FACULTAD DE CIENCIAS ECONÓMICAS Y DE ADMINISTRACIÓN
IECON INSTITUTO DE ECONOMÍA
UNIVERSIDAD DE LA REPÚBLICA URUGUAY

Mark ups and pass-through in small and medium retailers for rice, tomato sauce and oil

Pablo Blanchard

INSTITUTO DE ECONOMÍA
Serie Documentos de Trabajo

Noviembre, 2023
DT 20/23

ISSN: 1510-9305 (en papel)
ISSN: 1688-5090 (en línea)

Este documento surge de uno de los capítulos de mi Tesis de Doctorado en Economía del DECON, FCS, UDELAR. Agradezco a mis tutores Sebastián Fleitas y Fernando Borraz por su apoyo y dedicación en este proceso. Todos los errores u omisiones son mi entera responsabilidad. Durante mi doctorado recibí apoyo financiero de la Comisión Académica de Posgrados (CAP – CSIC – UDELAR).

Forma de citación sugerida para este documento: Blanchard, P. (2023) “Mark ups and pass-through in small and medium retailers for rice, tomato sauce and oil”. Serie Documentos de Trabajo, DT 20/2023. Instituto de Economía, Facultad de Ciencias Económicas y Administración, Universidad de la República, Uruguay.

Mark ups and pass-through in small and medium retailers for rice, tomato sauce and oil

Pablo Blanchard *

Resumen

En este artículo, recuperamos y descomponemos los márgenes de ganancia y estimamos el pasaje del costo a los precios en comercios minoristas pequeños y medianos en Uruguay para aceite, salsa de tomate y arroz, utilizando un modelo estructural de demanda y supuestos sobre el comportamiento competitivo de los productores. El poder de mercado de estos productos está bajo estudio de la Comisión de Promoción y Defensa de la Competencia desde 2016, y la metodología propuesta permite profundizar en la medición y comprensión del origen de ese poder de mercado. Además de proporcionar un insumo fundamental para las políticas de defensa de la competencia en Uruguay, este estudio contribuye a la literatura académica internacional al aportar evidencia sobre el pasaje de costos a precios en una economía en desarrollo con un poder de mercado potencialmente mayor que el de los países desarrollados. Los márgenes para el aceite y la salsa de tomate son de alrededor del 25% para el supuesto de competencia a la Nash Bertrand y del 50% para el supuesto de colusión, mientras que para el arroz son del 36% y el 75% respectivamente. Por su parte, alrededor del 65% del poder de mercado bajo el supuesto de Nash Bertrand se explica por la capacidad de las empresas para diferenciar productos y el 35% por la estructura de propiedad en el caso del aceite y la salsa. En el caso del arroz, el 49% se explica por diferenciación y el 51% por estructura de propiedad. Finalmente, las tasas de pasaje son bajas para los tres productos, siendo bajo ambos supuestos de comportamiento inferiores al 55% para los tres productos.

Palabras clave: Poder de mercado, Pasaje de costos a precios, Modelo de elección discreta, Diferenciación de producto

Código JEL: D43, L11, L81

Abstract

In this paper, we recover and decompose markups, and estimate the pass-through rates from cost to prices in small and medium retail stores for oil, tomato sauce, and rice in Uruguay using a structural model of demand and assumptions about the competitive behavior of producers. The market power for these products has been under the Commission of Promotion and Defence of Competence study since 2016, and the proposed methodology allows for deepening in the measure and the understanding of the origin of that market power. In addition to providing a fundamental input for competition defense policies in Uruguay, this study enhances the international academic literature by contributing evidence on cost-to-price pass-through in a developing economy with potentially greater market power than that found in developed countries. The markups for oil and tomato sauce are around 25% for Nash Bertrand competition assumption, and 50% for the collusion assumption, while for rice are 36% and 75% respectively. For its part, about 65% of the market power under Nash Bertrand assumption is explained by the ability of firms to differentiate products and 35% for the ownership structure in the case of oil and sauce. In the case of rice, 49% are explained for differentiation and 51% for ownership structure. Finally, the pass-through rates are low for the three products, being under both behavioral assumptions lower than 55% for the three products.

Keywords: Market Power, Cost Pass-Through, Discrete choice models, Product differentiation

JEL Classification: D43, L11, L81

(*) Email: pablo.blanchard@fcea.edu.uy; IECON, FCEA Universidad de la República, Montevideo, Uruguay. Orcid id: 0000-0002-0772-391X

1 Introduction

In the last years, the formation of prices for articles of the basic basket has been in the public debate in Uruguay and there have been incipient efforts by the Commission for the Defense and Promotion of Competition (CDPC) to analyze the existence of anti-competitive practices in these markets. In particular, in 2016 the commission carried out an analysis of price formation for a series of specific products (oil, rice, tomato sauce, and bread), on which it wanted to know the market power exercised by firms and the possible existence of anti-competitive practices in price formation.[1]

As a result of this analysis, implemented from descriptive statistics on quantities sold, consumer prices, and prices paid by the supermarket chain to the producers, the margins of the main supermarket chains for these products are known, as well as a general characterization of concentration in each market (Czarnievicz and Zipitría (2018)). However, as the report points out, it is difficult to deepen the analysis with this methodology.

This paper seeks to delve into the analysis of price formation, market power, and pass-through from cost to price for 3 of the aforementioned items: oil, rice, and tomato sauce. In particular, the markups and the capacity of the production firms to transfer cost shocks to prices (pass-through) consistent with the demand information and different assumptions about the way in which the production firms compete are estimated. For its part, it breaks down market power into two sources: generated by product differentiation and generated by the fact that firms offer different varieties of the same product (portfolio effect). In addition to providing a fundamental input for competition defense policies in Uruguay, this study enhances the international academic literature by contributing evidence on cost-to-price pass-through in a developing economy with potentially greater market power than that found in developed countries.

The analysis focuses on producers and there is information on quantities and sales prices for small and medium-sized retail stores from April 2016 to January 2018. We estimate a structural model of demand for differentiated products according to the methodology proposed by Berry et al. (1995) (BLP approach), using information on prices and quantities, relieved from scanning at the time of purchase. The demand estimate is then used in conjunction with different assumptions about competition among firms to recover marginal costs and markups. Following the methodology of Nevo (2001), the different estimated marginal costs and markups are compared with each other and with descriptive statistics of production costs from other sources of information to separate between different sources that explain the observed margins. Finally, it is analyzed how different simulated cost shocks are transferred to

[1] Resolution No. 31/016: https://www.gub.uy/ministerio-economia-finanzas/institucional/normativa/resolucion-n-31016-asunto-12-2016-estudio-preparatorio-mercados-productos

sales prices by firms.

In terms of the relevance of the problem addressed, measuring the capacity of firms to increase their price above the marginal cost of production is a central problem in the literature on industrial organization and is usually the measure used to analyze the market power that a firm can exercise. For its part, the pass-through from costs to prices is an issue of great importance for understanding price formation at the microeconomic level and developing competition defense policies. Understanding how firms transfer increases in their costs to prices and how these increases depend both on the behavior of firms and demand is a relevant problem in economics.

On the one hand, the article is related to the empirical literature that focuses on the analysis of firms' market power, usually understood as the ability of firms to increase prices above the marginal costs. This is also a key concern for competition policy, not only in terms of the measure itself but also what is the origin of this market power (Bet (2021)). As market power is a function of demand and cost primitives, but also of the firm conduct, its estimation presents several difficulties. Some literature has focused on how to distinguish between competing oligopoly models based on an IV approach (e.g, Bresnahan (1982), Berry and Haile (2014), Duarte et al. (2021)). As is pointed out in Bet (2021), identifying firm conduct following this approach is difficult because of the nature of the required instruments, which often are weak. There is also the production function approach (Hall (1988), De Loecker and Warzynski (2012), De Loecker et al. (2016), De Loecker and Scott (2016), Raval (2020), Doraszelski and Jaumandreu (2019), among others) which relies on production data, and some recent efforts to use simultaneously both approaches (Bet (2021), De Loecker and Scott (2016)). Finally, Nevo (2001) or Slade (2004) use information on production cost from another source and compare it with the results obtained from the demand estimation and observed prices, and different competing oligopoly models. This last alternative is followed in this article due to the fact that the Uruguayan market is very concentrated and there are few firms producing each item, so it is not possible to reliably apply the production function approach.

