Market power

in the Argentine liquid fuels wholesale chain*

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Abstract

The liquid fuels market in Argentina is characterized by a high level of concentration, especially in local geographic areas. This paper studies the demand of the liquid fuels wholesale chain in Argentina, using the discrete choice approach, based on the premise that different firms offer differentiated goods, by virtue of the intrinsic characteristics of the good, and that such differentiation gives them the power to set prices above marginal production costs. The difference between prices and marginal costs determines the firm market power. Using a novel dataset, we provide new empirical evidence that quantifies market power across firms and regions.

Keywords: Liquid Fuels; Market Power; Product Differentiation.

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1 Introduction

The liquid fuels market is important for a variety of reasons. Its performance affects other markets and may condition a country's macroeconomic development. In recent years, Ar-

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gentina became a net importer of crude oil and most of its by-products, according to the Energy Balance published by the National Energy Secretariat (Secretaria de Energia, 2016 –2019). It was a net exporter until 2013, year after which the country became a net importer of almost all products. There are concerns about the sustainability of the current levels of fuel consumption, imports, and production.

The domestic price of crude oil mined and used in Argentina, the main input of liquid fuels available in the market, such as diesel oil and gasoline, is subject to the regulations of the National Energy Secretariat (SEN). Price controls have been implemented through different mechanisms throughout the production and commercialization chain and involve measures such as the establishment of progressive tariffs on exports of crude oil and its by-products, the establishment of minimum values for cutting by-products with biofuels, among others. The SEN is the national agency that regulates the operations that may be carried out by the actors in the sector and keeps under its orbit all the provisions issued in this regard.

There are at least four forms of intervention available to the national government to influence the final price of the by-products to be analyzed here. The first of these is the regulation of the price of crude oil and biofuels (whose proportion in the gasoline and diesel cuts are established by law, and whose prices are determined by the SEN), i.e., the regulation of the main costs associated with the production of biofuels.[1] The second form corresponds to the influence exercised by the national government through the determination of the price of by-products such as gasoline and diesel oil in its different varieties, through the company YPF, the main fuel supplier in the country, whose majority shareholding is in State hands. Finally, the modification of the tax on liquid fuels as well as the use of decrees of necessity and urgency to temporarily fix the price of commercialized by-products are the two additional tools of influence that the national government has used to regulate the market.

Tariff policies over the years have been diverse, and the objectives pursued by the gov-

[1]This also includes policies such as the use of export and import tariffs, import quotas or similar.

ernment in determining them have not responded to the same criteria throughout different political cycles. For example, at the beginning of 2016, the government of Mauricio Macri carried out measures aimed at reducing the gap between local and international prices. The liberalization of tariff prices, which formally took form toward the end of 2017 and was implemented through Decree 962/2017, allowed companies to freely adjust prices according to the prevailing market conditions (since it enabled the free acquisition of products from abroad, so that domestic companies could import the product from abroad if it was cheaper). This regulation had a direct impact both upstream and downstream.

This measure was accompanied by the possibility of adjusting gasoline and fuel prices freely.[2] This situation of deregulation offers the possibility of analyzing the behavior of the actors and the internal structure of the market, and its free operation. Participants in the upstream and downstream sectors are relatively concentrated, which could imply that prices are determined in an oligopolistic market context. These are some of the reasons that justify a detailed study of the various actors involved in the fossil fuel market.

This paper seeks to identify the magnitude of market power in the wholesale chain of fossil fuels in Argentina using the discrete choice approach, which models the aggregate demand for products as the probability of choosing a brand over all others if the characteristics associated with the product provide greater utility to the consumer. In this context, the wholesale chain is understood as the product purchase and sale relationship between the banners or companies that make up the market and the service stations that demand it for subsequent retail sale. This study is expected to contribute to the understanding of the economic mechanisms that guide the decisions of intervening actors and will enrich the discussion on energy policy and contract design in this particular sector. For this purpose, information corresponding to the period 2016-2019 will be used. The aim is to determine whether there is market power on the part of the companies in the sector as a consequence of the differentiation of products. This differentiation entails the strategies carried out by

[2] At least until August 2019, the month in which the price freeze was imposed by the government through decree 566/2019.

the companies in relation to after-sales services and the location of their points of sale, and to specific contractual supply clauses, among others.

1.1 Background

Little economic research has been carried out on such a fundamental sector as the liquid fuels market in Argentina. Among the works carried out, the following can be mentioned. Coloma (1998) who uses a traditional supply and demand approach to represent the liquid fuels market between 1994 and 1999. The paper includes different assumptions of supply behavior (perfect competition, Cournot oligopoly, collusion, and price leadership), and then estimates a simultaneous equations model with the aforementioned assumptions. The author concludes that price fluctuations are linked to changes in the price of a barrel of oil, and that the most appropriate model to represent reality in the period under analysis is one of perfect competition. Subsequently, the same author tries to explain the behavior of the market before and after the integration of YPF with Repsol, using a system of equations that permits working simultaneously with supply and demand components. These works highlight market oligopoly characteristics giving rise to the need for regulation in order to make private and social interests compatible (Coloma, 2002).

Other approaches involve the analysis of aggregated time series to study the fuel market in Argentina. Mercuri (2001) analyzes the asymmetries in the price response of different types of fuel to fluctuations in the international price of a barrel of oil, using time series models. The author corroborates the widespread belief that the reaction in fuel prices is in magnitude and speed higher in the case of barrel price increases.

Similarly, Porto and Pizzi (2018) analyze the pass-through of international prices to domestic fuel prices, using multivariate dynamic models and using lagged crude oil prices as an explanatory variable, as well as the lagged product price variable (gasoline and diesel), in the period 2005-2017. The authors confirm Mercuri (2001)'s findings, and point out that between 2005-2016 there was a decoupling of domestic and external prices, and that

the main control measure used by the national government to regulate domestic prices was export withholding taxes.

Coria (2005), on the other hand, studies the determinants of the demand for some by-products such as diesel and super gasoline, by means of linear models of multidimensional time series, in the period 1994-2004. That paper concludes that the elements best predicting future fuel consumption are past consumption and the evolution of the level of activity.

The aforementioned works analyze demand or supply from a traditional perspective, or they study the linkage of equilibrium prices with variables typically related to price determinants in this market. None of these approaches enables us to provide an answer to the price differences within the territory that exist among the different flags or companies and the localities for each of the marketed by-products.

Fuels may not be considered a perfectly homogeneous good if we take into account the product differentiation tools used by various companies to build customer loyalty and the specific characteristics of each banner or company, as well as their geographic location strategy, the modality of sales, and the contractual clauses used by each company. Likewise, the services provided by the different banners have been expanding and include different facilities and benefits, such as exclusive promotions with certain banking entities, discounts for subscribers of paid magazines, point cards redeemable for different products or that are associated with travel services, discounts for companies, including exclusive benefits for companies in the agricultural sector, among others. All these factors constitute differentiating elements that turn the final product into a differentiated good. This premise will be used to estimate the wholesale demand and supply of fuels in Argentina, considering it as a demand for differentiated products, in which the consumer chooses to consume the product of the flag that maximizes his utility, and the firms take into account the characteristics of the customers to determine what they offer in the market.

Brenner (2001) analyzes the main determinants of market power, which include applying price discrimination, the existence of markets with few suppliers, aggressive advertising tools,

and relatively non-concentrated consumer tastes, among others. In the wholesale fuel market, some of these features can be seen, such as the existence of few suppliers (especially if we consider the market locally) and the possibility of applying different prices in different geographic regions.

In order to estimate the demand for different varieties of fossil fuels in Argentina, we will work under the structural approach of differentiated product markets, with discrete choice models of random coefficients, mainly following the work carried out by Berry (1994) and Berry, Levinsohn, and Pakes (1995).

