotta-Maistro (2002), for instance, analyzes the fuel market in the years of 1995 to 2000. The author concludes that, for the analyzed period, the fuel sector still operated under the protection of the State, closely to what happened during the 1990’s. At that time, the government still tended to absorb the external shocks, preventing those to reach the market.⁴

With a different approach, using game theory, Pinto and Silva (2004) studied the role and behavior of unbranded gas stations (retailers without an exclusive contract with a particular distributor) on the prices and quantities of the fuel market. The authors elaborate a model that took under consideration the relationship between the distributors (upstream) and retailer (downstream). Their main hypothesis was the existence of a partial vertical integration so that the branded gas stations were integrated with distributors, via contracts, while the

¹ Barron et al (2004) argues that the prices dispersion can be associated with the number of competitors in the gasoline market and the results of its study suggested that the larger the density of gas stations (number of competitors inside of a certain area) the smaller must be the prices dispersion.
² Shepard, considering the vertical integration in the fuel market of the United States, suggests that the prices retail (of the gas stations) depend on the contractual form between refiner and the station, which, in turn, is function of the characteristics of the gas stations.
³ One of the problems in this line of studies is the lack of recent and available data that would allow such studies. In the last years the some data have been made available by the Agência Nacional do Petróleo (ANP), at its website: www.anp.gov.br
⁴ Petrobrás still plays a role similar to that by “controlling” prices as the recent events have shown: international oil price when up from US 60,00 to US$ 130,00 a barrel during the first half of 2008, but the wholesale prices, mostly determined by Petrobrás, did not change during this period in Brazil.
unbranded ones remained not integrated. One of their main conclusions was that the existence of unbranded gas stations promotes, in equilibrium, lower optimal prices and larger fuel supply.

Another interesting contribution it is offered by of the paper by Nunes and Gomes (2005). In their work, they analyzed the competition in the retail fuel market for the State of São Paulo. Their basic hypothesis is that a negative relationship between price dispersion within the cities and retail’s margins would imply the use of anti-competitive practices by the sector. They found evidence of such relationship for São Paulo. The paper also uses a Logit Multinominal Model to verify role unbranded gas station on level and its variability of retail price. Their results suggested that the presence of these unbranded stations implied more competition. They concluded that the smaller the participation of unbranded gas station – indicating concentration of gas station related to some distributor brand – the smaller the variation of the margins and prices and, thus, the greater is the indication of anti-competitive practices.

In the next section we take a look at the relationship between distributors and gas stations and its possible effect on retail price and margins.

3. Vertical relation in the retail gasoline market and its possible effects

This section mainly is based on the article by Shepard (1993) which presents a vertical structure in a retail market as characterized by a principal-agent problem with the manager of a gasoline station, that sells gasoline to the final consumer, as the agent and the refiner (or distributor - such as Mobil or Shell, for example), offering gasoline to the stations (as the principal). Shepard analyzes the effects of this structure on the behavior of the managers and on the retail prices.

The starting point is the observation that the gas station in itself is a good where both parts, distributors and managers (owner), can make some investment. The contract that rules the relationship between the principal and the agent specifies how the investment is divided and how the gas station is managed. In the general, the distributor makes the initial investment; it has the initial control of the good, and designs a contract. In the United States, the majority of the stations are constructed by a distributor who chooses the localization, the sales capacity, and the services to be offered (for example, convenience store or car wash). From there, the distributor elaborates the contract making a “take it or leave it” type of offer for potentials managers. Given the characteristics imposed in the contract, and stations

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5 In this paper, we follow the same logic to look at the national and regional markets.
characteristics, the manager chooses the retail price and the level of effort to maximize its profit.

The final demand for the product of the station (gasoline and other products and services) is assumed to be increasing with the quality the decreasing and with the price. As the effort to run the station is costly to the manager, in general, he/she does not choose the optimal level from the point of view of the distributor, if he/she is not subjected to contractual restriction that stimulates him/her in such a way. The purpose of the vertical contract is to induce the manager to make the preferred choices, from the distributors’ point of view, either by the direct specification of the product or through incentives that align their interests.6

The contractual problem of the distributor is complicated by the limitations of how the downstream choices can be included in the contract. The effort of the manager may not be subject to direct control because it is not observable.