On the other hand, this article is related to a strand of empirical and theoretical literature that addresses the pass-through from costs to prices from the industrial organization literature. As pointed out in Kim and Cotterill (2008), the first theoretical antecedents of this literature focus on the cases of perfect competition and monopoly. In the first case, the pass-through from costs to prices is determined by the elasticities of supply and demand, being greater the more inelastic the demand and the more elastic the supply, reaching one hundred percent when the supply is infinitely elastic. For its part, in the case of a monopoly, the pass-through of costs to prices depends on the slope of the demand curve and the elasticity of the cost function to changes in quantity. Bulow and Pfleiderer (1983) show that, if marginal cost is constant and demand is linear, the cost-to-price pass-through coefficient for a monopoly is fifty percent. In Weyl and Fabinger (2013) it is shown that, under different assumptions about the cost function and the curvature of the demand function, the pass-through of costs to prices in monopoly is not bounded, and may be greater than one hundred or less than fifty percent.

As a way to overcome the limitations implied by assuming perfect competition or monopoly, several studies have theoretically analyzed the pass-through from costs to prices in the presence of imperfect competition (Stern (1987), Katz and Rosen (1983), Delipalla and Keen (1992)), but focusing on homogeneous products and competition in quantities.

Among the most relevant theoretical antecedents of works that have focused on the pass-through of costs to prices in markets with differentiated products are the works of Anderson et al. (2001), where the incidence of taxes in an oligopolistic industry is analyzed when competing for prices in differentiated markets and Froeb et al. (2005), where the effect of company mergers on prices is analyzed.

On the other hand, there are theoretical antecedents from the marketing literature, among which Moorthy (2005) stands out, who proposes a comparative static analysis of the pass-through from costs to prices for retailers, when there are multiple retailers competing and each one sells multiple varieties of a product. By incorporating multiple varieties of each product, the dimension of the retailer is introduced as a manager who is interested in the joint profits derived from the sales of the different varieties of a product. The paper focuses on how different types of cost changes (distinguishing for example between aggregate, brand-specific, and store-specific shocks), as well as inter-retailer and inter-brand competition, affect the pass-through from costs to prices.

There is also literature that empirically addresses this problem, mostly through reduced-form analyses with industry-level data (Sullivan (1985); Karp and Perloff (1987); Besley and Rosen (1999)). Regarding the empirical antecedents that use structural models, two works stand out for their proximity to the methodology that will be used. In the first place, the work of Nevo (2001), in which market power in the cereal industry for the United States is studied, estimating a demand system for differentiated goods at the brand level and using the estimated parameters together with assumptions about competition between producers to recover marginal costs and profit margins. Second, the Kim and Cotterill (2008) study, which constitutes the empirical background most directly related to the present work. The authors study the pass-through of costs to prices in the processed cheese market in the United States, estimating a structural model of demand for differentiated goods that they use to recover the marginal costs of each product under different supply assumptions (collusion or Bertrand prices competition) and then calculate the pass-through from costs to prices. In the aforementioned work, the results obtained by structural estimation are compared with those obtained based on reduced-form equations. From this, they conclude that the processed cheese market in the United States operates in imperfect competition, with a level of competition greater than absolute collusion, but less than full competition in prices.

The empirical literature on the pass-through of costs to prices has focused on the study of markets in developed countries, and no precedents have been found for developing countries. The study of the pass-through of costs to prices in consumer goods is potentially different in developing economies due to possible differences in the levels of existing competition, as well as in the regulation for its promotion. In economies with less intensity of competition, it is expected to find higher price levels and markups, which may cause cost shocks to be transmitted to final prices to a lesser extent. To the best of our knowledge, this phenomenon has not been studied empirically for consumer goods, and one of the limitations is given by the scarcity of markets for consumer goods with low levels of competition that are registered in developed countries. Along these lines, Mahoney and Weyl (2017) theoretically discusses the possibility that lower levels of competition are characterized by the lower transmission of cost shocks to prices in markets with adverse selection.

The next sections are organized as follows. Section 2 introduces a short description of the setting. In Section 3 we describe the data, present detailed information about how we work with it, and statistics descriptives of the industry. Section 4 describes the model, the estimation procedure, and identification. Results are presented in Section 5 and finally, Section 6 concludes.

2 Setting

Our focus is on the estimation of demand and recovering markups and pass-through for rice, oil, and tomato sauce during the period from April 2016 to January 2018. The three products analyzed have in common the fact that they are mainly produced in Uruguay and the domestic market shows oligopolistic structures with a concentration in one or two firms with the majority of the market share. From Czarnievicz and Zipitría (2018) we know that during the period 2014-2016 and in supermarket chains, for oil the firm COUSA represented approximately 69% of the market share, for rice there was a duopoly between SAMAN (41%) and Coopar (47%) and in tomato sauce Barraca Deambrosi presented a clear leadership with 47% of the market share, followed by Conaprole (21%).

The rice sector has very different characteristics from the others, since Uruguay is a world-class rice exporter, with high productivity in its production. Since 1959, the price paid by the mills to the producer has been determined between the Rice Growers Association and the Rice Mills Guild, based on production costs, the domestic price, and the export price. In 2017 the estimated consumption of white rice in the domestic market was 45.000 tons[2], which represented approximately 5% of what was exported (Miraballes Iguiní (2021)), so we are studying a market that represents a small fraction of the total sales of this firms.

Tomato production reached 39,000 tons in the 2016/17 harvest, while the imported volume was 1,826 tons (Yearbook 2017, OPYPA). Nevertheless, of the total tomato produced, 20% is destined for processing. Therefore, national production covers between 20 and 25% of industrialized tomato consumption and the rest of the raw material is imported.[3] Regarding the tomato processing industries, in a 2014 resolution, the Commission for the Promotion and Defense of Competition sanctions 5 companies and exonerates 1 for carrying out an illicit agreement for anti-competitive purposes (Resolution No. 24/014).

Regarding the oil, in the present work sunflower, soybean and canola oil are included as different varieties of the same product. In 2017 the estimated domestic consumption of these varieties of oil was 74.000 tons[4]. During the analyzed period, the agricultural production of oil in Uruguay shows a significant increase in soybean production, accompanying the regional evolution and a pronounced decrease in sunflower production. For its part, the oilseed industrial sector is made up of a single company (COUSA), which in 2015 had an installed capacity of approximately 1,450 tons per day. The oil sector in Uruguay is strongly protected against imports (Brum et al. (2012)). During the period analyzed, the tariff rate for imports from Argentina was 16% (Ordinance No. 643/006) and for areas outside Mercosur it was 21%. Nevertheless, there is some degree of imported products and the competitors are mainly products imported from Argentina (Horta et al. (2017)).

In the present study, the margins and the pass-through of costs to the final prices of the products are analyzed. Nevertheless, the available data do not allow an analysis of the vertical links between producers, distributors, and retailers. Similar to Nevo (2001) and Kim and Cotterill (2008), the focus is on the competition between producers. We assume that retail margin is an additional cost to producers, which is consistent with a wide variety of models of manufacturer-retailer interaction. Additionally, following standard practice in the BLP approach, we treat the retail industry as a price-taking, perfectly competitive industry, which implies that the store and product-level elasticities are identical. This is a problematic assumption, particularly when working with large supermarket chains. As mentioned in the description of the data, in this article we are working with small and medium retailer firms, but still, we should be cautious with this simplification.

As these are oligopolistic markets in which there are few producers, it is not possible to make good

[2]https://www.indexmundi.com/agriculture/?pais=uy&producto=arroz-blanco&variable=consumo-domestico&l=es

[3]INIA report http://www.ainfo.inia.uy/digital/bitstream/item/4878/1/hd-105-tomate-industria-Oct.2011.pdf

[4]https://www.indexmundi.com/agriculture/?pais=uy&producto=aceite-de-semilla-de-girasol&variable=consumo-domestico&l=es

estimates with the production function approach. As an imperfect approximation, descriptive data are presented in Table 1, containing information on production costs, collected from the Economic Activity Survey (EAE) 2016, for companies in whose total sales, the analyzed products weigh at least 50%[5]. The gross price-average variable cost margin for these industries is 30.1% for oil, 34.6% for tomato sauce and 39.7% for rice[6] It is relevant to emphasize that what we recover in the Table is the gross margin and not the markup. To recover the mark up we need the marginal costs, which we cannot obtain from descriptive information from surveys.