Demand estimation models with random coefficients, as pointed out by Nevo (2000), retain the benefits of alternative discrete choice models, but produce more realistic demand elasticities. They can be estimated using market-level information, and they permit dealing with endogeneity in prices.

Berry (1994) proposes a two-stage estimation strategy to calculate the average utility derived from the consumption of each good in the market by a set of individuals, considering the observed characteristics of the product. In addition, he considers the unobserved characteristics, which enter the utility function through a term that contemplates the unobserved variability among individuals, characterized by a specific density function. This estimation can be carried out with aggregate market prices and quantities, in conjunction with a set of data characterizing the goods. This approach enables dealing with price endogeneity, which appears as a result of prices being correlated with the error term (which in this context means that it is linked to the unobserved characteristics of the product such as differences in quality within the limits stablished by the SEN). If the error term is distributed according to the extreme type I distribution function, and the assumption that individual-level observations are independent and identically distributed holds, substitution between brands depends directly on the market share of the firms, and not on the relative similarity between products.

In response to this limitation, Berry, Levinsohn, and Pakes (1995) propose a general-

ization of the previous model by allowing the coefficients linked to price and unobserved characteristics to vary at the individual level, which implies that substitution between goods will no longer be guided solely by the market share held by each firm, but also by the distribution of the coefficients associated with the variables price and observed and unobserved characteristics of market participants. The aforementioned approach has been adopted by many authors to study corporate behavior in different markets and reach different conclusions. Nevo (2001) analyzes the incentives and effects of corporate mergers in the case of the U.S. cereal industry, and then analyzes the market power of the firms in the sector, proposing a series of novel instruments to solve the problem of endogeneity in prices.

Pinkse, Slade, and Brett (2002), on the other hand, incorporate the geographical location of the participants into the differentiated product models in order to distinguish local competition (companies that compete directly with their neighbors) from global competition (all participants compete with everyone, even if the competition is not symmetrical). This distinction allows the author to explain those situations in which a consumer chooses multiple goods of different brands at the same time.

Berry and Haile (2014) work with nonparametric estimation of cost functions in discrete choice differentiated product models, allowing for richer heterogeneous preferences, unobservable market variables, and endogenous prices, to make the available estimation models richer and more flexible. These authors show that, under certain circumstances, it is possible to empirically differentiate the competition models by exploiting the variations observed in market conditions. Bonnet and Dubois (2010) analyze the market power exercised in the wholesale and retail chain in France and determine its impact on final product prices. Bokahari and Mariuzzo (2018) use this approach to estimate the demand for specific drugs and simulate the effects that mergers between companies would have on the market, under different assumptions regarding the way in which individuals choose each purchase. Recent studies by Michel and Weiergraeber (2018) analyze industry behavioral patterns over time as well as the heterogeneity among firms under the structural approach, considering flexible

behavioral patterns from the supply side. The authors developed a new instrument that exploits the relative closeness of products in the feature space to rival firms' advertising expenditures.

The purpose of this paper is to detect the existence of elements of differentiation that have a significant influence on the pricing power, i.e., the market power of each company, if the latter is significant.

The rest of the paper is organized as follows. Section 2 sets out the theoretical model used; in Section 3 we show the identification and estimation strategies. Section 4 contains the application of the model to the fuel market in Argentina and details the treatment of the information used as well as the estimation results. Section 5 presents the conclusions reached and proposes lines of future work. The Appendix contains some additional results regarding the random coefficients specification.

2 The Model

The theoretical base model used in this research is derived from the model proposed by Berry (1994) and Berry, Levinsohn, and Pakes (1995). The model presented by Berry (1994) is extended by assuming that individuals differ at the regional level. A model of random coefficients by region is then estimated, adjusted by the use of an instrument for product prices following the model of Swamy (1970). The instruments used in this paper consist of a function of competitors' prices, following Nevo (2001)'s approach. Further details about their construction can be found in Section 4.3.

General Aspects. As is well known, the primitives of the model are product characteristics, consumer preferences, and the concept of equilibrium. All characteristics and decisions are observed by market participants, with the exception of the econometrician, who may not observe all product characteristics, nor the decisions of individual consumers. It is assumed that the econometrician observes the values of prices and quantities sold by each of the firms

at the market level.

There are N firms in the market, and it is assumed that the production of each good generates neither economies nor diseconomies of scale in the production of the other goods. For product j the observed characteristics are denoted by the vector $z_j \in \mathbb{R}^K$. The elements of z_j include characteristics that affect demand (x_j) and marginal costs (w_j). Then the vector of characteristics of all firms is included in $\mathbf{z} = (z_1, ..., z_N)$. Similarly we define $\mathbf{x} = (x_1, ..., x_N)$ and $\mathbf{w} = (w_1, ..., w_N)$.

Discrete Choice Model. Consumers' choice is based on the utility they derived from product's observed and unobserved characteristics. Formally: Consumer i utility derived from product j is denoted by $U(x_j, \xi_j, p_j, \nu_i, \theta_d)$ where x_j, ξ_j, p_j and θ_d are observed product characteristics, unobserved (by the econometrician) product characteristics, and price and demand parameters, respectively. The term ν_i captures those particularities of the individual unobserved by the econometrician. Estimation relies on parametric assumptions. Berry (1994) in it simplest form, proposes the following specification for the utility function.

$$u_{ij} = x_j\beta - \alpha p_j + \xi_j + \nu_{ij} \tag{1}$$

where β and α are unknown parameters linked to consumer tastes. The term ξ_j can be thought of as consumers' mean valuation of unobserved product characteristics, such as unobserved quality. The "error term" ν_{ij} is a mean-zero heteroskedastic error that captures random variation in tastes. As shown by Berry (1994) this term can be decomposed into the sum of two terms, one depending on unobserved product and individual characteristics, say ϕ_{ij} and the other, ϵ_{ij} that correspondes to random variation in consumers tastes which is assumed to enter in an additive form and is independent and identically distributed across products and consumers. Distributional assumptions about ϵ lead to different specifications of the discrete choice model.

Following Berry (1994), the average utility provided by the consumption of product j,

can be expressed as

$$\delta_j \equiv x_j\beta - \alpha p_j + \xi_j \tag{2}$$

Given the discrete choice model posed, each consumer chooses to buy a unit of the good that provides the highest utility. That is, conditional on the characteristics of goods (x, ξ) and prices $\mathbf{p}$, consumer i (who in this case is the owner of the gas station), will buy a unit of good j if and only if for all $m \neq j$:

$$U(x_j, \xi_j, p_j, \nu_i, \theta_d) \geq U(x_m, \xi_m, p_m, \nu_i, \theta_d)$$

This implicitly defines a set of unobserved variable parameters linked to the tastes, ν_{ij} that result in the purchase of good j. Then, we can define a set of unobserved variables that lead to the consumption of good j as $A_j(\delta) = \{\nu_i | \delta_j + \nu_{ij} \geq \delta_m + \nu_{im}, \forall m \neq j\}$. The market share of the j-th firm is represented by the probability that ν_{ij} is within A_j. Given a cumulative distribution function $F(\cdot, x, \sigma)$ for ν, with density $f(\cdot, x, \sigma)$, market share is

$$\sigma_j(\delta(\mathbf{x}, \mathbf{p}, \xi), \mathbf{x}, \theta) = \int_{A_j(\delta)} f(\nu, x) d\nu \tag{3}$$

where the integral is over the set of unobservable consumer characteristics, implicitly defined by A_j.