Shepard (1993) presents the three possible forms of contracts between refiner (or distributor) and gasoline stations for the United States:

a) Company-owned, Company-operated. A station run under this type of contract is owned by the distributor and the manager is an employee. All control placed on the manager is typical of the employer-employee standard relationship. This is the only type of contract which the distributor is allowed to impose the retail price.

b) Company-owned, Dealer-operated. In a contract like this the distributor owns the station and makes most of the investments, but the manager is self-employed. The distributor establishes the wholesale price and an annual rent. The type of rent varies with the distributor, but he will try to establish a tax that is proportional to the net income that the station can generate. The contracts can, for example, specify schedule of operation, define that type of products and services that can be sold, besides gasoline, and still require that the manager spends a certain amount of time at the station. The typical contract also specifies a minimum volume of gasoline that the manager must acquire.

c) Dealer-owned, Dealer-operated. In this in case, the distributor does not make any investment in the station. The distributor controls the wholesale price, but he does not charge a rent or a tax. The decisions on quality of the service and the retail price are exclusive of the manager. The only substantive restriction to the behavior of the manager is with respect to the

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6 Brickley and Dark (1987) looked at the effect of monitoring of costs and investments in reputation in the decision by an upstream firm to operate a downstream firm as a franchise unit instead of one of their own. They found patterns consistent companies saving in monitoring costs in units with difficult access. Lafontaine (1992) and Norton (1988) also had reported results suggesting that the monitoring costs and moral hazard affect the choice between opening a new unit and using a franchisee.
quality of the product and the brand, if the dealer chooses to carry a brand. For instance, managers cannot sell gasoline supplied by another refiner in pumps identified with the distributor (for instance, cannot sell Texaco on pumps identified as Shell).\footnote{This is especially hard and costly to monitor and it tends to happen frequently, at least in Brazil.} If the dealer decides to run an unbranded station, he/she can by gasoline from any distributor or refiner he chooses. As in the case presented in b), these contracts frequently include a minimum volume of gasoline to be acquired by the station.

According to Serebrisky (2001), for the retail fuel market in Brazil, the two last forms are the most common ones. However, the Law nº 9478/1997 and the ANP (Agência Nacional do Petróleo) decree nº 116/2000 which deal with the separation, recently occurred, of the activities of distribution and retail, forbids the refiner and distributor to act directly as retailers, but allow them to own a station, thus allowing the first type of contract, with the station as a property of the distributor but managed by a employee (a manager).

The vertical relationship described above, and the types of contracts presented, can induce different effects on the behavior of the station managers, which can also affect the retail prices (prices to the consumer) and the station profits.

In principle, the prices can be higher or lower in the case of stations owned by the distributors, but the requirement of minimum amounts of gasoline acquired by stations defined by contracts of type b) and c) suggests that the prices, when there are volume restrictions, could be lower in stations owned by refiners. Barron and Umbeck (1984) found evidence that a small sample of refiner owned stations charged lower prices in relation the stations managed by other contract forms.

It is worth noting that the imposition of a minimum volume of purchase in contracts between distributor and dealer (either type b or c above) imposes some limits on the station retail prices policies, but it is not a perfect substitute for the direct determination of the prices by the distributor (that can occur in type a contract). The imposed volumes are, in general, determined for long periods of time and they are not usually adjusted for variations on demand or supply conditions. In this sense, the imposed limits must be low enough in order to guarantee that the stations will able to satisfy them under a wide rage of situations, so that, it is not very likely that these restrictions, by themselves, are capable of equating the retail prices, and profits, of the stations run under the three types of contracts. In other words, the profits (margins) can differ for the three types of contracts.
Perhaps, the main factor that influences the retail prices, and profits, of the gas stations is the distributor wholesale price. In a typical franchise solution, the distributor could establish the wholesale price equal its marginal cost and extract income from the station through the annual rent. However, for the unbranded stations (whose contracts deal only with the price of the gasoline with no franchise of annual fees) the distributor could charge a non linear wholesale price that would have the same effect. Still, differently of the annual fees, the wholesale prices can be frequently adjusted. Evidently, establishing a different wholesale price for each station, i.e., defining thousands of non linear schemes is sufficiently costly and demands detailed information on the stations.