Table 1: Aggregate descriptive of production costs

	Oil		Tomato sauce		Rice	
	Mill pesos	% of value	Mill pesos	% of value	Mill pesos	% of value
Sales	6531	100	3530	100	23919	100
Materials	3890	59.6	1765	50	15565	65.1
Labor	607	9.3	525	14.9	2027	8.5
Energy	70	1.1	18	0.5	417	1.7
Gross margin (GM)	1964	30.1	1222	34.6	5910	24.7
GM internal market	-	-	-	-		39.7

Notes. Source: Economic Activity Survey (EAE, 2016). Sector: four-digit ISIC revision 3. we use firms in which at least 50% of sales correspond to the analyzed product.

3 Data and descriptives

A novel database is used that consists of a panel with prices and quantities sold in each store for different varieties of the three products studied, defined at the UPC level, for the main localities of Uruguay, with daily information for the period between April 2016 to January 2018. The information comes from the scan at the time of purchase and is provided by a Point of Sales (POS) provider, which specializes in providing this service to small and medium-sized retailers, and is one of the leading firms in this segment of retailers. We observe the universe of sales in the retailers who operate with this provider.

In order to have a notion of how much the sales in these stores represent in the total consumption of the studied products, table 2 shows the percentage represented by the quantities sold during 2017 in the available database in relation to the total consumption of white rice and oil (sunflower plus

[5]In this Survey only firms with at least 50 employees are mandatorily included in the sample.

[6]In the case of rice, we can decompose the gross margin in the internal and external market, knowing the sales (PxQ) to the internal and external market (EAE), quantities exported and export prices (MGAP - DIEA. FLAR) and sales prices of the producers to the big national retailers (Czarnievicz and Zipitría (2018)), assuming that the margin is the same for small retailers (in the reality the margin in the internal market is a weighted average between the margins obtained from the big chains and medium/small retailers).

soybean) in Uruguay, reported in Index Mundi. The database represents 18% of the total consumption of rice and 12% of the total consumption of oil in 2017 in Uruguay.

Table 2: SALES IN SAMPLE AND CONSUMPTION IN URUGUAY IN 2017

Product	Total sales (quantities)	Consumption in Uruguay	Ratio
Oil (soy + sunflower)	8.89	74	12%
Rice	8.15	45	18%

Notes. Total sales are the quantities of kilos or liters sold in all available stores in the database during 2017. Consumption in Uruguay is the total consumption of the goods reported in index mundi for 2017. Own elaboration based on the database and https://www.indexmundi.com/. There is no information about tomato sauce.

As can be seen in Table 3, in general terms we observe small and medium-sized retailer firms from 50 different regions of Uruguay. The median retailer in the database sells 127 kilos (or liters) of the product by month. The main chains of supermarkets, analyzed in Czarnievicz and Zipitría (2018) are not included. One limitation of the database is that there is no additional information on the size of the stores (beyond the total sales and quantities of these products) or whether they belong to a chain.

Given the focus of the article and based on the main related literature, a series of decisions are made on how to work with the data. The locality and not the store is taken as the unit of analysis, taking the aggregate of sales in the locality and the average prices (weighted by the number of sales in each store). This is because when dealing with small stores, we want to avoid the presence of zeros in the base, which are problematic for the BLP estimate. For its part, since the interest lies in the competition between producers, it is understood that it is a reasonable simplification. A third reason is that, since we do not have georeferenced information on the location of the stores, to work at the store level we should assume that they are local monopolists (Chidmi and Lopez (2007)). In relation to the period of time, we work at the quarter level (we observe 8 quarters), also in line with the main related literature. Regarding the different presentations of each product (for example 900 milliliters or 500 milliliters oil), all presentations are expressed as a price per liter or kilo depending on the item.

Additionally, to rule out varieties of products whose sales levels are insignificant at the national level, only varieties with at least a 2% market share at the national level are taken.

Table 4 presents descriptive of the demand information available for the three products, including the producer, the variety, the average price and share for the entire period, and the main observable characteristics (this information is complemented with Figures A.1, A.2 and A.3 of the appendix, with

Table 3: Descriptive statistics of retailers by locality

Department	Locality	Municipality	Retailers	Quantities sold		
				p25	p50	p75
Artigas	Artigas		5	26	30	81
Artigas	Bella Union		4	159	343	653
Canelones	Barros Blancos		8	28	192	2904
Canelones	Canelones		8	292	1013	2615
Canelones	La Paz		5	96	519	1185
Canelones	Las Piedras		20	57	909	2893
Canelones	Pando		12	64	156	253
Canelones	Parque Del Plata		5	471	748	2047
Canelones	Paso Carrasco		7	60	902	2870
Canelones	Pinar		8	43	58	727
Canelones	Progreso		10	27	95	163
Canelones	Salinas		8	86	303	867
Canelones	San Ramon		6	49	671	845
Canelones	Santa Lucia		8	176	802	1293
Canelones	Sauce		7	49	125	215
Canelones	Solymar		9	379	992	1180
Canelones	Toledo		7	30	84	357
Cerro Largo	Melo		11	36	246	373
Colonia	Carmelo		7	139	360	3441
Colonia	Colonia		3	83	618	1307
Durazno	Durazno		6	104	705	3448
Flores	Trinidad		7	55	623	2116
Florida	Florida		15	159	664	2067
Lavalleja	Minas		6	588	1498	2981
Maldonado	Maldonado		31	224	760	1654
Maldonado	Piriapolis		5	33	352	1594
Maldonado	Punta Del Este		2	86	250	414
Maldonado	San Carlos		6	176	687	3574
Montevideo	Montevideo	A	49	64	261	687
Montevideo	Montevideo	B	72	32	125	425
Montevideo	Montevideo	C	34	129	218	736
Montevideo	Montevideo	CH	49	55	207	422
Montevideo	Montevideo	D	36	130	263	687
Montevideo	Montevideo	E	36	75	227	722
Montevideo	Montevideo	F	38	141	374	2227
Montevideo	Montevideo	G	33	74	419	1314
Paysandu	Paysandu		18	34	104	360
Rio Negro	Fray Bentos		9	70	707	882
Rio Negro	Young		7	55	207	1749
Rivera	Rivera		14	23	102	235
Rocha	Rocha		12	97	172	728
Salto	Salto		22	96	437	738
San Jose	Ciudad Del Plata		11	156	260	713
San Jose	Libertad		8	126	368	713
San Jose	San Jose De Mayo		17	33	292	1032
Soriano	Dolores		5	22	60	466
Soriano	Mercedes		4	80	172	2626
Tacuarembo	Paso De Los Toros		2	125	474	823
Tacuarembo	Tacuarembo		11	33	86	535
Treinta Y Tres	Treinta Y Tres		8	114	212	1765

Notes. Descriptive for retailers that register sales throughout the period. The last 3 columns show the average monthly quantities of units of products sold by retailers in the 25th, 50th, and 75th percentiles of each location. To build the percentiles, a pool of the 3 products is made, where the kilos for tomato sauce and rice and liters for oil are added.

the evolution of shares and prices for each variety).[7] For oil, we observe 9 varieties and 5 different producers. COUSA is the leading firm, with 78% of the market (in line with Czarnievicz and Zipitría (2018)) and 5 varieties. There is a clear distinction in terms of prices between soy oils and the rest, being the first one the cheaper for the entire period. Nevertheless, it is observed a sharp reduction in the prices of sunflower and canola oil mainly produced during 2016. It is also important to note that while there is competence in the segment of soy oil, that is not the case in the canola and sunflower segments.

For tomato sauce, we observe 10 varieties produced by 6 firms. The leading firm is Barraca Deambrosi with 57% of the market, which produces 4 varieties. In this market, there are competitors in different segments of quality and price. Conaprole offers a concentrated variety with the highest price, while Don Perita offers a variety with the lowest price. The evolution of prices and shares is relatively stable in the period, with an increase in the prices of Conaprole and a decrease in the prices of Cololo. For its part, Big presents a slight decrease in prices and a marked increase in share.