In the model with independent and identically distributed consumer tastes and extreme type I distribution of the error term, ϵ_{ij} (hereafter "Logit"), only the average utility level δ_j differentiates products. Then, all market demand properties, including market shares and elasticities, are determined solely by δ_j. In particular, the cross-price elasticities can depend only on the value of δ_j, with no additional effects from product characteristics. In practical terms, this implies assuming that any two brands that have the same market share have the same cross-price elasticity, regardless of whether the two brands have similar characteristics or not. It also implies that two brands having the same market share have equivalent substitution patterns with respect to a third brand.

Several alternatives have been proposed to overcome the practical implications of working with this model, among them Berry, Levinsohn, and Pakes (1995) suggest using a model of random coefficients per individual. This approach generates more reasonable substitution patterns. For the proposed utility function, in particular, the model takes the form

$$u_{ij} = x_j\beta_i - \alpha_i p_j + \xi_j + \epsilon_{ij}. \tag{4}$$

We refer to this model as the random coefficients model by region. This specification is estimated at the region level as an attempt to characterize wholesale demand through specific geographic factors.

Market size and external good. The measure of the total market size is denoted by M. This value can be observed or estimated. In the case of fuels, it is defined by the total volume traded in each market by product. The observed quantity of the firm's output is,

$$q_j = \mathbf{M} \times s_j(\mathbf{x}, \xi, \mathbf{p}, \theta_d) \tag{5}$$

where s_j is firm j market share.

Together with the list of products competing in the market (products with horizontal differentiation, which in this case are each represented by a different flag or firm), $j = 1, ..., N$, the existence of an external good $j = 0$ is assumed. This specification enables dealing with the fact that consumers may decide not to buy any of the N offered goods. In the context of the fuel market, the existence of the external good makes sense if one considers that the demand of gas station owners is a derived demand, which ultimately depends on the demand of final consumers. Then, the final consumer can choose not to consume any of the available options, and this translates into not buying in the wholesale market.

The existence of an external good with market share s_0, while timely, implies that the mere observation of the quantities produced by the N firms $(q_1, ..., q_N)$ are not sufficient to

calculate the market shares of $(N+1)$ alternatives. If the total market size M is directly observable, s_j can be calculated directly as $s_j = q_j/M$.

The definition of external good is closely related to the problem under analysis and implies assigning a market share to the no-purchase alternative. In this market, the external good is defined as the potential sales not purchased in the period by the different companies in the wholesale segment. To estimate the magnitude of potential sales, the maximum sales volume for each of the flags in each period (month/year) is calculated as the maximum sales volume of the years immediately preceding and following the period under analysis. The magnitude of the external good is then defined as the difference between potential sales in a given market and actual sales for the period in question. Under this approach, potential sales of companies that were under the process of a merger under the period (and concentrate supply contracts with several more gas stations) are not underestimated.

Supply. It is assumed that N firms in the market have pricing power. The total costs of firm j are given by the cost function $C_j(q_j, w_j, \omega_j, \gamma)$ and marginal costs are $c_j(q_j, w_j, \omega_j, \gamma)$, where γ is a vector of unknown parameters. The net profit for firm j in each market is

$$\pi_j(\mathbf{p}, \mathbf{z}, \xi, \omega_\mathbf{j}, \theta) = p_j \mathbf{M} \mathit{s}_j(\mathbf{x}, \xi, \mathbf{p}, \theta_d) - C_{jt}(q_j, w_j, \omega_j, \gamma), \tag{6}$$

where $\theta = (\theta_d, \gamma)$. Assuming the existence of an inner equilibrium in pure strategies (Berry, 1994), the price vector satisfies the first order condition

$$[p_j - c_j(q_j, w_j; \omega_j, \gamma)][\partial \mathit{s}_j(\mathbf{x}, \xi, \mathbf{p}, \theta_\mathbf{d})/\partial p_j] + \mathit{s}_j(\mathbf{x}, \xi, \mathbf{p}, \theta_\mathbf{d}) = 0$$

or equivalent

$$p_j = c_j + \mathit{s}_j/|\partial \mathit{s}_j/\partial p_j|. \tag{7}$$

If there are N equations, they define a unique equilibrium for values of c_j. Thus, the first-order conditions implicitly define a reduced form function for the price, $\boldsymbol{p}_j(\mathbf{z}, \xi, \omega, \theta)$, as

a function of exogenous variables and parameters. The equilibrium price, in conjunction with the demand function thus defines a reduced form expression for the equilibrium quantities, given by $q_j(\mathbf{z}, \xi, \omega, \theta) = \mathbf{M}\mathcal{s}_j(\mathbf{x}, \xi\boldsymbol{p}(\mathbf{z}, \xi, \omega, \theta), \theta_{\mathbf{d}})$.

3 Identification and Estimation

The presence of the term ξ_j corresponding to the unobserved characteristics brings econometric difficulties in estimating the demand for good j. The estimation of the vector of demands, given by $\mathbf{x}$, is not straightforward because, although the distribution of the demographic variables θ_d can be characterized, there is no information on the unobserved variables, which are linked to the price of the good. In equilibrium, the observed market shares s_j should be equal to those predicted by a model $\mathcal{s}_j$.

$$s_j = \mathcal{s}_j(\mathbf{x}, \mathbf{p}, \xi, \theta).$$

Unobserved characteristics are expected to be correlated with prices, which is why prices on the right-hand side of the equation would be endogenous. Traditionally, this problem is solved with the use of instrumental variables, but since the unobservable variables enter the equation in a non-linear way, this method cannot be implemented directly.

If we knew exactly the distribution of the unobserved variables, market shares would depend only on the average levels of utility provided by each product.

$$s_j = \mathcal{s}_j(\delta) \quad j = 1, \ldots, N. \tag{8}$$

The mean utility levels δ contain the aggregate error $\xi_{\mathbf{j}}$, so that, conditional on the true values of δ, the model should fit the data perfectly. Berry (1994) suggests exploiting the fact that $s = \mathcal{s}(\delta)$ holds with equality, to rescue the value of $\delta = (\mathcal{s})^{-1}(\mathbf{s})$, provided that the function $\mathcal{s}$ admits inverse.

Thus, the observed market shares, in conjunction with the distributional assumptions about ν, uniquely determine the average utility of consumers for each good. Then, conditional on setting the value of the average utility of the external good δ_0 equal to zero, the market share function is bijective. For each possible vector of observed market shares, there will exist a vector of average utilities in $\mathbb{R}^{(N+1)}$ that will replicate the vector of observed shares via the relation $s_j = \mathcal{s}_j(\delta)$. As a result, each vector of observed market shares can be explained only by a vector of average utilities.

This vector of mean utilities that depends on the observed market shares $\delta(\mathbf{s})$ can be used in a simple estimation strategy. The calculated average utility levels can be treated as a known nonlinear transformation of the market shares. From equation (2), for true values of (α, β) it holds.

$$\delta_j(\mathbf{s}) = x_j\beta - \alpha p_j + \xi_j, \tag{9}$$

This equation can be estimated using standard instrumental variables techniques to learn the unknown parameters. In particular, valid instrument Z should satisfy

$$\frac{1}{J}\sum_{j=1}^{J}((\delta_j(\mathbf{s}) - x_j\beta + \alpha p_j)Z) \to 0. \tag{10}$$

In principle, the value of the average utility is not known. Assumptions about the error distribution enable us to circumvent this drawback and proceed to estimate the parameters α and β by using instrumental variables. Valid instruments for the analysis will be discussed in the next section.

