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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's 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.

JEL: C52,L13,L71.

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, Argentina became a net importer of crude oil and most of its by-products, according to the Energy Balance published by the National Energy Secretariat. 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 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 the cutting of 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 one 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 governments in determining them have not responded to the same criteria throughout the different political cycles.

At the beginning of 2016, the government of Mauricio Macri carried out measures aimed

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

at reducing the gap between local and international prices. The liberalization of tariff prices, towards the end of 2017, 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 had a direct impact on 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 different 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. It is expected to contribute to the understanding of the economic mechanisms that guide the decisions of the 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 2016/2020 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 that entails the strategies carried out by the companies in relation to after-sales services and the location of their points of sale, specific contractual supply clauses, among others.

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

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 allows working simultaneously with supply and demand components. These works highlight that the market presents oligopoly characteristics giving rise to the need for regulation in order to make private and social interests compatible (Coloma, 2002).

Other approaches used 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 allows corroborating 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) analyzes the pass-through of international prices to domestic fuel prices, through the use of multivariate dynamic models, 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's findings, and also point out that in the 2005-2016 period 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. The paper concludes that the elements that best predict 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 study the linkage of equilibrium prices with variables typically related to price determinants in this market. None of these approaches allows us to provide an answer to the price difference that exists within the territory between the different flags or companies and localities for each of the by-products marketed.

Fuels may not be considered a perfectly homogeneous good if we take into account the product differentiation tools used by the different companies to build customer loyalty and the specific characteristics of each banner or company, as well as their geographic location strategy, the modality and 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 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 is the premise that 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 offer in the market.

Brenner (2001) analyzes the main determinants of market power. These include the possibility of applying price discrimination, the existence of markets with few suppliers, aggressive advertising tools, 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, can be estimated using market-level information, and allow 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 the set of individuals, taking into account the observed characteristics of the product, and the unobserved characteristics, which enter the utility function through a term that contemplates the unobserved variability among individuals, characterized by a specific density function. The estimation can be carried out with aggregate market prices and quantities, in conjunction with a set of data characterizing the goods. The approach allows to deal 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). 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 generalization 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 notions linked to the geographical location of the participants into the differentiated products 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, so as to make the available estimation models more flexible and richer. These authors show that, under certain circumstances, it is possible to empirically differentiate the different 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 different companies would have on the market, under different assumptions regarding the way in which individuals choose on each purchase occasion. Recent studies by Michel and Weiergraeber (2018) analyze industry behavioral patterns over time and heterogeneity among firms under the structural approach, taking into account flexible behavioral patterns from the supply side. The authors develop 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, or 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 to be 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. It details the treatment of the information used as well as the estimation results. Section 5 presents the conclusions reached and proposes lines of work to be developed.

2 The Model

The theoretical base model used in the paper is derived from the model proposed by Berry (1994) and Berry, Levinsohn, and Pakes (1995). 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).

General Aspects. As it 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 usually 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

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

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 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) suggests using a model of random coefficients per individual. This approach generates more reasonable substitution patterns. 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 allows to deal 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 merge or fusion 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

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

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

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

or equivalent

$$p_j = c_j + s_j / |\partial s_j / \partial p_j|. \tag{7}$$

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 $\boldsymbol{q}_j(\mathbf{z}, \xi, \omega, \theta) = \mathbf{M} s_j(\mathbf{x}, \xi \boldsymbol{p}(\mathbf{z}, \xi, \omega, \theta), \theta_{\mathbf{d}})$.

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.

Then, 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 $s_j = \mathscr{s}_j(\delta)$. Then, 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 will allow 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 are independent and identically distributed across consumers and across markets, under an extreme type I distribution, the market shares function has analytical form given by

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

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, Pampeana. This implies assuming that the individuals that 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 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 taking into account 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, in order 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. 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, 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, offering a product similar to that of the competition, 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 different banks, points cards, 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, which represents an advantage for gas stations' owners. Likewise, the presence of the brand (quantity and extension) in the different markets allows the final consumer to take advantage of the benefits associated with the flags that have customer loyalty instruments. This is why it is observed that the companies with the greatest presence in the country are those that have 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 their regular and premium versions. To illustrate this, 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	6505.49	6775.33	6100.92	6732.62

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 is an incentive to analyze market power and, if so, 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.