In the rice market, we observe 10 varieties produced by 4 firms, and a duopoly of Saman and Coopar, with 38% and 57% of the market, producing 4 varieties each one. In Figure A.3 we can see a clear pattern in terms of prices and observable characteristics: varieties of type one (at least 90% of entire grains) with prices approximately between 35 and 40 Uruguayan pesos and varieties of lower quality with prices between 23 and 28 Uruguayan pesos. While for varieties of lower quality, there is competition between the 4 firms, in the high-quality segment there are only varieties of the two main firms.

In the last column of Table 4 we can observe the percentage of retailers in which each variety of the product is available. It is important to note that when we aggregate information at the locality level and calculate substitution patterns at that level, we are ignoring the fact that these different varieties could not be available in the same retailer.

Additionally, as demographic characteristics for the BLP model, we include information from the national census of 2011, related to age, education years, and sex by region. Descriptive statistics by region are reported in Table A.1 of the appendix.

Finally, a relevant problem in demand estimates is given by the determination of the size of the market for the calculation of market shares. As pointed out in Nevo (2000), the total size of the market must be defined according to the context and the particularities of the problem addressed but making sure that it is large enough to avoid the market shares of the external option is worth zero (the outside option includes the possibility of not acquiring the product or acquiring it in a store that is not part

[7] In the descriptives, we show current prices. In the main specifications, we deflate the prices using as base 2016. Nevertheless, the main results hold with current prices.

Table 4: Descriptive statistics of products

Product	Producer	Variety	Price	Share	Characteristic			% of retailers selling
					Soy	Canola	High ol.	
Oil	COUSA	Optimo canola	64	4	0	1	0	52
Oil	COUSA	Optimo girasol	73	11	0	0	0	84
Oil	COUSA	Optimo girasol altoleico	85	2	0	0	1	49
Oil	COUSA	Uruguay girasol	60	16	0	0	0	71
Oil	COUSA	Condesa soja	44	47	1	0	0	86
Oil	De diez	De diez soja	45	6	1	0	0	6
Oil	Demas	Demas soja	47	5	1	0	0	32
Oil	Revelacion	Revelacion soja	45	4	1	0	0	32
Oil	Soldo	Rio de la plata soja	47	4	1	0	0	31
					Conc.			
Tomato sauce	Barraca Deamb.	Qualitas	33	4	0			22
Tomato sauce	Barraca Deamb.	Gourmet	50	22	1			72
Tomato sauce	Barraca Deamb.	De ley	46	28	0			62
Tomato sauce	Barraca Deamb.	Gourmet napolitana	51	3	1			37
Tomato sauce	Big	Big	37	12	1			34
Tomato sauce	Cololo	Cololo	49	3	0			35
Tomato sauce	Conaprole	Conaprole	59	12	1			81
Tomato sauce	Don Perita	Don Perita	30	5	0			32
Tomato sauce	Rigby	Rigby	33	6	0			28
Tomato sauce	Rigby	Rigby italiana	40	6	0			24
					Type 1	Parbo		
Rice	Casarone	Casarone	23	2	0	0		20
Rice	Coopar	Blue patna parboiled	39	2	1	1		34
Rice	Coopar	Shiva patna	23	19	0	0		49
Rice	Coopar	Blue patna	37	8	1	0		70
Rice	Coopar	Green chef	36	28	1	0		87
Rice	SAMAN	Saman patna	34	6	1	0		43
Rice	SAMAN	Saman parboiled	40	4	1	1		62
Rice	SAMAN	Saman	36	16	1	0		75
Rice	SAMAN	Aruba patna	24	12	0	0		51
Rice	San Jose	San jose	23	4	0	0		18

Notes. Varieties with at least 2% of the market share at the national level. Average prices and market shares for the entire period. Prices are expressed in Uruguayan pesos by liter for oil and sauce and by kilo for rice. Type 1 takes the value 1 if the rice variety has more than 90% of entire grains. Soy and Canola refer to the plant from which the oil is extracted (the third type in the database is sunflower). Finally, high oleic oil is one that contains at least 75% oleic acid in its composition.

of the database). For example, Nevo (2001) in his study on the cereal market, assumes that the size of the market is one serving of cereal per capita per day, while Bresnahan et al. (1997) to estimate the demand for computers, take the number of office employees.

In the present study, the unit of analysis is the locality quarter. The market size is determined in relation to the number of inhabitants of each locality, taken from the 2011 census and scaled as follows:

for tomato sauce and rice it is assumed that one liter/kilo per quarter is consumed, and for oil, it is assumed that two liters are consumed (maintaining the relationship between rice and oil consumption observed in Table 2)[8].

4 Model

The strategy consists of estimating the demand system for each product at the locality-quarter level, modeling it as a function of product characteristics and consumer preferences. That demand information is then used in conjunction with assumptions about how producers compete to estimate marginal costs, margins, and finally the pass-through from costs to prices consistent with estimated demand.

4.1 Demand

The demand system is estimated using a logit model of random coefficients. This type of model makes it possible to incorporate the heterogeneity of consumer preferences for the observed and unobserved characteristics of the products. We follow the methodology proposed by Berry et al. (1995) and Nevo (2001), which allows estimating this type of model with aggregate demand data (that is, without knowing what each individual buys).

It is assumed that with each purchase, consumers buy one unit of the product and choose the variety that offers them the greatest utility. Following Kim and Cotterill (2008), the indirect utility of consumer i, for variety j in market m is given by $U_{ijm}(x_{jm}, \xi_{jm}, p_{jm}, D_i, v_i; \theta)$, being x_{jm} the observed characteristics of the product, ξ_{ijm} unobserved characteristics of the product, p_{jm} prices, D_i observed characteristics of consumers, v_i characteristics unobserved of the consumers. For its part, θ is a vector of unknown parameters to be estimated.

The introduction of observed characteristics of consumers does not require information at the individual level, but rather it can be extracted from the empirical distribution of these characteristics in the population, as is done in the present work.

The indirect utility function is defined as:

$$u_{ijm} = \beta_i x_{jm} - \alpha_i p_{jm} + \xi_{jm} + \epsilon_{ijm} \tag{1}$$

Where α_i is the marginal utility of income of consumer i, β_i represents specific individual parameters related to other product characteristics different from price and ϵ_{ijm} is a zero-mean stochastic term.

[8] It is important to bear in mind that this market size should not represent total consumption, but potential purchases in these stores.

Let be $\theta = \theta(\theta_1, \theta_2)$ a vector containing the parameters of the model. The vector $\theta_1 = (\alpha, \beta)$ contains the linear parameters, while $\theta_2 = (\Pi, \Sigma)$ contains the non-linear parameters.

Indirect utility can be divided into two parts:

$$u_{ijm} = \delta_{jm}(x_j, p_{jm}, \xi_{jm}; \theta_1) + \mu_{ijm}(x_j, p_{jm}, v_i, D_i; \theta_2) + \epsilon_{ijm} \tag{2}$$

$$\delta_{jm} = \beta x_{jm} - \alpha p_{jm} + \xi_{jm} \tag{3}$$

$$\mu_{ijm} = [-p_{jm}, x_j](\Pi D_i + \Sigma.v_i) \tag{4}$$

On the one hand, the average utility of variety j in the market m (δ_{jm}), and on the other, the deviation from the average utility, which captures the effect of the random coefficients (μ_{ijm}).

The deviations from the mean utility (μ_{ijm}) depend on the observed characteristics of the individuals D_i, and the unobserved characteristics v_i. The distribution of the parameters of consumer preferences by the characteristics of the products is modeled as:

$$\begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \Pi D_i + \Sigma v_i \ , \quad v_i \sim P_v^*(v) \ and \ D_i \sim \hat{P}_D^*(D) \tag{5}$$

being $P_v^*(.)$ a parametric distribution and $\hat{P}_D^*(.)$ a non-parametric distribution extracted from the 2011 population census. Π is a (K+1)xd matrix with coefficients representing how tastes for product characteristics vary with demographic characteristics. The unobserved individual characteristics are taken from random draws from a multivariate normal distribution, that is $P_v^*(.)$, is a $N(0, I_{k+1})$. In this way, individual heterogeneity is introduced in the taste for the characteristics of the products. One draw is taken for each individual for each product characteristic used, plus one for price (hence the K+1). In this context, it is an array of parameters of dimension (K+1)x(K+1), which allows each component to have different variances and correlations between characteristics. It is assumed that v_i and D_i are independent.