3.1 Logit and Random Coefficients Models

For the logit model, it is assumed that heterogeneity among individuals enters the model only through the random, additive, separable error ϵ_{ij} which is independent and identically distributed across consumers and across markets Under an extreme type I distribution, the market shares function has an analytical form given by

$$\imath_j(\delta) = \frac{e^{\delta_j}}{\sum_{k=0}^{N} e^{\delta_j}}. \tag{11}$$

Normalizing the average utility of the external good $\delta_0 = 0$ and taking logs to linearize, gives the expression for the average utility of product j

$$ln(s_j) - ln(s_0) \equiv \delta_j = x_j\beta - \alpha p_j + \xi_j. \tag{12}$$

In this way δ_j is unambiguously identified directly by a simple algebraic calculation.

Next, the logit model is implemented using an IV regression of the difference between the logarithms of the market share in (x_j, p_j). Again, despite the simplicity of its implementation, it produces undesirable substitution patterns, which limits the conclusions that can be derived from it.

On the other hand, the random coefficients model in equation (4), is estimated by applying the logit model to each of the products analyzed, by geographic region: Cuyo, Patagonia, Northwest, Northeast, and Pampeana. This implies assuming that the individuals who make up each of the regions are relatively homogeneous among themselves. The strategy of estimating the model at the regional level seeks to enrich the analysis by incorporating heterogeneity factors based on regional geographic diversity. The choice of geographic openness responds to the need for the most relevant variables in the analysis to be identified (the latter conditioned the decision to select regions over provinces). For estimation, we used the procedure indicated by Swamy (1970) but considering the use of instruments for the price variable, so that specific coefficients were obtained for each product and for each panel, defined by the sales (prices and quantities) by region, period, and commercialization channel. Specifically, to obtain the coefficients associated with the variables of interest, the coefficients were estimated for each panel β_i,

$$\beta_i = (Z^T X)^{-1} Z^T Y \tag{13}$$

where Z is the instrument matrix, the instrument of the non-price variables being the variables themselves. The general coefficients associated to the estimation by instrumental variables, given by the vector $\hat{\beta}$, are the result of the following expression

$$\hat{\beta} = \sum_i W_i \beta_i,$$

where W_i acts as a weight that penalizes the regional estimates with a greater magnitude of variability in relation to the variability of the coefficients of the other regions. The variance-covariance matrix was adjusted by the degrees of freedom resulting from the instrumentation performed.

4 Application: Fuel Market in Argentina

Fuel prices are a sensitive variable in a country whose north-south extension is approximately 3,779 kilometers, with an uneven distribution of road infrastructure centered in the Autonomous City of Buenos Aires (CABA) and Greater Buenos Aires area. This affects logistics costs and establishes different cost structures depending on the geographical location of those involved.

The fuel value chain ranges from mineral extraction to refining, distribution, wholesale, and retail. The actors involved may participate in some link of the chain, or be fully integrated, as is the case of YPF S.A., a company whose activity includes all the stages mentioned above.

From the point of view of the wholesale market, the sale of liquid fuels can be conceived as an oligopolistic market of differentiated products. In relation to the wholesale distribution of fuels, there are high entry costs due to several factors, among which are the high logistics

costs related to the handling of the product, and the investments required to carry out the activity, among others. Likewise, the companies must have the capacity to respond to the demands of the retail operators with whom they sign supply contracts. Differentiation is vertical (different product qualities) and horizontal, the latter being understood as that which makes each brand stand out from the rest by offering a product similar to that of the competition, but with differences associated with the benefits derived from the purchase of fuel from a particular company.

The differentiation strategies among brands are diverse, and may include the degree of purity of the final product within the standard purity margins defined by the regulatory agency for each category, additional services targeted to specific customers, score cards, discounts through partnerships with various banks, reward cards, and geographic location, among others.

The presence or not of the companies in each market, as well as the number of gas stations associated with each company, are part of the observed characteristics of the products. The benefits associated with each flag (such as points cards redeemable for products or discounts) are more attractive to final consumers, and they represent an advantage for gas station owners. Likewise, the presence of the brand (quantity and extension) in the different markets permits the final consumer to take advantage of the benefits associated with the flags that have customer loyalty instruments. Thus, it is observed that the companies with the greatest presence in the country are those with web applications, cards, and/or specific discounts to build customer loyalty.

4.1 Market Concentration

Without discriminating by region or by year, total sales in Argentina in the 2016-2020 period show a high degree of concentration for both gasoline and diesel, in both regular and premium versions. To illustrate this fact, the value of the Herfindahl-Hirschman Index (HHI) for the four products is shown. This index is a measure widely used in economics to analyze

concentration in a market, and is calculated according to the following formula

$$IHH = \sum_{i=1}^{n} s_i^2, \tag{14}$$

where s_i represents the market share of firm i. The index ranges between 10,000 (total concentration or monopoly) and zero (no concentration).

Table 1: Herfindahl-Hirschman Index at the aggregate level (Argentina), by product, for the period 2016-2020.

	Diesel	Premium Diesel	Regular Gasoline	Premium Gasoline
HH Index	6496.50	6748.33	6091.20	6719.71

A value above 2,500 is already considered indicative of high levels of concentration, and in the case of Argentina, for sales carried out in the marketing channels and period under study, the index exceeds 6,000. This value increases significantly in geographic regions where the number of competitors decreases, and total sales are concentrated in a few companies.

This incentive encourages analyzing market power and its magnitude, especially if it is considered that at the regional or local level, concentration may be higher because not all banners or firms are present in all regions of the country.

The market for the four products shows a high level of concentration. In relative terms, there is a higher concentration in the common diesel market, followed by the premium diesel market. Next in order of importance is the premium gasoline market, with the common gasoline market being the most competitive in relation to the four products analyzed (the latter is the market with the highest total volume traded).

Figures 1 and 2 show the distribution of firms market shares. In general terms, it is confirmed that the largest companies (YPF, Shell, Axion) have higher (average by region) market shares than the rest of the companies. However, this does not prevent the possibility of the existence of smaller companies with high market shares, since they sell their products in geographic markets with little presence of competitors. Also note the difference in market

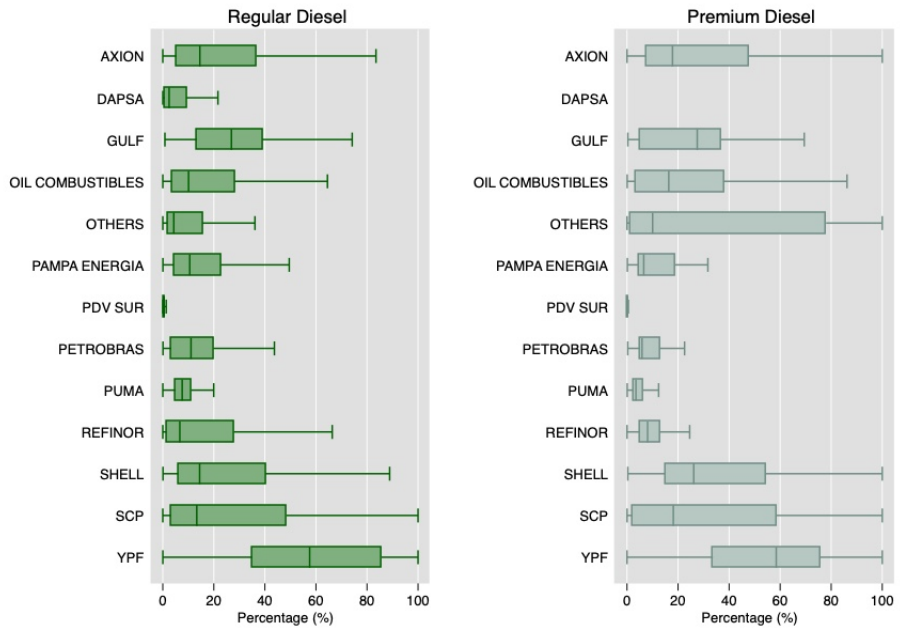

Figure 1: Distribution of market shares by company, for regular and premium diesel.

shares of firms in the country: a greater magnitude of the interquartile range (given by the length of each of the "boxes" specified for each firm), indicates greater variability in the market share of firms.