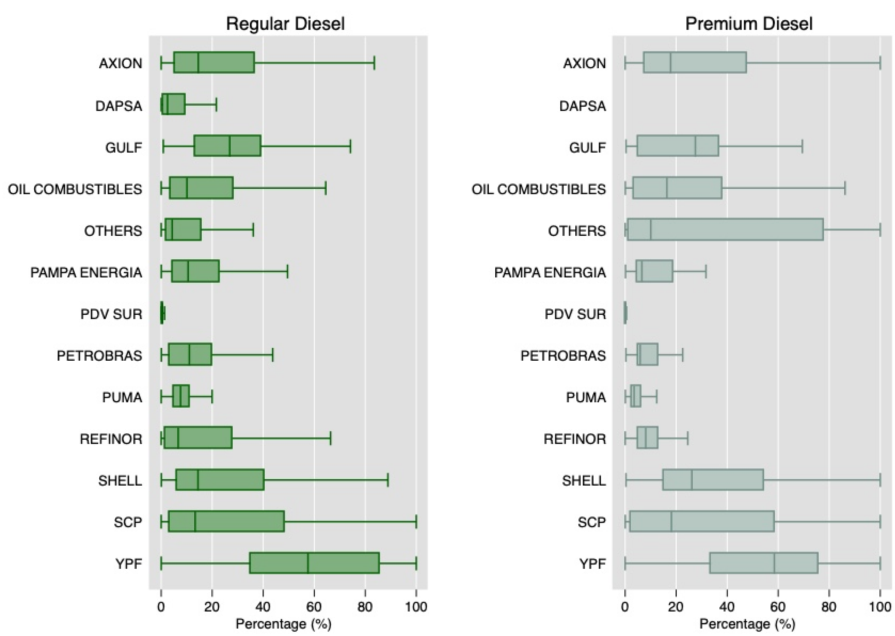

Figure 1: Distribution of market shares by company, for regular and premium diesel.

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).

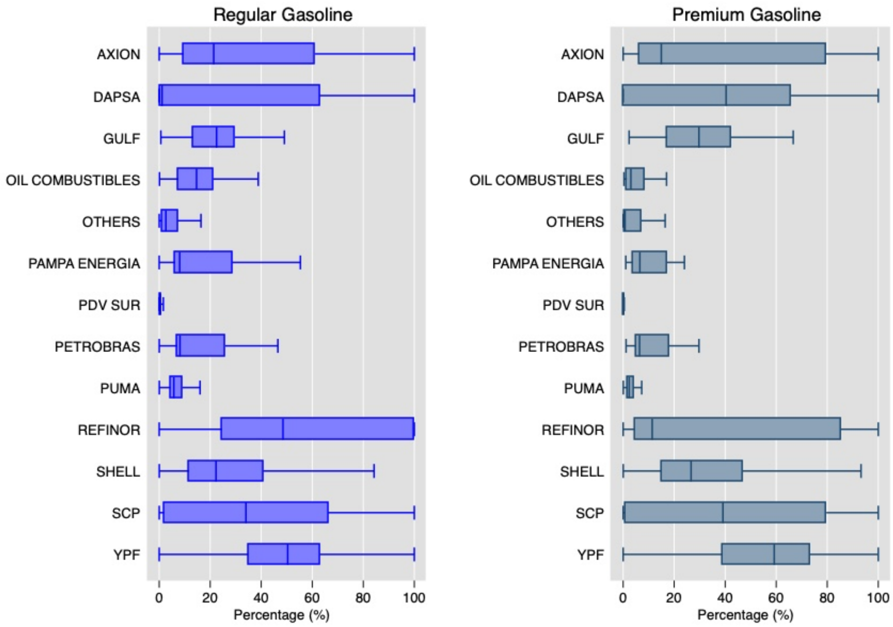

Figure 2: Distribution of market shares by company, for regular and premium gasoline.