Summing up, if prices policies and volumes impositions are sufficient instruments to control the retail price, consumer prices become not related the contractual form. If this is not the case, prices in stations owned the distributors, that is, branded stations, will tend to be lower.

However, this advantage on price can be compensated by effect stemming from efforts applied by the stations’ managers. There are evident differences among the three types of contracts described above with respect to directly controlling the effort managers and providing incentives related to performance. The amount of effort controlled by the distributors is higher in the stations that they own than in those owned by the dealers. On the other hand, incentives related to the performance, designed to induce more effort by the stations’ manager, work better for contracts of type b and c. To compensate for such fact, some distributors include wage incentives for the managers of the stations they own, tied to managers’ effort. The moral hazard problem here, typical principal-agent of relationship, is how to verify the manager’s level of effort.

Thus, distributors tend to prefer contracts type b or c when maintaining a desirable level of effort by the manager is more difficult and costly. When the manager efforts increase the demand for gasoline, stations with contracts b or c are able to increase their margins (difference between retail and wholesale price) over extra volume sold. Thus, the margins for the independent stations, branded or unbranded, tend to be higher than the margins of the “company-owned, company-operated” stations, when it is difficult to observe the effort level.

Considering the differences between the branded and unbranded, Lewis (2006) notes that the unbranded stations are free to buy fuel from of any distributor and would suffer little influence from the latter in the moment of establishing a retail price and, consequently, defining its margins. This means that they could always bid for the lowest price, regardless of a distributor brand. As already pointed, Pinto and Silva (2004) model suggests that that the
existence of unbranded gas stations promotes, in equilibrium, lower retail prices. This means that the final effect of unbranded station over commercialization margins could be either positive or negative. They will usually charge a lower retail price, what would reduce their margins, but they can bid for lower prices among distributors, what would have a positive effect on their margins. If one believes, as it seems possible, that they have a limited strength over the distributor, the final result would be that the reductions on the retail prices would greater than the discounts they could obtained from the distributor, and the margins for the branded stations would be smaller than that from the branded stations.

3.1 Gas station characteristics and retail prices

Other characteristics can play an important role in determining the retail price and margin, besides the type of contract between the distributor and gas stations. Lewis (2006) points out that the prices charged by the gas stations, and consequently its margins, may be related to the existence of “amenities” (services) in the station, such as convenience store, free parking lots and restaurants. According to Lewis, these “amenities” could make consumers willing to pay more for the fuel. If this is the case, one could expect that the profits derived from gasoline sales will be lower for stations that do not offer complementary services (stations could charge more for the gasoline in the presence of “amenities” than otherwise, and they would pay the same wholesale price as the other independent station). Other characteristics, such as localization of the station in street of intense movement and the presence of close competitors can also play a part in determining stations’ prices.

Next section deals with the empirical work of this paper. The main goal is to check for the indication of anti-competitive behavior in the Brazilian gasoline retail market.

4. Econometric approach and some initial results

The econometric section of this paper is divided in three basic parts: a) first, using aggregated data, we test for the existence of a relationship between margins and industry concentration; b) then, by looking at data at the gas station level, we try to identify which are the main determinates of the margins, with special attention to the presence and importance of unbranded gas station; c) Finally, we look at some of the variables that affect price dispersion.