The specification of the demand closes with equation (6), which represents the utility of an external option (outside option or outside good), which is normalized in such a way that $\mu i0m = \epsilon i0m$. If the outside option is not included, a simultaneous increase in the price of domestic goods does not result in any change in aggregate consumption. The market share of the outside option is defined as the total size of the market minus the sum of the market shares of the inside goods.

$$\mu_{i0m} = \xi_{0m} + \Pi_0 D_i + \omega_0 v_{i0m} + \epsilon_{i0m} \tag{6}$$

A_{jm} is defined as the set of values D, v and ϵ that induce the choice of j in market m. D, v, and ϵ are assumed to be independently distributed. D is taken from an empirical distribution F, obtained from the national census of 2011, and v is taken from a multivariate normal distribution N. For its part, it is assumed that ϵ has an extreme value type 1 distribution. This assumption is key since it allows market shares to have a closed-form solution.

$$A_{jm}(x, p_{.m}, \delta_{.m}; \theta_2) = \{D_i, v_i, \epsilon_{im} | u_{ijm} > u_{ihm} \forall h = 0, 1, ..., J\} \tag{7}$$

where $p_{.m} = (p_{1m}, ..., p_{Jm})'$ and $\delta_{.m} = (\delta_{1m}, ..., \delta_{Jm})'$. The market share of product j can be written as a function of average utility levels:

$$s_{jm}(x, p_{.m}, \delta_{.m}; \theta_2) = \int_{A_{jm}} dP^*(D, v, \epsilon) = \int_{A_{jm}} dP^*(D) dP^*(v) P^*(\epsilon) \tag{8}$$

With the aforementioned assumption about ϵ, we have that $s_{ijm} = exp(\delta_{jm} + \mu_{ijm})/(1 + \sum_{k=1}^{J} exp(\delta_{km} + \mu_{ikm}))$ is the probability of individual i of buying variety j. In this context, each individual may have a different price sensitivity, and substitution patterns between brands are not derived from functional form. The estimation strategy is to select parameters that minimize the distance between the predicted market share in equation 8 and the observed market share. Equation 8 does not have a closed analytical form, so the integral must be computed using simulation methods.

4.2 Supply

4.2.1 Pricing equations

Following Kim and Cotterill (2008), we assume that there are F firms and each one produces a subset of the varieties $1, \ldots, J$. We assume that the firms solve for each market m an independent maximization problem and that the marginal costs mc vary between markets. Each firm f maximizes profits in market m:

$$\pi_f^m = \sum_{j=1}^{J_f} (p_{jm} - mc_{jm}) \times M \times s_{jm}(\mathbf{p}) - C_f \tag{9}$$

being mc_{jm} the marginal cost of variety j in market m, M the size of the market, $s_{jm}(\mathbf{p})$ the market share of variety j in market m (which depends on the price of all varieties) and C_f the fixed cost of production.

Assuming positive prices and the existence of a pure-strategy Nash-Bertrand equilibrium in prices (Nevo (2001)), the first-order conditions with respect to the prices of the problem are the following set of J equations (we omit the reference to the market m):

$$\sum_{k=1}^{J_f} (p_k - mc_k)\partial s_k(\mathbf{p})/\partial p_j + s_j(\mathbf{p}) = 0 \tag{10}$$

In vector notation, the first-order conditions became:

$$(\mathbf{p} - \mathbf{mc})\Delta(\mathbf{p}) + \mathbf{s}(\mathbf{p}) = 0 \tag{11}$$

where $\mathbf{p}$ is the vector of prices for all varieties, $\mathbf{mc}$ is the vector of marginal costs for all varieties, and $\mathbf{s}(\mathbf{p})$ is the vector of market shares. Finally, Δ is a J*J matrix defined in a different way depending on the type of competition that we suppose to exist in the market. If we assume that there is Nash Bertrand competition, that is, that the firms choose their prices simultaneously and in an uncoordinated manner, the matrix is $\frac{\partial s_k(p)}{\partial p_j}$ valid when varieties k and j are produced by the same firm and 0 in the rest of the cases. In other words, the firm behaves like a monopolist with respect to its varieties. On the other hand, if collusion is assumed to exist, the matrix is $\frac{\partial s_k(p)}{\partial p_j}$ valid for the varieties of colluding firms and 0 otherwise. In our case, we build a scenario with perfect price collusion (or monopoly), where the final structure is the joint profit-maximization of all the brands.

Returning to formula 11, we can rewrite solving for the marginal cost for each variety in each market:

$$\hat{\mathbf{mc}} = \mathbf{p} + \Delta(\mathbf{p})^{-1}\mathbf{s}(\mathbf{p}) \tag{12}$$

It is observed that the estimated marginal cost depends on prices and market shares, which are observed, and on the parameters of the demand system $\Delta(\mathbf{p})$, which are estimated. Therefore, we can obtain the marginal costs (and profit margins) from the demand information, making assumptions about how the varieties of each product compete in the market, without looking at the cost information.

4.2.2 Pass-through equations

For the pass-through ratios, following Kim and Cotterill (2008), if there is an industry-wide shock to the marginal cost, the market prices will converge to a new equilibrium, which can be solved as the system of first-order condition in the Equation 11. Now we know the marginal cost (given the size of the shock and the assumption about the model of competence in the market), and the primitives of demand, and we can recover the equilibrium prices. The price pass-through rate is defined as the ratio of the price change to the change in marginal cost:

$$Pass\ through\ rate = (\Delta p / \Delta mc) \times 100 \tag{13}$$

where Δp is the difference between the new equilibrium price that solves the system 11 for the new marginal cost and the old price and $\Delta mc = mc_{new} - mc_{old}$.

4.3 Identification

These estimations must deal with the challenge of controlling for the correlation between prices and the error term, which includes unobservable product characteristics that are observed by consumers but not by the econometrician. As stated in Kim and Cotterill (2008), it is reasonable to think that this correlation is positive because higher levels of unobservable quality of the products can generate that consumers are willing to pay higher prices, and suppliers can set higher prices.

To control for the endogeneity of prices, one needs to find variables that are correlated with prices but are independent of unobserved product characteristics. A set of instruments with a range at least equal to the dimension of the vector of parameters to be estimated is required. In some cases, such as Berry (1994) and Berry et al. (1995) the endogeneity problem is addressed by assuming that the location of brands in the space of product characteristics is exogenous, or at least predetermined. In this context, the characteristics of the other products can be a valid instrument. In this study, as in that of Nevo (2001), there is no variability in the observed characteristics of each brand over time or between locations, so this type of instrument should be ruled out.

In this context, the set of instruments proposed in Hausman (1996) is used, that is, the prices in other localities in the region, exploiting the panel structure of the base. For this, the country is divided into 5 regions: Metropolitan: Montevideo, San José, Canelones; East: Maldonado, Rocha, Thirty-Three, Lavalleja; South-Central: Flores, Florida, Peach; Coast: Colonia, Soriano, Río Negro; North: Artigas, Salto, Paysandú, Rivera, Tacuarembó and Cerro Largo. The average prices of the product in the region for each month are used as instruments, without taking into account the price of the instrumented locality.

The assumption of identification is that by controlling for variety and demographic characteristics, the changes in the valuation of the varieties are independent between localities. Given this assumption, and because the marginal costs of the same variety in different stores are correlated with each other, the prices of the varieties in other localities are valid instruments. The assumption can be violated if there are national or regional demand shocks that modify the unobserved valuation of all varieties in all stores. A type of shock such as the ones mentioned can occur if the producing companies have advertising campaigns that are coordinated between localities and have an effect on the demand for the varieties. Following Nevo (2001), if it is about mature markets with well-established varieties, it is unlikely that there will be shocks of this type, and furthermore, these shocks can be captured by incorporating dummy variables by period, as we do.

The specification includes dummy variables by product variety, because, as indicated in Nevo (2000), in a context in which the observed characteristics of the varieties do not allow adequate capturing of the factors that determine the utility of individuals, the inclusion of variety fixed effects improves the fit of the model. Another reason was stated when describing the instruments used since the inclusion of dummy variables per variety allows capturing the characteristics that do not vary by market and the variety-specific mean of the unobserved components. By including fixed effects per variety, the coefficients associated with the preferences of individuals for the observed characteristics of the varieties cannot be directly identified. Following Nevo (2000) we recover these parameters using a minimum distance procedure developed in Chamberlain (1982).