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. It is also possible to note the difference in market 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 to carry out the study was 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 amount of outlets per company and period, in the country as a whole and at the provincial level were calculated in an effort to latter obtain a measure of geographical presence for each firm. The gas stations of the retail base were grouped in such a way they properly reflect the change in the companies in charge of supplying fuel, regardless delays on times of registration. This mainly attending to the acquisition of the assets of the Petrobras banner by Pampa Energia S.A. in July 2016, and its subsequent sale to the company Trafigura S.A. (who 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 others) by province 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 were smaller than prices net of taxes, they were edited using the Manual provided by the the National Energy Secretariat to recalculate net price.

[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.

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 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 conveniently 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, since it is understood that in such cases, there is no negotiation between the parties, and it is in fact a direct sale in the retail chain, and there are no competitors.

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 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 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

[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.

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. Such 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. In the case of gasoline, for which two instruments are used, it is also verified that the over-identification test is met.

Definition of external good. The definition of external good used 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 merge, since the potential sales of the year of the merger, which in the period under study occurs before 2020, are compared against the year immediately after in which the company is already operating as such, so as 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 region) is presented. Panels by region were used simply 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, e.g. 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. Sales to own stations of the same flag are not included in the analysis.

The following variables were included in the estimates: price (average without taxes in constant currency, weighted by sales volume), premium (quality indicator), points card (indicating the existence of a customer loyalty card associated with benefits for larger purchases), number of wholesale competitors (number of wholesale companies that sell in the province), (number of gas stations in the province), urbanization (urbanization rate in the province), pandemic (control for pandemic months included in the study), Alberto Fernandez's presidency (indicator of the change of presidential administration in the study period), and logarithm of the number of vehicle registrations (with variability by province and year). Control variables by region are also included for the general estimation by OLS and for 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 it is expected that 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 level of urbanization decreases the probability of purchase, simply because it decreases the relative distances of automobile travel, and in the case of diesel fuels, it reduces the possibility of sales to the agricultural sector, whose machinery uses this fuel. As expected, the crisis generated by Covid-19 had adverse effects on the demand for all fuels in general and for diesel fuels in particular, due to the reduction in traffic associated with the sanitary measures adopted. 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 allows 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. There, 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 Pampena region, i.e., a higher price elasticity of demand. In this region, unlike other regions, the existence of a customer loyalty card increases the probability of sale substantially. This is not the case in the Cuyo, Patagonia or Northwest regions. The increase in the number of wholesale competitors has a more attenuated effect in the Pampeana region compared to the rest of the country.

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 points card increases the likelihood of purchase for the

Table 2: Diesel

	(1) OLS	(2) IV	(3) RC
Price	-0.03***	-0.10***	-0.10***
Premium	0.28***	0.69***	0.72***
Reward Card	0.10***	0.10***	-0.04
Wholesale competitors	-0.34***	-0.38***	-0.48***
Flagged outlets(%)	1.78***	1.83***	2.13***
Urbanization	-0.96***	-1.25***	-0.69
Pandemic	-0.30***	-0.37***	-0.51***
Alberto Fernandez Turn	-0.41***	-0.28***	-0.19**
Vehicle fleet (log)	0.05***	0.01	0.00
Constant	4.63***	7.89***	7.67***
Observations	20754	20754	20754

Region controls: Cuyo, Pampeana, Patagonia, NOA and NEA in (1) and (2).

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

flags substantially. The number of competitors 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 in the case of diesel fuels, although in the case of gasoline this phenomenon is of greater magnitude (almost double in absolute value). 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 urbanization rate is not a significant variable. The pandemic was associated, as with diesel fuels, with a lower demand for gasoline, but the impact on gasoline demand is greater in magnitude (at least double) than in the case of diesel fuels. As with diesel fuels, the variability in the vehicle fleet in the period under analysis 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 allows 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 region, in relation to the other regions, that is, a higher price elasticity of demand. The existence of a points card with benefits for customers does not seem to have any effect in the Patagonia region, and neither in the Northwest region, being statistically insignificant in both regions. As in the case of diesel fuels, the number of wholesale competitors decreases the probability of purchasing a particular flag, but this effect is lower in absolute value in the Pampeana region.