4.1 Margins versus market concentration

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8 Another issue that can influence profits of the Brazilian stations is related to the capacity in promoting irregularities, such as the use adulterated gasoline and taxes evasions. Unbranded stations are not subjected to the same control level as the branded ones and present higher propensity to act in such way.
Our first step was to estimate an equation of margin (defined as the difference between the retail price and wholesale price divided by the wholesale price), using as explanatory variable an indicator of price dispersion (coefficient of variation = standard deviation of the retail price divided by the average retail price of gasoline) as shown by equation (1):

\[ \text{Marg}_{it} = \alpha + \beta CV_{it} + \varepsilon_{it} \] (1)

The basic idea here is that if the stations are behaving in an anti-competitive way, i.e. in collusion, one should find a negative relationship between margins and price dispersion. The negative sign for \( \beta \) in equation (1) would mean that the margins would be higher where the price dispersion is lower. In this scenario agents would have a clear incentive to collude (Nunes and Gomes, 2005).

Equation (1) was estimated using a panel data on the average retail margin of gasoline and the dispersion of retail price of gasoline of 555 Brazilian cities, covering the period of January of 2007 to April of 2008. These data were made available by the ANP. The variable \( \text{Marg} \) indicates the margin of commercialization of the gasoline in city \( i \) in date \( t \). The measure of dispersion is represented by \( CV \), the coefficient of variation of the retail price for the gasoline in city \( i \) and month \( t \). Equation (1) was estimated in logarithms.\(^9\)

Table 1 below reports the results of equation (1). The results point to a statistically significant relation between average margin within the cities and price dispersion of gasoline in local retail gasoline markets. The negative signal of the estimated parameter suggests, clearly, that in cities where there is lower dispersion in prices the gas stations practice a higher margin. The same is also observed when the data are disaggregated by region. It is worth noting the similarity among the estimated values for North, Northeast, Southeast and South regions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Brazil</th>
<th>North</th>
<th>Northeast</th>
<th>Southeast</th>
<th>South</th>
<th>Center-West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price dispersion</td>
<td>-0.11515*</td>
<td>-0.10200*</td>
<td>-0.1037*</td>
<td>-0.1165*</td>
<td>-0.1135*</td>
<td>-0.1880*</td>
</tr>
<tr>
<td></td>
<td>(-31.55)</td>
<td>(-9.13)</td>
<td>(-17.47)</td>
<td>(-19.39)</td>
<td>(-12.99)</td>
<td>(-12.45)</td>
</tr>
<tr>
<td>( N )</td>
<td>8404</td>
<td>699</td>
<td>1924</td>
<td>3789</td>
<td>1438</td>
<td>426</td>
</tr>
<tr>
<td>( F )</td>
<td>995.48</td>
<td>83.36</td>
<td>305.20</td>
<td>376.12</td>
<td>168.66</td>
<td>155.00</td>
</tr>
<tr>
<td>( P )</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

*Statistics in parenthesis.
* Significant at 5% ** significant at 10%

4.2 Margins determinants

\(^9\) The Hausman test indicated that a fixed effect most is more appropriate to the data.
We now try to look at the main determinants of the margins for gas station, with special attention the type of relationship between the gas station and the distributors (branded versus unbranded gas station). As discussed above, theory would predict that the unbranded gas stations would have incentives to lower the price and increase competition. As argued before (section 3), their final impact on commercialization margins would be negative, i.e. unbranded station would present lower margins.\textsuperscript{10}

However, as point in section 3 above, margins can also be associated with other factors. In line with of arguments of Shepard (1993) and Lewis (2006), gasoline retail prices and, thus, their margins, can be related with location variables, existence of “amenities” in the station and the number of competitors. In addition, the operational costs, represented, for instance, by the number of employees, could influence the definition of the final price. All these characteristics are taken into account in the analysis of this section.

The data used to estimate equation (1) does not allows us to capture all these elements that perhaps influence the retail price. To take in to account the influence of gas station heterogeneity on the commercialization margins, one need to look at the behavior of the margins at the gas station level. Here, we address this issue by using a database that contains information on 4.070 stations located in 427 Brazilian cities, for the year of 2003. The data contain information on the type station (branded or unbranded), location, services offered, number of employees, among other characteristics.\textsuperscript{11}