4.2 Database Considerations.

The main source of information enabling this study is the wholesale sales database published by the National Energy Secretariat. The database contains information about volume and price for every product, firm, and sale points by month and year. We combine these data with information regarding retail sales. Specifically, the number of outlets per company and period in the country as a whole and at the provincial level were calculated to obtain a measure of geographical presence for each firm. The gas stations of the retail base were grouped in such a way that they properly reflect the change in the companies in charge of supplying fuel, regardless of delays in times of registration. This mainly attends to the acquisition of the assets of the Petrobras banner by Pampa Energia S.A. in July 2016, and

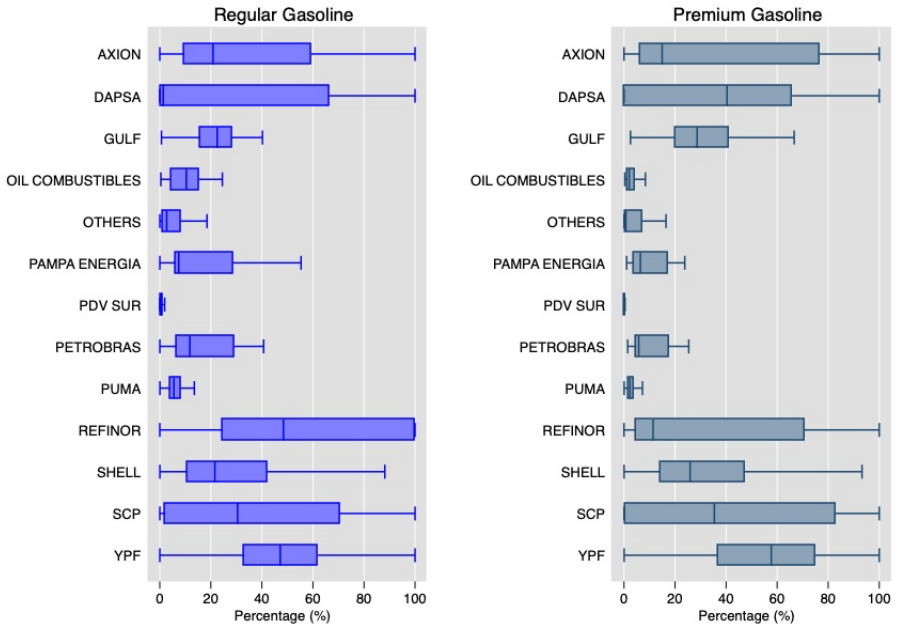

Figure 2: Distribution of market shares by company, for regular and premium gasoline.

its subsequent sale to the company Trafigura S.A. (which currently owns the Puma banner) in December 2017. Likewise, the gas stations of the former Oil Combustibles S.A. were distributed according to the distribution request made by the awarded companies (Destileria Argentina de Petroleo S.A. and YPF S.A., who assigned 124 points of sale of the former Oil to Delta Patagonia S.A.), as determined by the relevant court resolution. Additionally, census information provided by the National Institute of Statistics and Censuses was used to account for differences in levels of urbanization, and vehicle fleet (including cars, buses, and other vehicles) data by province were published by the Association of Vehicle Concessionaires of Argentina [3]

Specific price indexes were used in order to homogenize values with respect to a common reference period, December 2020, using the Internal Wholesale Price Index published by the National Institute of Statistics and Censuses. In order to carry out this work, the price net (of taxes) as of December 2020 is used as the reference price.[4] Whenever prices after taxes

[3]ACARA - Asociación de Concesionarios de autos de la República Argentina.
[4]This means that the price is free of fossil fuel tax, carbon dioxide tax and VAT.

were smaller than prices net of taxes, they were edited using the Manual provided by the National Energy Secretariat to recalculate net price.

Given the reclassification made, the market share of each company in the wholesale chain was estimated. Market share is defined as the portion of a company's total sales volume in a given geographical area, time period, and marketing channel. In this study, the market is defined as the combination "province/month/marketing channel," which implies that the market share of each company will be determined by the number of cubic meters meters of fuel sold per province, month, and marketing channel, for every product.[5] The analysis was carried out for four by-products: common and premium diesel, and common and premium gasoline. The marketing channels were reclassified to group the sales made by each flag. Since the wholesale marketing of liquid fuels is being modeled, sales of liquid fuels by wholesale companies to their own outlets have been excluded from the analysis. This exclusion was done because it is understood that in such cases, there is no negotiation between the parties, it is in fact a direct sale in the retail chain, and there are no competitors.

Data was selected including the period January 2016 –July 2019 as a period of free price setting, considering that on August of 2019 the government issued a decree to freeze fossil fuels prices for ninety days.[6]

4.3 Estimates for Gasoline and Diesel Demand.

The results obtained from the estimations carried out for diesel and gasoline are presented below. The results of the estimations made by applying the ordinary least squares (OLS) instrumental variables (IV) method to estimate the logit model proposed by Berry (1994) and the logit model with random coefficients by region are shown. The comparison of the model estimated by OLS with the others allows visualizing the importance of instrumenting

[5]The marketing channel was grouped as follows: Agro, Bunker, gas station retail, gas station wholesale, freight transport, public passenger transport, transport others and other channels. Sales to own service stations are kept out of gas station retail, since they are not included in the analysis because we understand there is no strategic interaction between different actors in that case, but direct sales from wholesalers to final consumers..

[6]Decree 566/2019.

the price, which is assumed to be correlated with the measurement error, in the presence of unobserved variables in the analysis (correlated with the price).

Instruments used. A set of instruments associated with the characteristics of the database was constructed, some of which are suggested by Nevo (2000). Given the market definition, the instrument was established considering the type of product, province, month, year, and marketing channel.

After carefully analyzing the different instrument alternatives available, the instruments that exhibited favorable results in the endogeneity and relative relevance F-tests of the instruments were selected. This led to instrumenting the price of diesel fuels, with the maximum price of the competition in the marketing channel, within the region, and the price of gasoline, with the average price of the flag in other marketing channels in the province and an indicator variable of the existence or not of a refinery in the province. Instruments showed good results, both at the aggregate level and at the panel level (for each region): in each case, the instrument was checked to ensure that it complied with the desired conditions at the aggregate level and at the regional level. The case of gasoline, for which two instruments were used, also verified that the over-identification test was met.

Definition of external good. The definition of external good corresponds to the potential sales not made by the banners in each market. For this purpose, the maximum volume of sales made in the market in the period between the year immediately before and after the month/year under analysis was taken as a reference. The difference between potential and actual sales thus represents the external good. This definition of external good is particularly useful for cases in which some firms merged, since the potential sales of the merger year, which in the period under study occurs before 2019, are compared against the year immediately after, in which the company is already operating as merged, in order not to underestimate the potential sales.

Fuel demand estimation. The results obtained from estimating the demands for diesel and gasoline, controlling for quality (using the "premium" variable) in each case, are presented below. The logit model is estimated by ordinary least squares without instrumenting for price (OLS), by means of the instrumental variables method (using an instrument for price, appropriate for each product), and, finally, the general result of estimating a random coefficients model instrumented by region (Cuyo, Patagonia, Northeast, Northwest, and Pampeana regions) is presented. Panels by region were used primarily because the number of observations at the provincial level, for the period under study, did not allow the identification of all the coefficients by province. Sales were grouped by marketing channel into retail sales to gas stations (including sales through different contractual modalities including consignment sales and purchase and sale contracts), sales to the agricultural sector, wholesale sales (storage and distribution), freight transport, public passenger transport, other types of transport, bunker, and other marketing channels.