Table 3: Gasoline

	(1) OLS	(2) IV	(3) RC
Price	0.00	-0.19***	-0.17***
Premium	-0.15***	0.79***	0.60***
Reward Card	0.30***	0.68***	0.46*
Wholesale competitors	-0.38***	-0.67***	-0.74***
Flagged outlets(%)	1.53***	1.11***	1.31***
Urbanization	-1.65***	-3.02***	-3.03
Pandemic	-0.73***	-0.88***	-1.00***
Alberto Fernandez Turn	-0.51***	-0.58***	-0.43***
Parque automotor (log)	0.11***	0.04	-0.02
Constant	3.15***	12.75***	13.25***
Observations	12882	12882	12882

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 country as a whole, under the random coefficients model, a greater market power can be seen in the common varieties in relation to the premium varieties, which is intuitive, considering that the premium varieties have an immediate substitute of inferior quality. The YPF flag presents higher markups in relation to the rest of the flags for all the products analyzed, being the flag with the highest average market share in the country as a whole. Then, among the companies with the highest Lerner Index for common diesel are Oil Combustibles, Gulf, and Sociedad Comercial del Plata (SCP); for premium diesel, Axion, SCP, Gulf; 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, which is 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.[6]

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. In the case of gasoline, Cuyo and Northwest regions had lower margins on average than the rest of the regions.

In the case of regular diesel, the company that dominates the market, YPF, increased two times its estimated markup between the region with the highest and lowest markup (Northwest and Pampeana regions, respectively). This tends to confirms the hypothesis that companies take into account geographical characteristics, among others, when determining prices in this market. Similar results were obtained for premium diesel.

YPF and Oil Combustibles estimated markups were higher than the general average in every region of the country for regular diesel, while Axion got estimated markups that were lower than this average for almost every region with the exception of Pampeana region.

[6]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 2016-2020.

	Markups: $\frac{p_{jt}-c_{jt}}{p_{jt}}$			
	Diesel	Premium Diesel	Gasoline	Premium Gasoline
Axion	5.82	7.45	5.83	5.38
Dapsa	4.27	.	4.64	5.01
Gulf	8.18	6.17	3.81	4.61
Oil Comb.	10.12	5.99	4.29	2.14
Others	5.01	7.92	2.37	1.78
Pampa Energia	3.36	3.23	1.90	1.07
PDV Sur	0.12	0.04	0.10	0.02
Petrobras	3.54	2.02	1.99	1.14
Puma	2.95	2.14	1.94	0.88
Refinor	4.57	3.62	8.38	3.77
Shell	3.97	6.16	3.24	3.26
SCP	7.08	6.32	6.38	5.93
YPF	17.64	15.44	9.80	9.63

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.

Puma (which is the commercial name of Trafigura S.A.), obtained estimated markups below general average for every region, while Shell only got estimated markups above average in Pamapeana region. Oil Combustibles went bankrupt in May 2018. Part of its assets were sold to Gulf, which obtained estimated markups above average in Pampeana region only for regular diesel.[7] DAPSA, which acquired the rest of the assets of Oil Combustibles, obtained above average markups in Cuyo and Northeast regions. Then, SCP, which acquired DAPSA in December of 2018, obtained above average markups in Cuyo, Northeast and Pampeana regions[8].

Regarding premium diesel, YPF and Axion got markups above general average for ev-

[7]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.

[8]As mentioned before, the database was updated to take these changes into account, specially those regarding market shares and flagged outlets. DAPSA disappears from database when 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.

ery region, while Oil Combustibles got markups above average for Northwest region only. DAPSA did not have significant sales of premium diesel during the period, while SCP and Gulf obtained markups above average for 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, specially those belonging to Compañia General de Combustibles S.A.) Once again, Shell showed markups above average solely for Pampeana region.

For both regular and premium diesel, YPF (the largest firm in the market), showed a difference of about three times between the markup obtained in the region with the highest markup, and the region with the lowest markup, as mentioned previously. SCP showed a bigger difference between its biggest and lowest estimated markups, whose ratio reached a value of 3.6 in the case of regular diesel and 4.7 in the case of premium diesel. For Axion Energy these ratios amount to 1.9 and 3.0 respectively, while for Shell Company, the ratios were 4.2 and 2.6. This 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 do not only get different profits in each region for each product, but they are also exposed to distinct variability in their income. This variability would depend on the product and the strategy followed in a particular market, which will be conditioned by demand itself.