The way the section is organized is the following: we start with a basic equation, equation (2), and then we added other characteristics that could influence the margins. The goal here is to verify how robust the initial results are to the presence of other important explanatory variables. Equations (2) through (6) are given by:

\[
Marg_i = \alpha + \beta_1 UN_i + \beta_2 FNC_i + \beta_3 CV + \varepsilon_i
\]  
(2)

\[
Marg_i = \alpha + \beta_1 UN_i + \beta_2 FNC_i + \beta_3 CNC1_i + \beta_4 CNC2_i + \beta_5 LOC_i + \beta_6 CV + \varepsilon_i
\]  
(3)

\[
Marg_i = \alpha + \beta_1 UN_i + \beta_2 FNC_i + \beta_3 CNC1_i + \beta_4 CNC2_i + \beta_5 LOC_i + \beta_6 CNV_i + \beta_7 PL_i + \beta_8 RST_i + \beta_9 CV + \varepsilon_i
\]  
(4)

\textsuperscript{10} We could not clearly differentiate between the three types of contracts described in section 3 (a, b and c), since we do not have information on how owns the station. We only have information on the fact that the station is branded or unbranded. All the unbranded stations are of type c contract, but the branded ones could be of any of the three types.

\textsuperscript{11} These data were used to re-estimate equation (1). The results were similar to those presented at table 1 and are presented at the end of this paper.
The costs, represented here by equation (2), are given by:

\[
Marg_i = \alpha + \beta_1UN_i + \beta_2FNC_i + \beta_3CNC1_i + \beta_4CNC2_i + \beta_5LOC_i + \beta_6CNV_i + \\
\beta_7EST_i + \beta_8RST_i + \beta_9SHP_i + \beta_{10}SUP_i + \beta_{11}CV + \varepsilon_i
\]

where \( Marg_i \) is the commercialization margin of gas station \( i \); \( UN_i \) is a dummy variable that indicates if the station is associated to some major distributor (equals to 1 if unbranded); \( FNC_i \) is the number of employees of station \( i \); \( CNC1_i \) is the number of competitors within a 2km radius from station \( i \); \( CNC2_i \) is a dummy variable that indicates if it is possible to see other competitors from station \( i \); \( LOC_i \) is a dummy variable that indicates if the station is located in a main avenue; \( CNV_i \) is a dummy variable equals to 1 if there is a convenience store at gas station \( i \); \( PL_i \) is a dummy variable equals to 1 if there is a parking lot at station \( i \); \( RST_i \) is a dummy for the presence of a restaurant at station \( i \); \( SHP_i \) indicates if station \( i \) is close to a mall; \( SUP_i \) is a dummy that takes the value of 1 if the gas station is close to a supermarket; \( RD \) are regional dummies; and \( CV \) is the coefficient of variation for the retail price of gasoline in a given city.

Then, equations (2) through (6) explore the relation between the gas station price margins and its characteristics. The average coefficient of variation for the city was added in every equation as measured of local price dispersion. The variables are all logarithms form. Table 2 reports the results.

As mentioned above, equation (2) is the basic set up. It considers the relationship between the margin and the fact that the station is branded or unbranded. The results suggest that the unbranded gas stations present a margin, on average, 10% lower than the branded ones, as one would expect. The costs, represented here by the number of employees, do not seem to be relevant to explain the margins. With respect to the parameter of the variable of price dispersion, it is statistically significant and with a value close to the one found equation (1).

In equation (3), three variables were added: competition 1 (CNC1), Competition 2 (CNC2) and the variable Location (LOC). The results of equation (3) corroborate the findings of equation (2), showing that even taking into account these new variables, the coefficients for unbranded and the price dispersion remain significant. Yet, it is possible to observe that the number of close competitors has a negative effect on the margins. However, having a competitor close enough so that consumers can easily see it does not seem to affect the
margins. The location dummy indicates that gas station located in main avenues present a 6.4% higher margin than those located outside of these corridors.

Equation (4) allows us to analyze how the convenience stores, restaurants and parking lots influences the margins of commercialization. The results show that gas stations with convenience stores and parking practice margins that are 7.1% and 4.2% superiors to those that do not offer these type of services. Restaurants, on other hand, do not seem to make any difference for the margins. Finally, it is worth noting the stability of the results of the variables unbranded, competition, location and price dispersion when compared with the results of equation (3).