4.4 Demand estimation

The estimation method is the one proposed by Berry et al. (1995), but with the differences indicated in Nevo (2001). The first of the differences is about the instrumental variables used, which was described in the previous section. In this context, the identification of demand does not require specifying a functional form on the supply side. The other difference was also mentioned in the previous section and refers to the fact that due to the panel structure of the data available, it is possible to control for the unobservable characteristics of the products using fixed effects by brand.

The model is estimated by the generalized method of moments (GMM) exploiting a population moment condition composed of the product of the instrumental variables and the error term. Let be $Z = [z_1, ..., z_M]$ a set of instruments such that $E[Z'.\omega(\theta^*)] = 0$, while θ (a function of the model parameters), is the error term and θ^* is the true value of the parameters. The estimator is $\hat{\theta} = arg\, min_\theta\, \omega(\theta)' Z A^{-1} Z' \omega(\theta)$ where A is a consistent estimate of $E[Z'\omega\omega' Z]$.

Following Berry (1994) and returning to equation 3, the error term can be decomposed into $\xi_j + \Delta\xi_{jm}$, that is, the average valuation at the national level for the unobserved characteristics of the products and a specific deviation of each market with respect to the average. Since fixed effects are included by brand, the error term is defined as $\Delta\xi_{jm}$.

The unobserved characteristics are computed as a function of the data and parameters, starting from the average utility δ_m, solving the following system of equations for each market:

$$s_{.m}(x, p_{.m}, \delta_{.m}; \theta_2) = S_{.m} \ , \quad m = 1, ..., M \qquad (14)$$

being $s_{.m}$ the market share defined in equation 8 and $S_{.m}$ the observed market share. In logit with random coefficients, two steps are required to solve this system of equations. In the first place, the left side of the equality is defined according to equation 8, and the integrals that define the market shares are computed by simulation.

Second, using these market shares, the system of equations defined in 14 is inverted. In the case of the model with random coefficients, the system of equations is non-linear, and therefore the inversion of the model must be done numerically. The system of equations can be solved using the contraction mapping proposed in Berry (1994), which is analogous to iterating over the system:

$$\delta_m^{h+1} = \delta_m^h + \log(S_m) - \log(s_m(x_m, p_m, \delta_m^h, P_{ns}; \delta_m)) \, , with \;\; m = 1, ..., M \; and \; h = 0, ..., H \tag{15}$$

Where $s(.)$ are the market shares estimated in the first step, H is the smallest integer such that $\|\delta_m^{H+1} - \delta_m^H\|$ is less than a certain tolerance level and δ_m^H is an approximation to δ_m. Once the inversion has been made, the error term is defined as:

$$\omega_{jm} = \delta_{jm}(x, p_m, S_m; \theta_2) - (x_j\beta + \alpha p_{jm}) \tag{16}$$

The estimation is carried out with the “BLPestimatoR” package of R. The details of the estimation are reported in appendix A.2.

5 Results

5.1 Logit model

As a first step, a logit model (without random coefficients) is estimated, which, despite its limitations regarding the substitution patterns it yields, is an adequate point of reference, mainly to analyze the importance of instrumenting the price and the effects of the instruments.

Table 5 presents the results of different specifications of the logit model. The dependent variable in this model is the logarithm of the market share of variety j in month t, minus the logarithm of the market share of the external option for the same month ($\log(S_{jt}) - \log(S_{0t})$). In the 3 specifications, fixed effects by quarter (we include 7 dummies of quarters) are included. In the second and third specifications, it is controlled by fixed effects by variety, while in the first it is controlled by observable characteristics of the products. Finally, all specifications include the logarithm of the average annual sales of the sum of the three products in the stores by locality, as a proxy of store size.

Table 5: Demand estimation. Logit model

VARIABLES	(1) OLS 1	(2) OLS 2	(3) IV	(4) OLS 1	(5) OLS 2	(6) IV	(7) OLS 1	(8) OLS 2	(9) IV
Price	-0.151***	-0.151***	-0.257***	-0.036***	-0.220***	-0.295***	-0.005	-0.375***	-0.424***
	(0.008)	(0.009)	(0.036)	(0.007)	(0.013)	(0.016)	(0.008)	(0.021)	(0.027)
Log of median age	-3.460***	-4.015***	-3.864***	-11.060***	-10.133***	-9.453***	-9.702***	-9.335***	-9.198***
	(0.980)	(0.845)	(0.868)	(0.954)	(0.859)	(0.884)	(0.938)	(0.803)	(0.751)
Log of median education	-1.058***	-0.634**	-0.858***	-0.513*	-0.790***	-0.981***	-2.265***	-2.042***	-2.033***
	(0.314)	(0.264)	(0.331)	(0.276)	(0.239)	(0.283)	(0.262)	(0.236)	(0.242)
Log of av sales	0.432***	0.469***	0.244***	0.639***	0.529***	0.472***	1.339***	1.049***	1.008***
	(0.055)	(0.051)	(0.091)	(0.051)	(0.050)	(0.050)	(0.046)	(0.045)	(0.045)
Log of av home size	-2.387***	-1.723***	-1.909***	1.345***	-0.009	-0.631	-0.082	-0.443	-0.544
	(0.537)	(0.464)	(0.509)	(0.514)	(0.463)	(0.496)	(0.490)	(0.443)	(0.409)
Observations	2,751	2,751	2,751	3,360	3,360	3,360	3,525	3,525	3,525
R-squared	0.254	0.458	0.415	0.174	0.321	0.312	0.332	0.516	0.515
Product characteristics	Yes	No	No	Yes	No	No	Yes	No	No
Brand dummy	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Product	Oil	Oil	Oil	Sauce	Sauce	Sauce	Rice	Rice	Rice
1st stage F-test			313			988			1225

Notes. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is $In(S_jt) - In(S_0t))$. All specifications include fixed effects by quarter (7 dummies of quarters). For each product, the first specification includes product characteristics (dummies for soybean, canola and high oleic in oil, type 1 for rice and concentrated for tomato sauce). In the third specification of each product, the instruments are prices in other localities, similar to Nevo (2001). All specification includes as controls demographic characteristics (the logarithm of the median age and years of education in the locality, and the logarithm of the average home size), and the logarithm of the average annual sales of the sum of the three products in the stores by locality, as a proxy of stores size.

Regressions (i) and (ii) are estimated by ordinary least squares. Regression (i) does not include fixed effects by brand, and this results in the error term containing the unobserved characteristics of the products.

Regression (iii) is estimated by least squares in two stages, instrumenting by the average price in the rest of the localities in the region in each month. It is observed that when using instrumental variables, price sensitivity increases for the three products studied. The fact that when controlling for endogeneity, the sensitivity of demand to prices increases is in line with what is theoretically expected, since it is reasonable to expect a positive correlation between prices and unobservable product quality.

In the 3 specifications, demographic characteristics are included as regressors: the logarithm of the median age in the locality, the logarithm of the median years of education by locality, and the logarithm of the average home size. It is understood that the evaluations that consumers make of the different varieties may have a local component that is captured in part by the inclusion of these variables. As pointed out in Nevo (2001), the coefficients associated with the demographic variables in a model of this type capture the change in the valuation of the product relative to the external option as a function of the demographic characteristics. The results suggest that the valuation for the three articles is lower in localities with younger inhabitants and lower educational levels. In the logit model of random coefficients, demographic characteristics are introduced in a more sophisticated way, but this preliminary analysis suggests that it is relevant to take these variables into account.

Observing the F statistics of the first stage of the specifications with instrumental variables, it can be seen that the proposed instruments are jointly significant, and it cannot be rejected that the instrumental variables have joint power. First-stage R-squares are also high, suggesting some statistical power of the proposed instruments. The complete regressions of the first stage for prices as instruments are presented in Appendix A.1. The central elements to retain from the presented logit model are the importance of controlling for the endogeneity of prices and of using demographic variables.

5.2 Random coefficients logit model

Table 6 presents the results of the random coefficient logit model that was described in section 4.1. The predicted market shares are calculated using equation 8. The demographic information used for the random extractions comes from the 2011 census, using 200 extractions per locality.

The first row contains the mean marginal utility for the price, that is, the linear parameter α. The estimated coefficients for the price are statistically significant in all cases, have the expected sign, and are similar in magnitude to those estimated by the logit with instrumental variables.