Gasoline market showed some differences in terms of main participants identities and magnitudes of markups by product, as compared to diesel varieties. YPF estimated markups for regular and premium gasoline were higher than the average in every region of the country, while Refinor got estimated markups above the average for almost every region with the exception of Cuyo region, both for regular and premium gasoline. For regular gasoline, Refinor got markups that exceeded those estimated for YPF. Puma obtained estimated markups below average for every region both for regular and premium gasoline. Axion got markups above average for Cuyo and Pampeana regions for regular gasoline, while it

Table 5: Markups by company and region, for common diesel, period 2016-2020.

Markups: $\frac{p_{jt}-c_{jt}}{p_{jt}}$					
	Cuyo	Patagonia	Northeast	Northwest	Pampeana
Axion	5.98	7.78	6.70	7.08	4.09
Dapsa	11.51	.	11.83	.	1.97
Gulf	7.67	.	5.26	.	5.26
Oil Comb.	11.57	13.84	14.32	19.48	5.67
Pampa EnergÃŋa	4.55	12.06	12.29	.	1.58
PDV Sur	.	.	.	.	0.12
Petrobras	2.96	12.09	17.38	.	1.37
Puma	3.09	4.99	2.12	1.41	1.68
Refinor	.	0.89	0.45	6.57	0.83
Shell	1.49	1.18	4.37	4.94	4.38
SCP	12.51	.	14.73	.	4.07
YPF	19.95	24.85	17.98	25.54	8.59
Average	8.13	9.71	9.77	10.84	3.30

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.

showed estimated markup above average for Northwest and Pampeana regions. Shell only got estimated markups above average in Pamapeana region, both for regular and premium gasoline, which apparently would be showing a strategy of retreat towards a primary market. Once again, the rest of the companies in the market, exhibit various estimated markups, depending on the product analyzed and the region observed.

YPF exhibit a difference of 4.4 and 4.2 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 5.0 for regular gasoline and 10.1 for premium gasoline. Shell got values of 15.9 and 8.3 for regular and premium gasoline, respectively. SCP showed a relative smaller difference between its biggest and lowest estimated markups for regular and premium gasoline: the ratio reached a value of 3.2 and 3.8 respectively. 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 2016-2020.

	Markups: $\frac{p_{jt}-c_{jt}}{p_{jt}}$				
	Cuyo	Patagonia	Northeast	Northwest	Pampeanaa
Axion	9.82	8.69	8.71	12.20	4.05
Dapsa	.	.	.	.	.
Gulf	9.59	.	7.76	.	3.35
Oil Comb.	4.37	.	6.51	20.87	2.64
Pampa En.	.	8.19	.	.	0.76
PDV Sur	.	.	0.35	.	0.03
Petrobras	.	5.11	.	.	0.76
Puma	1.42	2.71	0.39	0.56	1.01
Refinor	.	.	.	4.51	0.47
Shell	6.95	2.66	5.92	4.98	5.59
SCP	11.08	.	16.97	.	3.62
YPF	20.46	23.72	14.23	24.11	7.08
Average	9.10	8.51	7.61	11.21	2.67

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. This is 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 higher levels of market power, as it suggests the case of SCP, which tends to increase the regions of markup above average in comparison with DAPSA itself, both in magnitude and comparatively among regions and firms.[9]

It is interesting to note that, at the regional level, the same is not necessarily true as at the aggregate level. In the case of regular gasoline, Refinor shows margins similar to

[9]Which was fully acquired by SCP in 2018, as mentioned before.

Table 7: Markups by company and region, for gasoline, period 2016-2020.