Equation (5) adds variables that indicate the proximity to mall and/or commercial centers and supermarkets. The results show that gas stations close supermarkets have, on average, a margin 4.6% higher than other stations. However, being close to commercial center has a negative effect on the margins (-5.6%).

Table 2: Results of equations (2) through (6)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Equation (2)</th>
<th>Equation (3)</th>
<th>Equation (4)</th>
<th>Equation (5)</th>
<th>Equation (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbranded</td>
<td>-0.09522* (-5.04)</td>
<td>-0.09618* (-5.11)</td>
<td>-0.09668* (-5.11)</td>
<td>-0.09754* (-5.22)</td>
<td>-0.12287* (-8.9)</td>
</tr>
<tr>
<td>N° of employees</td>
<td>0.00201 (0.15)</td>
<td>0.0032063 (0.24)</td>
<td>0.00007 (0.01)</td>
<td>0.0017945 (0.13)</td>
<td>-0.0076709 (0.60)</td>
</tr>
<tr>
<td>Competition 1 (# of competitors)</td>
<td>* (-3.88)</td>
<td>-0.0422* (-4.29)</td>
<td>-0.0465* (-4.18)</td>
<td>-0.04516* (-4.18)</td>
<td>-0.04844* (-4.71)</td>
</tr>
<tr>
<td>Competition 2 (Dummy)</td>
<td>* (-0.41)</td>
<td>-0.00699 (-0.07)</td>
<td>0.00115 (0.07)</td>
<td>0.001102 (0.07)</td>
<td>0.01266 (0.78)</td>
</tr>
<tr>
<td>Location (main avenue)</td>
<td>* 0.064747* (3.19)</td>
<td>0.050676* (2.49)</td>
<td>0.053571* (2.63)</td>
<td>0.04180* (2.13)</td>
<td></td>
</tr>
<tr>
<td>Convenience store</td>
<td>* -</td>
<td>0.071006* (2.49)</td>
<td>0.071375* (4.34)</td>
<td>0.04149* (2.63)</td>
<td></td>
</tr>
<tr>
<td>Restaurant</td>
<td>* -</td>
<td>0.030995 (1.51)</td>
<td>0.032747 (1.59)</td>
<td>-0.000027 (0.001)</td>
<td></td>
</tr>
<tr>
<td>Parking log</td>
<td>* -</td>
<td>0.04224* (2.25)</td>
<td>0.041915* (2.24)</td>
<td>0.00864 (0.5)</td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
<td>* -</td>
<td>- -0.05573* (-3.16)</td>
<td>-0.02652 (-1.57)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supermarket</td>
<td>* -</td>
<td>- 0.045646** (1.95)</td>
<td>0.03949** (1.72)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>* -</td>
<td>- - - -0.57327* (-11.41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southeast</td>
<td>* -</td>
<td>- - - -0.78766* (-15.89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>* -</td>
<td>- - - -0.46155* (-9.43)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center-West</td>
<td>* -</td>
<td>- - - -0.45446* (-8.61)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price dispersion</td>
<td>-0.13863*</td>
<td>-0.13287*</td>
<td>-0.12794*</td>
<td>-0.125*</td>
<td>-0.11581*</td>
</tr>
</tbody>
</table>
Finally, in equation (6), regional dummies are added. The omitted region was the North, where gas stations practice the highest margins. One can observe from table 3 that the regional differentials are significant for the margins. Controlling for regional effect, also affects the remaining parameters. For instance, the unbranded stations now present a margin that is 12.8% inferior to that of branded gas stations. The existence of convenience store increases the margins in 4.1% against the 7.1% (without the regional control). The effect of the price dispersion on the margins also decreased with the inclusion of regional dummies, but it is still consistent with the one estimated in equation (1).

Taking a closer look at the regional aspects of the relationship between the margins and characteristics of the gas stations, equation (6) was estimated for the five Brazilian regions. Table 3 reports the results.