The results of the random part show the estimated heterogeneity with respect to the means. It is observed that the estimated parameters of the standard deviations of the observed characteristics are not significant, as well as the majority of the interactions with the demographic characteristics. However, for rice, it is observed that more educated people tend to be less price sensitive and more sensitive to type 1 quality, while for tomato sauce more educated people tend to be less price sensitive and more sensitive to the level of concentration of the product.

Table 6: RESULTS FROM THE FULL MODEL

	Means	Sd	Education	Age
Oil				
Price	-0.400**	0.002	0.161	-0.065
	0.184	0.178	0.198	0.116
Soy	−2.086	-0.077	2.376	
	2.625	16.158	6.575	
Canola	−4.575	-0.556	-0.988	
	3.843	11.390	5.954	
High oleic	2.715	-0.862	0.485	
	3.843	7.124	2.821	
Tomato sauce				
Price	-0.449***	-0.001	-0.202*	0.072
	0.075	0.166	0.104	0.087
Concentrated	5.445*	-0.177	4.476*	
	1.679	20.390	2.430	
Rice				
Price	-0.426***	0.001	-0.102*	-0.256
	0.106	0.485	0.052	0.246
Type 1	4.528***	0.185	3.263*	1.712
	0.589	3.740	1.738	2.177

Notes. Based on 2751 (oil), 3687 (rice) and 3389 (sauce) observations. All regressions include brand and time (7 dummies of quarters) fixed effects and the logarithm of the average annual sales of the sum of the three products in the stores by locality, as a proxy of store size. Estimated by GMM. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Prices are instrumented with regional price averages for the variety, as described in section 4.3. Linear coefficients of characteristics different from price are estimated from a minimum distance procedure. Type 1 takes the value 1 if the rice variety has more than 90% of entire grains. Soy and Canola refer to the plant from which the oil is extracted (the third type in the database is sunflower). Finally, high oleic oil is one that contains at least 75% oleic acid in its composition.

The results for the elasticities are presented below. The price elasticities of market shares in a random coefficient model are defined as follows:

$$\eta_{jkm} = \frac{\partial s_{jm} p_{km}}{\partial p_{km} s_{jm}} = \begin{cases} -\frac{p_{jm}}{s_{jm}} \int \alpha_i s_{ijm}(1 - s_{ijm}) d\hat{P}^*_D(D) d\hat{P}^*_v(v) & \text{if } j = k \\ \frac{p_{km}}{s_{jm}} \int \alpha_i s_{ijm}(1 - s_{ikm}) d\hat{P}^*_D(D) d\hat{P}^*_v(v) & \text{otherwise} \end{cases} \tag{17}$$

Substitution patterns are not derived from functional form (as in a logit model), but from differences in price sensitivity between consumers, allowing for flexible substitution patterns.

Tables 7, 8 and 9 present the own and crossed elasticities for the median of all markets. The elasticity of the variety in the row with respect to a change in the price of the variety in the column is presented. High sensitivities of market shares to changes in prices are observed for the three products: for oil, the own elasticities vary from -6.54 to -15.25, for tomato sauce from -3.67 to -17.64 and for rice from -7.56 to -10.75.

To understand the richness of the substitution patterns that the random coefficient logit model yields, it is useful to remember what the elasticities are like in the logit model without random coefficients:

$$\eta_{jkm} = \frac{\partial s_{jm} p_{km}}{\partial p_{km} s_{jm}} = \begin{cases} -\alpha p_{jm}(1 - s_{jm}) & \text{if } j = k \\ \alpha p_{jm} s_{jm} & \text{otherwise} \end{cases} \tag{18}$$

That is, the cross elasticities within the same "column" are all the same. The presented tables illustrate the changes observed in the logit model of random coefficients.

Table 7: Median own and cross price elasticities, oil

	Condesa soja	Diez soja	Demas soja	Optimo canola	Optimo girasol	Optimo girasol altoleico	Revelacion soja	Rio de la plata soja	Uruguay girasol
1 Condesa soja	-9.07	0.11	0.11	0.19	0.38	0.03	0.07	0.13	0.75
2 Diez soja	1.68	-11.06	0.05	0.18	0.39	0.03	0.04	0.17	0.67
3 Demas soja	1.68	0.08	-10.32	0.08	0.37	0.04	0.05	0.11	0.57
1 Optimo canola	1.86	0.08	0.07	-16.86	0.52	0.02	0.06	0.10	2.03
1 Optimo girasol	1.02	0.05	0.07	0.08	-12.50	0.08	0.03	0.08	0.58
1 Optimo girasol altoleico	0.36	0.00	0.03	0.01	0.29	-6.54	0.01	0.03	0.15
4 Revelacion soja	2.03	0.08	0.11	0.16	0.38	0.04	-11.02	0.13	0.74
5 Rio de la plata soja	1.65	0.09	0.09	0.13	0.40	0.04	0.05	-10.45	0.61
1 Uruguay girasol	1.86	0.10	0.09	0.49	0.57	0.03	0.06	0.12	-15.25

Notes. Cell entries i, j, where i indexes row and j column, give the percent change in market share of brand i with a 1% change in price of the good j. Each entry represents the median elasticity for all markets, weighted by the population in each market.

To complete the analysis of the demand results, the diversion ratios for each product are reported, defined as the fraction of consumers who leave product j after a price increase and switch to product k. As pointed out in Conlon and Mortimer (2021), while own-price elasticities are informative about the market power of the firm, cross-price elasticities alone are insufficient to understand how close

Table 8: Median own and cross price elasticities, sauce

	Cololo	Conaprole	De Ley	Don Perita	Gourmet	Gourmet Napolitana	Qualitas	Rigby	Rigby Italiana	Big
1 Cololo	-4.72	0.21	0.30	0.02	0.05	0.00	0.05	0.07	0.03	0.10
2 Conaprole	0.04	-17.07	0.25	0.11	2.16	0.02	0.15	0.15	0.05	0.19
3 De Ley	0.05	0.31	-5.98	0.06	0.10	0.03	0.10	0.14	0.07	0.18
4 Don Perita	0.07	1.39	0.56	-9.68	1.11	0.03	0.29	0.31	0.09	0.37
3 Gourmet	0.01	3.90	0.11	0.13	-17.64	0.00	0.16	0.16	0.03	0.17
3 Gourmet	0.00	0.13	0.16	0.02	0.03	-3.67	0.04	0.07	0.03	0.08
3 Qualitas	0.06	1.00	0.67	0.21	0.97	0.05	-9.64	0.29	0.07	0.41
5 Rigby	0.04	0.85	0.74	0.12	1.21	0.07	0.29	-9.42	0.13	0.41
5 Rigby	0.04	0.41	0.86	0.08	0.37	0.09	0.18	0.22	-8.33	0.31
6 Big	0.07	0.72	0.63	0.11	0.48	0.05	0.20	0.23	0.08	-8.94

Notes. Cell entries i, j, where i indexes row and j column, give the percent change in market share of brand i with a 1% change in price of the good j. Each entry represents the median elasticity for all markets, weighted by the population in each market.

Table 9: Median own and cross price elasticities, rice

	Aruba patna	Blue patna	Blue patna parboiled	Casarone	Green chef	Saman blanco	Saman parboiled	Saman patna	San jose	Shiva patna
2 Aruba patna	-7.74	0.60	0.08	0.05	2.52	1.27	0.35	0.51	0.18	0.61
1 Blue patna	0.28	-10.04	0.15	0.04	2.56	1.11	0.36	0.38	0.11	0.49
1 Blue patna parboiled	0.20	0.61	-9.98	0.03	2.08	0.83	0.33	0.29	0.08	0.37
3 Casarone	0.42	0.62	0.10	-8.09	2.74	1.29	0.35	0.46	0.13	0.57
1 Green chef	0.32	0.69	0.15	0.05	-8.48	1.15	0.36	0.39	0.12	0.51
2 Saman blanco	0.28	0.64	0.13	0.05	2.60	-9.84	0.36	0.39	0.13	0.45
2 Saman parboiled	0.21	0.52	0.11	0.03	1.84	0.90	-9.07	0.26	0.09	0.26
2 Saman patna	0.37	0.66	0.09	0.05	2.64	1.36	0.40	-10.75	0.20	0.52
4 San jose	0.36	0.59	0.10	0.04	2.76	1.21	0.33	0.40	-8.02	0.69
1 Shiva patna	0.39	0.68	0.13	0.06	2.89	1.14	0.30	0.44	0.15	-7.56

Notes. Cell entries i, j, where i indexes row and j column, give the percent change in market share of brand i with a 1% change in price of the good j. Each entry represents the median elasticity for all markets, weighted by the population in each market.

substitutes two products are, and diversion rates are more appropriate to understand this.