The following variables were included in the estimates: price (average without taxes in constant currency, weighted by sales volume), premium (quality indicator), reward card (indicating the existence of a customer loyalty card associated with benefits for purchases), number of wholesale competitors (number of wholesale companies that sell in the province), flagged outlets (percentage of flagged outlets by province and company), urbanization (urbanization rate in the province), and logarithm of the number of vehicle registrations (with variability by province and year). Control variables by region are also included the general estimation by OLS and the IV regression.

Diesel. The use of a price instrument increases the absolute value of the coefficient, in this case by three times. The value of the coefficient controlling for product quality also increases substantially. The existence of a loyalty points card is significant for the instrumental variables model with a fixed effect by region but is not statistically significant for the random coefficients model. The number of competitors in the wholesale segment has the expected

sign and is significant, reflecting that the greater the number of competitors, the lower the probability of purchasing from a particular flag. The number of flagged gas stations in the retail segment is a relevant variable and increases the probability of purchase in the wholesale segment. This variable, a priori, is a good indicator of the geographic coverage of a flag, since a company that has flagged many stations has an extended network in its territory, while a lower number of flagged stations would indicate the opposite. The urbanization rate is not a significant variable. The change in the vehicle fleet for the time period considered has a null effect on the demand for diesel fuels. The random coefficients model at the general level presents similar results to the fixed effects model (which is the instrumental variables model with control by region). The Hausman test enabled selecting the random effects model over the fixed effects model.

The Appendix shows the estimates for each of the regions derived from using the random effects model, and the variability in the value of the regressors at the regional level can be analyzed. Of particular interest is the value of the price coefficient, which in the case of diesel fuels has a higher absolute value in the Pampeana region, i.e., a higher price elasticity of demand. The existence of a customer loyalty card increases the probability of sale only in Pampeana region. The increase in the number of wholesale competitors has a more attenuated effect in the Pampeana region compared to the rest of the country. The number of flagged outlets is a relevant variable in the analysis, especially in Northwest and Northeast regions.

Gasoline. As in the case of diesel fuels, the use of an instrument for gasoline prices is highly relevant: the coefficient goes from being null and non-significant to significant and negative, both for the instrumental variables model with fixed effects by region and for the random coefficients model. The value of the coefficient controlling for quality also increases substantially. The existence of a loyalty points card for gasoline, unlike for diesel products, substantially increases the likelihood of purchase for the flags. The number of competitors

Table 2: Estimates corresponding to equation (12) using different methods of estimation, for the period January 2016 - July 2020, for diesel products.

	(1) OLS	(2) IV	(3) RC
Price	-0.03***	-0.12***	-0.11***
Premium	0.30***	0.84***	0.87***
Reward card	0.14***	0.16***	-0.27
Wholesale competitors	-0.35***	-0.40***	-0.53***
Flagged outlets	1.89***	1.85***	2.31***
Urbanization	-0.58*	-1.08***	-1.91
Vehicle fleet (log)	0.05***	0.02	-0.11
Constant	4.11***	8.22***	10.93***
Observations	16218	16218	16218

Region controls: Cuyo, Pampeana, Patagonia, NOA and NEA in (1) and (2).
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

in the wholesale segment has the expected sign: the greater the number of competitors, the lower the probability of purchasing from a particular flag as with diesel fuels, although in the case of gasoline this phenomenon is of greater magnitude. The number of flagged gas stations in the retail segment is a relevant variable and increases the probability of purchase in the wholesale segment. The level of urbanization would decrease the probability of purchase, by decreasing the relative distances of automobile travel.

As with diesel fuels, the variability in the vehicle fleet in the period is not relevant for the analysis, possibly because the time period is not long enough to show structural changes in the number of vehicles per province. The random coefficients model presents similar results to the instrumental variables model with fixed effects by region. The Hausman test enables us to select the random effects model over the fixed effects model for gasoline.

The Appendix shows the estimates for each of the regions derived from using the random effects model for gasoline. Of particular interest is the value of the price coefficient, which in the case of gasoline has a higher absolute value in the Cuyo and Northwest regions in relation to the other regions, that is, a higher price elasticity of demand. The existence of a loyalty card with benefits for customers does not seem to have any effect in the Patagonia region, being statistically insignificant in that region. In the case of gasoline fuels, the number

of wholesale competitors decreases the probability of purchasing a particular flag and is a significant variable for determining the probability of sale. This effect is lower in absolute value in the Pampeana region. In almost every region of the country,with the exception of Patagonia region, unlike for diesel products, the existence of a loyalty card does have a positive effect on the probability of sale. The number of flagged outlets is not a significant variable for determining the probability of sales for the Cuyo region, but it is relevant for every other region in the country. The urbanization rate is an important variable, with a significant coefficient for the Cuyo, Patagonia, Northwest, and Pampeana regions.

Table 3: Estimates corresponding to equation (12) using different methods of estimation, for the period January 2016 - July 2020, for Gasoline products.

	(1) OLS	(2) IV	(3) RC
Price	-0.00	-0.18***	-0.19***
Premium	-0.15***	0.71***	0.83***
Reward card	0.31***	0.60***	0.91**
Wholesale competitors	-0.39***	-0.64***	-0.90***
Flagged outlets	1.80***	1.46***	1.34**
Urbanization	-1.75***	-3.29***	-5.96*
Vehicle fleet (log)	0.14***	0.09***	-0.04
Constant	2.89***	11.64***	16.71**
Observations	10333	10333	10333

Region controls: Cuyo, Pampeana, Patagonia, NOA and NEA in (1) and (2).
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.4 Predicted Markups

Using the estimates given by the random coefficients model and the specification given by equation (7), we can recover the markup measure or Lerner index, given by

$$\frac{p_{jt} - c_{jt}}{p_{jt}} = \frac{s_{jt}/p_{jt}}{|\partial s_{jt}/\partial p_{jt}|}.$$

The results obtained should be considered within the limitations imposed by the models used. In general terms, when analyzing the results for the entire country, under the random

coefficients model, a greater market power can be seen in the common varieties on average in relation to the premium varieties for diesel, which is intuitive, considering that the premium varieties have an immediate, usable substitute of inferior quality and lower cost. When inspecting the magnitude for the three top firms in terms of commercialized volume for diesel (YPF, Shell and Axion), markups are higher for premium varieties in Axion and Shell, while YPF markups are higher for the regular variety. In the case of gasoline, the three top firms in terms of volume commercialized in the period under consideration are the same as for diesel companies, but markups do not differ considerably between regular and premium varieties for each firm.

The YPF flag presents higher markups in relation to the rest of the flags for all the products analyzed, and it is the flag with the highest average market share in the country as a whole. However, among the companies with the highest Lerner Index for common diesel are Oil Combustibles, Axion, and Sociedad Comercial del Plata (SCP); for premium diesel, Axion, Shell, Oil Combustibles; for gasoline, Refinor, SCP, and Axion; and for premium gasoline, SCP, Axion, and Dapsa. It is important to clarify that the values are averages for the period January 2016 uly 2019, which explains why the aforementioned companies may have obtained a higher markup in a time interval within the period analyzed, and a lower markup in another interval of the period. The companies with the lowest markup according to the information analyzed were PDV Sur, Puma, Petrobras, and Pampa Energia.[7]

When analyzing average profit margins by region, there were substantial differences with respect to the strategies used by the companies, both geographically and by product. In general terms, in the case of diesel fuels, lower markups were observed for almost every company and product in the Pampeana region, which has the highest level of competition in the wholesale market, although they are not necessarily the lowest markups for every firm. In the case of gasoline, Northwest and Cuyo regions had lower margins on average than the other regions.