As it can be observed by the F statistics, it is not possible to reject the null hypothesis that all the parameters are equal the zero for the model estimated for the North region. Therefore, the results for this region will not be analyzed. Looking at the results for the other regions, it is possible to note that the presence of unbranded gas station is important to reduce the margins, as it was observed for the whole sample. The impacts of the unbranded gas stations are stronger in the South, 16.3%, followed by the Center-West, Northeast and Southeast. For this last region the unbranded station tend to reduce the margins, on average, in 10.8%, in line with the results of the whole sample, and providing a strong indication that the of this kind of firm do practice lower prices than its competitors which are associated to some brand.

Table 3: Margins’ equations for the regions

<table>
<thead>
<tr>
<th>Variables</th>
<th>North</th>
<th>Northeast</th>
<th>Southeast</th>
<th>South</th>
<th>Center-West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbranded</td>
<td>0.171502</td>
<td>-0.12543*</td>
<td>-0.1026*</td>
<td>-0.16327*</td>
<td>-0.13853*</td>
</tr>
<tr>
<td>Competition 1 (# of competitors)</td>
<td>-0.06677</td>
<td>-0.0605*</td>
<td>-0.04881*</td>
<td>-0.04591*</td>
<td>-0.00841</td>
</tr>
<tr>
<td>Competition 2 (Dummy)</td>
<td>-0.0614</td>
<td>0.012935</td>
<td>0.028202</td>
<td>0.030178</td>
<td>-0.05889</td>
</tr>
<tr>
<td>Location (main avenue)</td>
<td>0.235943</td>
<td>0.026409</td>
<td>0.020932</td>
<td>0.059304**</td>
<td>0.079539</td>
</tr>
<tr>
<td>Convenience store</td>
<td>0.096911</td>
<td>0.038623</td>
<td>0.083485*</td>
<td>-0.00421</td>
<td>-0.03082</td>
</tr>
</tbody>
</table>

* Significant at 5% ** significant at 10%

1 statistics in parenthesis.
With regard to the remaining variables, the larger the number of close competitors the smaller are the margins, probably also confirming, in regional level, the argument of Barron (2004) regarding the relation between retail price and density of close competitors. In the Northeast, besides brand and the number of competitors, only the price dispersion is relevant to explain the margins. Only for the Southeast, the existence of convenience store positively affects the margins. In the South, a larger diversity of gas station characteristics, such as location, proximity shopping and supermarkets, is relevant to explain the margins. Finally, as the results for price dispersion indicate, for all regions, the stations located in cities with smaller variation in prices among retailer present higher commercialization margins.

4.3 Determinants of price dispersion

The results present above clearly pointed to a relationship between margins and price dispersion in the retail gasoline market. In this last part of the paper we try to shed some light on the determinants of price dispersion. Barron (2004) investigates how the density of gas station affects the competition among them and, consequently, their retail prices. On the other hand, the difficulty to investigate the possible cartels in the retail fuel market can stimulate the unification of prices in a city, reducing the price dispersion. Below, the relationship between price dispersion and the density of gas stations (defined as the number of stations of the city divided by the area of the city) is examined in equations (7) and (8). The distance to the state capital, where normally are located the headquarters of the agencies which investigate this market is include in the analysis. One would expect that cities that are more distant to the capital will present lower price dispersion. Equations (7) and (8) are given by:

\[ CV_i = \alpha + \beta_1 D\bar{P}_i + \beta_2 DIST + \epsilon_i \]  

(7)
\[ CV_i = \alpha + \beta_1 DP_i + \beta_2 DIST_i + \sum_{j=1}^{4} \beta_{j,3} DR_j + \varepsilon_i \]  

where \( DP_i \) is the density of gas stations of city \( i \), \( DIST_i \) is the distance of city \( i \) to state capital and \( DR \) are regional dummies.

Table 4 presents the results of equations (7) and (8). The number of gas stations by \( km^2 \) seems to positively affect the coefficient of variation of the price of gasoline. For an increase of 1% in the density, the coefficient of variation increases, on average, 0.038%. As Baron (2004) points out, this result is in accordance with the traditional models of monopolistic competition, where a larger number of competitors implies in more dispersion in prices. The results suggest that the cities away from the state capitals are those where the dispersion in prices is smaller, reflecting, perhaps, the fact in these cities, far from the regulatory agencies, it is easier to maintain a cartel for longer periods, with very low probability of been discovered by the authorities.