	Markups: $\frac{p_{jt}-c_{jt}}{p_{jt}}$				
	Cuyo	Patagonia	Northeast	Northwest	Pampeanaa
Axion	3.52	13.17	6.87	3.08	12.49
Dapsa	3.86	.	9.09	.	8.04
Gulf	2.06	.	1.27	.	9.04
Oil Comb.	2.88	.	8.54	4.26	5.85
Pampa Energia	.	12.67	.	.	2.50
PDV Sur	.	.	.	.	0.19
Petrobras	.	12.93	.	.	2.72
Puma	0.60	7.52	1.10	0.80	3.17
Refinor	.	32.30	14.86	6.41	26.41
Shell	1.35	0.65	4.36	1.04	10.31
SCP	4.12	.	9.40	.	13.03
YPF	6.67	28.28	9.74	6.39	15.88
Average	3.13	15.36	7.25	3.66	9.14

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.

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 Cuyo, Northeast and Northwest regions the markups of diesel fuels are higher than the markups of gasoline (more than double), while in the Patagonia and Pampeana regions, the average markups of gasoline are higher than the average markups of diesel fuels. It is important to clarify that the volume marketed in the case of gasolines is substantially higher than that of diesel fuels, since more than 75% of the sales volume for the period are gasolines.

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

	Markups: $\frac{p_{jt}-c_{jt}}{p_{jt}}$				
	Cuyo	Patagonia	Northeast	Northwest	Pampeanaa
Axion	2.78	10.64	5.46	3.44	11.20
Dapsa	3.88	.	6.80	.	9.76
Gulf	3.35	.	14.75	.	9.18
Oil Comb.	0.97	.	3.35	3.34	2.36
Pampa EnergÃŋa	.	6.59	.	.	1.40
PDV Sur	.	.	.	.	0.06
Petrobras	.	7.17	.	.	1.58
Puma	0.12	2.95	0.14	0.14	1.43
Refinor	.	32.80	7.76	3.26	14.54
Shell	1.53	1.49	4.04	1.28	10.58
SCP	3.54	.	9.39	.	13.41
YPF	6.51	27.57	9.70	7.01	15.80
Average	2.84	12.74	6.82	3.08	7.61

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 main products traded in the liquid fuels market in Argentina is clearly concentrated. This concentration increases if local markets are considered. At the regional level, the number of companies operating is significantly reduced. 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, specific promotions by segment, among others) and observed characteristics (such as the benefits associated with each brand: points cards, discounts for bank promotions for end consumers, number of flagged service stations, geographical 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 allows 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.

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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 Card	Competition in province	Fraction of Gas Stations in province	Urbanization	Pandemic	A. Fernandez	Log vehicle fleet.	Cons.
Cuyo	-0.08***	0.63***	-0.26***	-0.50***	1.43***	1.88	-0.54***	-0.01	0.08	4.94**
Patagonia	-0.07***	0.52***	-0.52***	-0.55***	1.53***	-5.03***	-0.61***	-0.30***	0.05	11.12***
Northwest	-0.10***	0.87***	0.12	-0.57***	2.38***	1.75*	-0.57***	-0.13	0.08	5.50***
Northeast	-0.07***	0.49***	0.02	-0.49***	2.90***	-3.86***	-0.60***	-0.22***	-0.03	8.94***
Pampeana	-0.15***	1.02***	0.41***	-0.30***	2.40***	1.63***	-0.26***	-0.27***	-0.19***	7.89***

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

	Price	Premium	Reward Card Card	Competition in province	Fraction of Gas Stations in province	Urbanization	Pandemic	A. Fernandez	Log vehicle fleet.	Cons.
Cuyo	-0.30***	1.31***	1.19***	-0.73***	-1.11***	-1.84***	-1.57***	0.15	-0.18**	18.50***
Patagonia	-0.08***	0.42***	-0.02	-0.68***	1.16***	-10.53***	-0.70***	-0.37***	-0.15**	18.30***
Northwest	-0.18**	0.56***	0.53*	-0.82***	1.86***	1.86	-1.23***	-0.65***	0.14**	7.59***
Northeast	-0.22***	0.70***	0.09	-1.13***	3.27***	-3.91***	-0.68***	-0.59***	-0.07	17.27***
Pampeana	-0.07***	0.12	0.54***	-0.34***	1.02***	-2.45***	-0.79***	-0.58***	0.08***	7.22***