[7]Within the companies included here, which leaves aside those companies whose size of operations is marginal on an individual basis.

Table 4: Average markups by company and product, total country, period January 2016-July 2019.

	Diesel	Premium Diesel	Gasoline	Premium Gasoline
Axion	5.25	7.05	5.33	5.00
Dapsa	3.61	.	4.08	4.40
Gulf	4.21	4.19	1.99	2.42
Oil Comb.	8.56	5.07	3.77	1.88
Pampa Energia	2.84	2.73	1.67	0.94
PDV Sur	0.10	0.03	0.08	0.02
Petrobras	3.00	1.71	1.75	1.00
Puma	2.82	2.40	1.74	0.78
Refinor	4.03	3.34	8.23	3.68
Shell	3.46	5.64	3.08	3.11
SCP	5.96	5.00	5.92	5.31
YPF	16.18	13.90	8.97	9.07

Note: Results from the estimations of the random coefficients model. Average prices are taken for the whole country, periods and marketing channels, weighted by sales volume per company. Empty cells indicate that there is not enough data for the estimation.

YPF and Oil Combustibles estimated markups were higher than the general average in every region of the country for regular diesel, while Axion had estimated markups that were lower than this average for almost every region with the exception of the Pampeana region. Puma (which is the commercial name of Trafigura S.A.), obtained estimated markups below the general average for every region, while Shell only had estimated markups above average in the Pampeana region.

Oil Combustibles went bankrupt in May 2018. Part of its assets were sold to Gulf, which obtained estimated markups above average in the Pampeana region both for regular and premium diesel.[8] Gulf markups were lower than those of its predecessor, partly because Gulf acquired only part of Oil Combustibles, and because as a new brand it takes time to build loyalty. DAPSA, which acquired the remainder of the assets of Oil Combustibles, obtained above average markups in the Cuyo and Northeast regions for regular diesel. SCP, which acquired DAPSA in December of 2018, obtained above average markups in the Cuyo,

[8]YPF bought the assets of Oil Combustibles in October of 2018, that consisted on 135 flagged outlets, agroservice stations and a refinery, in partnership with DAPSA. The former then sold its part to Gulf in December of 2018.

Northeast, and Pampeana regions, both for regular and premium diesel.[9] SCP markups were higher than markups obtained by DAPSA, as one should expect, because the company increased its overall market share.

Regarding premium diesel, YPF and Axion had markups above general average for every region, while Shell only showed markups above average for the Pampeana region. Oil Combustibles showed markups above average for the Northwest region only. DAPSA did not have significant sales of premium diesel during the period, while SCP obtained markups above average for the Cuyo, Northeast, and Pampeana regions (in the case of SCP, this is a consequence of having previous assets in the oil market apart from those obtained when DAPSA was bought, especially those belonging to Compañia General de Combustibles S.A). Once again, Shell showed markups above average solely for the Pampeana region.

YPF showed a ratio between the highest and lowest markup of 2.8 and 3.4 for regular and premium diesel, respectively. For Axion these ratios amount to 1.6 and 2.7, while for Shell, the ratios were 5.4 and 4.0. SCP showed a ratio of 3.8 in the case of regular diesel and 2.9 in the case of premium diesel.

This ratio is relevant because it helps to strengthen the hypothesis that companies take into account geographical characteristics, among others, when determining prices in the market. It is also important to understand that firms not only achieve different profits in each region for each product, but they are also exposed to distinct variability in their income. This variability depends on the product and the strategy followed in a particular market, which will be conditioned by demand.

The gasoline market showed some differences in terms of the major participants' identities and magnitudes of markups by product, as compared to diesel varieties. YPF, Shell, and Axion are still the top three firms in the market in terms of commercialized volume, but in the gasoline market, Refinor appears as an important actor, followed by SCP.

[9] As mentioned before, the database was updated to take these changes into account, especially those regarding market shares and flagged outlets. DAPSA disappears from database when it was sold to SCP to avoid duplicates with the rest of the companies that were acquired by some other company in the period under analysis.

Table 5: Markups by company and region, for common diesel, period January 2016- July 2019.

	Cuyo	Patagonia	Northeast	Northwest	Pampeana
Axion	6.62	5.90	6.81	4.31	4.40
Dapsa	12.79	.	11.72	.	1.90
Gulf	1.37	.	1.43	.	3.94
Oil Comb.	12.86	9.72	14.18	11.48	5.47
Pampa Energia	5.06	8.47	12.16	.	1.53
PDV Sur	.	.	.	.	0.11
Petrobras	3.29	8.49	17.21	.	1.32
Puma	2.11	3.59	0.94	1.45	1.81
Refinor	.	0.62	0.45	4.08	0.82
Shell	1.70	0.89	4.79	3.02	4.32
SCP	13.35	.	14.67	.	3.85
YPF	24.03	19.25	18.84	16.30	8.64
Average	8.32	7.12	9.38	6.77	3.18

Note: Results from the estimations of the random coefficients model. Average prices are taken for the region, for the period under analysis, weighted by sales volume per company. Empty cells indicate that there is not enough data for the estimation.

Refinor's estimated markups for regular gasoline were the highest for almost every region of the country with the exception of Cuyo. YPF followed Refinor in terms of markup magnitude. This situation is possibly related to the fact that YPF owns 50% of Refinor, and it can influence price decisions. Both Shell and Axion, the second and third companies in importance in terms of annual commercialized volume, showed markups above average in the Pampeana region, and in Cuyo in the case of Axion only. These markups partly result from the traction of economic activity in the capital city, which belongs to the province of Buenos Aires, and is part of the Pampeana region. SCP showed higher markups than DAPSA, which is of particular interest, because as mentioned earlier, SCP bought DAPSA in 2018, increasing its market share and its markups. Other companies' markups tend to reflect the existence of market niches, which are understood as strategic positions of firms on specific commercialization channels and provinces.

For premium gasoline, YPF showed the highest markups for every region, with the exception of the Patagonia region. Refinor followed YPF in terms of markups magnitude. Axion

and Shell, two companies with a relevant commercialized volume in the market, showed significant differences on markups in relation to YPF; in Cuyo, the Axion markup was less than half the YPF markup, while in Patagonia, the Axion markup was about a third of the YPF markup. Shell presents markups below average for every region but the Pampeana region, where it concentrates its major sales. Once again, the rest of the companies in the market exhibit various estimated markups, depending on the region.

YPF exhibits a difference of 6.3 and 5.5 between the markup obtained in the region with the highest markup, and the region with the lowest markup, for regular and premium gasoline, respectively. Refinor showed ratios of 6.3 for regular gasoline and 12.9 for premium gasoline. Shell obtained a difference between the highest and lowest estimated markups of 12.9 and 9.4 for regular and premium gasoline, respectively. Axion's ratios were 5.2 and 3.8. Once again, these results are important because they show the different outcomes of decisions based on unequal starting points regarding infrastructure and localization strategies, among others.

Table 6: Markups by company and region, for premium diesel, period January 2016- July 2019.

	Cuyo	Patagonia	Northeast	Northwest	Pampeana
Axion	12.15	6.53	9.38	7.89	4.48
Dapsa	.	.	.	.	.
Gulf	3.22	.	5.80	.	3.00
Oil Comb.	4.86	.	6.45	12.31	2.55
Pampa Energia	.	5.75	.	.	0.74
PDV Sur	.	.	0.34	.	0.03
Petrobras	.	3.59	.	.	0.74
Puma	3.66	2.08	0.33	0.61	1.19
Refinor	.	.	.	2.79	.
Shell	8.36	2.09	6.57	3.19	5.68
SCP	10.50	.	9.50	.	3.61
YPF	24.00	18.10	14.68	15.16	7.07
Average	9.54	6.36	6.63	6.99	2.91

Note: Results from the estimations of the random coefficients model. Average prices are taken for the region, for the period under analysis, weighted by sales volume by company and product. Empty cells indicate that there is not enough data for the estimation.