Finally, in the model with regional dummies, the elasticity of price dispersion with respect to distance to the capital is no longer statistically significant. Only the gas station density would explain the variability of prices of the cities. Moreover, the parameters for regional dummies, with exception of the South, are not statistically significant, indicating the inexistence of relevant regional particularities which explain the price dispersion in the retail fuel market in Brazil.

5. Final remarks

The goal of this paper was to investigate the existence of indications of collusive practices in the retail fuel market that could affect the resale prices and, consequently, the
commercialization margins of stations in Brazil. The results suggest that smaller the price dispersion in the cities, the higher are the margins practiced by the gas stations, a result that indicates the existence of incentives of prices alignment among retail firms in this market, given the possible profits gains.

This result was found using two distinct databases and using techniques of panel data and OLS. Even with the inclusion of additional variables in the model, the estimated parameters did not suffer significant changes, indicating the robustness of such result. This relationship kept its signal and remained significance when we controlled for stations’ characteristics, such as the existence of convenience store and location.

Regarding the type of contract between the distributor and station, we found that the unbranded gas stations practice smaller margins. In the same way as observed for the results with price dispersion, the results for brand were robust to the addition of other gas station characteristics and regional dummies. The fact of not presenting a exclusive relationship with a specific distributor gives the unbranded stations more flexibility to look for the distributor with lower wholesale price at the same time that the they are free from possible pressures by the distributors to establish theirs retail prices. In this sense, the existence of unbranded gas stations can stimulate competition, consequently, prevent the formation of cartels.

The results also showed that having more stations within a specific area increases competition, as one may suspect. However price dispersion within one city can be related to other variables, such as concentration of gas station under one brand of distributor or number gas stations owned by a single group or firm. One possible next step in this line research is to investigate how such variables affect the price dispersion and margins.

References


Annex

The disaggregated data make it possible to compute the average commercialization margins and the coefficient of variation for the prices by city. Thus, equation (1) was re-estimated using these data. The results are presented on table A1 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Brazil</th>
<th>North</th>
<th>Northeast</th>
<th>Southeast</th>
<th>South</th>
<th>Center-West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price dispersion</td>
<td>-0.13425*</td>
<td>-0.063834</td>
<td>-0.20161*</td>
<td>-0.08592*</td>
<td>-0.10718*</td>
<td>-0.24866**</td>
</tr>
<tr>
<td>t statistics</td>
<td>(-4.66)</td>
<td>(-0.70)</td>
<td>(-2.77)</td>
<td>(-2.09)</td>
<td>(-2.96)</td>
<td>(-1.80)</td>
</tr>
<tr>
<td>N</td>
<td>427</td>
<td>10</td>
<td>90</td>
<td>147</td>
<td>133</td>
<td>47</td>
</tr>
<tr>
<td>F</td>
<td>21.75</td>
<td>0.50</td>
<td>7.70</td>
<td>4.35</td>
<td>8.76</td>
<td>3.25</td>
</tr>
<tr>
<td>PROB&gt;F</td>
<td>0.0000</td>
<td>0.5068</td>
<td>0.0067</td>
<td>0.0338</td>
<td>0.0000</td>
<td>0.0782</td>
</tr>
</tbody>
</table>

The results of table A1 for Brazil are similar to those presented in table 1 - with the longitudinal data on margin and price dispersion. However, in the regional results, one can note significant differences among coefficients. In the North, although estimated parameter presents the same sign of that from equation (1), it is no longer statistically significant. The sample size available for the region (10 cities) certainly leaves doubts the validity of this result. For the other regions, the signs of the parameter remains the same and all estimated parameter are statistically significant. However, differences in the magnitudes of the parameters are observed, in particular, for the Northeast. Despite of the differences in the sample size and techniques used to estimate the equations, in the same way that in table 1, it is in the Center-West where if it is possible to observe the large elasticity of the margins with respect to price dispersion.