Estimated markups differ among regions for a specific company, and among companies in the same region. These differences are related not only to the existence of competition but also to the ability of firms to scatter themselves geographically in order to gain higher market shares and set higher prices, when demand conditions allow it.

Higher concentration levels could lead to higher markups, or to higher levels of market power, as is suggested in the case of SCP, which tends to increase the regions of markup above average in comparison with DAPSA, both in magnitude and comparatively among regions and firms.[10]

Table 7: Markups by company and region, for gasoline, period January 2016- July 2019.

	Cuyo	Patagonia	Northeast	Northwest	Pampeana
Axion	3.25	11.12	7.53	2.12	9.94
Dapsa	3.58	.	9.88	.	6.06
Gulf	0.39	.	0.28	.	4.92
Oil Comb.	2.67	.	9.28	2.81	4.40
Pampa Energia	.	11.46	.	.	1.88
PDV Sur	.	.	.	.	0.15
Petrobras	.	11.70	.	.	2.05
Puma	0.38	6.02	0.95	0.72	2.37
Refinor	.	29.21	16.15	4.66	19.88
Shell	1.34	0.63	5.14	0.69	8.11
SCP	4.00	.	10.21	.	10.20
YPF	6.46	27.37	10.80	4.35	12.39
Average	2.76	13.93	7.80	2.56	6.86

Note: Results from the estimations of the random coefficients model. Average prices are taken for the region, for the period under analysis, weighted by sales volume per company. Empty cells indicate that there is not enough data for the estimation.

It is interesting and important to note that, at the regional level, the same aspects of the situation are not necessarily true, as they are at the aggregate level. In the case of regular gasoline, Refinor shows margins similar to YPF and even higher in four of the five regions, while in the case of premium gasoline, the situation is reversed and YPF shows higher profit margins than the other companies, with the exception of the Patagonia region.

If we visualize the average markup values by region and product, it is clear that in the

[10]DAPSA was fully acquired by SCP in 2018, as mentioned earlier.

Cuyo, Northeast, and Northwest regions the markups of diesel fuels are higher than the markups of gasoline, while in the Patagonia and Pampeana regions, the average markups of gasoline are higher than the average markups of diesel fuels.

Table 8: Markups by company and region, for premium gasoline, period 2016-2020.

	Cuyo	Patagonia	Northeast	Northwest	Pampeana
Axion	2.57	8.97	6.15	2.38	8.98
Dapsa	3.61	.	7.39	.	7.35
Gulf	0.65	.	.	.	5.07
Oil Comb.	0.90	.	3.65	2.21	1.78
Pampa Energian	.	5.96	.	.	1.05
PDV Sur	.	.	.	.	0.04
Petrobras	.	6.49	.	.	1.19
Puma	0.06	2.59	0.14	0.20	1.07
Refinor	.	29.67	8.44	2.30	10.94
Shell	1.52	1.43	4.81	0.90	8.44
SCP	3.54	.	9.69	.	10.25
YPF	6.46	27.01	10.97	4.95	12.68
Average	2.41	11.73	6.41	2.16	5.74

Note: Results from the estimations of the random coefficients model. Average prices are taken for the region, for the period under analysis, weighted by sales volume by company and product. Empty cells indicate that there is not enough data for the estimation.

5 Conclusions

The demand for the major products traded in the liquid fuels market in Argentina is clearly concentrated, and this concentration increases if local markets are considered. At the regional level, the number of companies operating is significantly reduced compared to nationally, where all firms are considered. This phenomenon intensifies as one moves away from the country's capital city. The demand faced by the wholesale fuel market is conditioned by different factors, among which are unobserved characteristics of the product (such as the contractual form assumed by the operators or owners of gas stations with the brand, the requirements to be able to operate under a certain flag, average duration of the contracts, and specific promotions by segment, among others) and observed characteristics (such as the

benefits associated with each brand: loyalty cards, discounts for bank promotions for end consumers, number of flagged service stations, and geographic location of the points of sale, among others). The companies take these factors into account when determining the prices of their products and apply specific profit margins by product and region. The exercise of market power, measured by the value acquired by the Lerner index, by region and flag, is linked to the companies' market share. This exercise of market power enables companies to set prices higher than those set by their competitors, by virtue of the differential in regional market shares, and characteristics of the products offered, as well as the retail demand they face. These factors imply that service station owners will pay greater prices based on their location, not necessarily because a company must deal with higher cost of provision, but because they deal with relatively low competition levels. Thus, the competition level will affect final consumers' welfare, who will pay prices that includes not only wholesale competitors' margins but the service station's profits as well.

Data analyzed included Oil Combustibles' bankruptcy and its assets distribution between YPF and DAPSA, and DAPSA's subsequent merger with Sociedad Comercial del Plata (SCP), among others changes in the market. These factors are important because information was treated considering real time occurrence and not its registration. It was also relevant to determine real flagged outlets, since retail database presented severed outdated information in relation to real flag (i.e., company responsible for supply). This is really a contribution to understanding Argentine liquid fuels wholesale performance under a period of no regulation in which mergers and acquisitions took place, under which average markups increased as showed in the case of SCP.

The application included a novel way of determining outside option magnitude based on the difference between potential sales for the market as a whole and actual sales. Hopefully, this paper will enrich discussions about how prices are determined in the wholesale chain, and how that determination affects both the retail segment and the consumers. The analysis relies on obtaining consistent estimates of demand parameters and correctly specifying cost

structures. Further studies should take into account different cost structures among companies, as well as various utility (or profit) functions to characterize service station demands. It would also result of interest to reply the analysis to other Latin American countries as Brazil, Chile or Peru, whose large territory may configure the opportunity of strategic location for companies in order to obtain greater markups from the relatively isolation of their clients.

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Appendix

The results of the demand estimates for each product and region resulting from applying the random coefficients model specified by Swamy (1970), instrumented using the tools specified in Section 3, can be viewed below.

Table A-0.1: Results of the random coefficients model by region: Diesel.

	Price	Premium	Reward Card	Wholesalen competitors	Flagged outlets	Urbanization	Log vehicle fleet.	Cons.
Cuyo	-0.08***	0.77***	-0.50***	-0.58***	1.88***	-6.62***	-0.31***	16.31***
Patagonia	-0.10***	0.64***	-0.66***	-0.60***	1.46***	-4.95***	0.08	11.53***
Northeast	-0.10***	1.00***	-0.03	-0.59***	2.78***	2.78***	0.01	4.94***
Northwest	-0.12***	0.87***	-0.66***	-0.55***	3.02***	-3.79***	-0.17***	13.37***
Pampeana	-0.16***	1.09***	0.51***	-0.30***	2.42***	2.64***	-0.20***	9.14***

Table A-0.2: Results of the random coefficients model by region: Gasoline.

	Price	Premium	Reward Card	Wholesalen competitors	Flagged outlets	Urbanization	Log vehicle fleet.	Cons.
Cuyo	-0.31***	1.32***	1.32***	-0.93***	-0.27	-18.31***	-0.67***	39.00***
Patagonia	-0.07***	0.49***	-0.11	-0.75***	1.51***	-5.69***	0.22***	9.08***
Northeast	-0.14***	0.62***	0.62***	-0.78***	1.29***	0.88	0.24***	5.50*
Northwest	-0.36***	1.52***	2.06***	-1.69***	3.01***	-6.26***	-0.13	24.97***
Pampeana	-0.10***	0.28***	0.71***	-0.41***	1.19***	-2.41***	0.09***	8.20***