It is observed that the highest diversion ratios occur between products with similar observable characteristics. In the last row of each Table, the diversion ratio of the market share of the external option with respect to a change in the price of the good in the column is observed. For the three products, it can be seen that when faced with increases in the prices of each variety, a relevant fraction of consumers stop buying the good, with the outside option generally being above 40 percent.

Table 10: Diversion ratios oil

	Condesa soja	Diez soja	Demas soja	Optimo canola	Optimo girasol	Optimo girasol altoleico	Revelacion soja	Rio de la plata soja	Uruguay girasol
1 Condesa soja	1.00	0.12	0.11	0.12	0.09	0.08	0.12	0.12	0.12
2 Diez soja	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3 Demas soja	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
1 Optimo canola	0.03	0.02	0.01	1.00	0.01	0.00	0.02	0.01	0.06
1 Optimo girasol	0.03	0.03	0.03	0.03	1.00	0.07	0.03	0.03	0.04
1 Optimo girasol altoleico	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
4 Revelacion soja	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
5 Rio de la plata soja	0.02	0.02	0.02	0.02	0.02	0.02	0.02	1.00	0.02
1 Uruguay girasol	0.06	0.04	0.04	0.15	0.05	0.03	0.05	0.04	1.00
Outside good	0.84	0.76	0.77	0.67	0.81	0.79	0.75	0.77	0.75

Notes. Cell entries i, j, where i indexes row and j column, give the fraction of unit sales lost by the product j due to an increase in its price of 1% that would be diverted to the i product. Each entry represents the median elasticity for the markets with all varieties of the product, weighted by the population in each market.

Table 11: Diversion ratios sauce

	Cololo	Conaprole	De Ley	Don Perita	Gourmet	Gourmet Napolitana	Qualitas	Rigby	Rigby Italiana	Big
1 Cololo	1.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.01
2 Conaprole	0.04	1.00	0.03	0.03	0.09	0.02	0.03	0.03	0.02	0.03
3 De Ley	0.24	0.06	1.00	0.10	0.05	0.19	0.10	0.10	0.15	0.12
4 Don Perita	0.01	0.01	0.02	1.00	0.02	0.01	0.02	0.02	0.01	0.02
3 Gourmet	0.03	0.20	0.05	0.12	1.00	0.03	0.10	0.12	0.06	0.08
3 Gourmet	0.10	0.00	0.02	0.01	0.00	1.00	0.01	0.01	0.01	0.01
3 Qualitas	0.04	0.02	0.04	0.04	0.03	0.03	1.00	0.04	0.04	0.04
5 Rigby	0.05	0.03	0.05	0.05	0.06	0.04	0.05	1.00	0.05	0.05
5 Rigby	0.04	0.02	0.05	0.03	0.03	0.04	0.03	0.03	1.00	0.03
6 Big	0.05	0.03	0.06	0.05	0.04	0.05	0.05	0.05	0.05	1.00
Outside good	0.40	0.61	0.68	0.57	0.67	0.57	0.59	0.59	0.60	0.61

Notes. Cell entries i, j, where i indexes row and j column, give the fraction of unit sales lost by the product j due to an increase in its price of 1% that would be diverted to the i product. Each entry represents the median elasticity for the markets with all varieties of the product, weighted by the population in each market.

5.3 Price-cost margins

Table 13 shows the recovered marginal costs and markups for each product, calculated as the mean for all markets[9] The calculations are made under three different conduct assumptions: Nash Bertrand competition with the current ownership, Nash Bertrand competition with single product ownership (in which the price of each brand is set by a profit-maximizing agent that considers only the profits from that brand), and the collusion assumption. To recover the marginal cost, equation 12 and the

[9] In Tables A.3, A.4 and A.5 of the appendix we present the information by brand.

Table 12: Diversion ratios rice

	Aruba patna	Blue patna	Blue patna parboiled	Casarone	Green chef	Saman blanco	Saman parboiled	Saman patna	San jose	Shiva patna
2 Aruba patna	1.00	0.06	0.05	0.06	0.07	0.07	0.05	0.06	0.06	0.07
1 Blue patna	0.04	1.00	0.04	0.04	0.05	0.05	0.04	0.05	0.04	0.04
1 Blue patna parboiled	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 Casarone	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
1 Green chef	0.21	0.22	0.20	0.21	1.00	0.27	0.21	0.24	0.19	0.23
2 Saman blanco	0.14	0.16	0.14	0.13	0.17	1.00	0.15	0.16	0.13	0.13
2 Saman parboiled	0.03	0.04	0.04	0.02	0.04	0.05	1.00	0.03	0.03	0.02
2 Saman patna	0.06	0.06	0.05	0.05	0.08	0.07	0.05	1.00	0.05	0.06
4 San jose	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	1.00	0.01
1 Shiva patna	0.06	0.05	0.04	0.05	0.06	0.05	0.04	0.06	0.05	1.00
Outside good	0.46	0.40	0.43	0.43	0.51	0.42	0.45	0.39	0.45	0.44

Notes. Cell entries i, j, where i indexes row and j column, give the fraction of unit sales lost by the product j due to an increase in its price of 1% that would be diverted to the i product. Each entry represents the median elasticity for the markets with all varieties of the product, weighted by the population in each market.

information that arises from the estimation of demand are used. The markup is calculated as (p-cmg)*100/p.

As expected, the recovered marginal costs under the assumption of Nash Bertrand competition with single-product firms are higher than under Nash Bertrand with the current ownership, and these are higher than under collusion. As a counterpart, the markups are smaller.

The inclusion of an assumption of conduct as Nash Bertrand single-product firms is not based on the fact that it is a case of relevant conduct in itself to be tested because it is known which firms sell each variety of product. Its interest lies in the fact that it makes it possible to distinguish between the market power that firms obtain due to their ability to differentiate products from those of their competitors, with respect to that obtained by owning two products perceived as imperfect substitutes by consumers and charging higher prices to those who would charge two firms that sell the good separately (Nevo (2001) and Slade (2004)).

Therefore, with this information, we can say that if we assume that firms are competing in prices a la Nash Bertrand, on average their margins are 27.9% for oil, 36.1% for rice, and 22.3% for sauce. But also we can decompose these margins in two sources: for oil, 18.2 of this 27.9 (65% of the market power) is explained by the ability of the firms to offer products perceived as different from the rest of the market by the consumers, while 35% is explained by the fact that firms own several varieties of the product. If we apply the same reasoning for rice and sauce, 49% of the market power in the rice market is explained by product differentiation and 51% for ownership structure, and for sauce 65% for differentiation and 35% for ownership.

Without additional information, in principle, neither Nash Bertrand competition with current ownership nor collusion can be ruled out. In order to deepen the analysis and rule out some of the behavior assumptions, it is necessary to use information on costs or markups from another source (as in Nevo (2001) or Slade (2004)). If we rely on the observed information on costs and margins on the production side (Table 1), we could say that for the three products, the observed margins are between the estimates assuming collusion and the estimates assuming Nash Bertrand with the observed ownership structure, but closer to the competition à la Nash Bertrand. The literature has broadly followed two paths to deepen the analysis: 1- test each assumption of behavior against the observed data (menu approach, Nevo (2001), Berto Villas-Boas (2007)) or, 2- based on the observed data, recover behavioral parameters, that is, instead of testing whether they are colluding completely or competing completely a la Nash Bertrand, parameters on the degree of collusion are recovered (conduct approach, Miller and Weinberg (2017), (Miller et al. (2021)). However, in this application, no conduct tests will be carried out, due to the problems presented by the "observed" cost information.

Table 13: Mean prices, marginal cost and margins

	(1) Oil mean	(2) Rice mean	(3) Sauce mean
Prices	55.9	32.4	43.9
Single product marginal cost	52.2	26.9	37.9
Current ownership marginal cost	46.4	21.1	34.7
Collusion marginal cost	35.6	9.9	23.0
Single product margin	18.2	17.6	14.5
Current ownership margin	27.9	36.1	22.3
Collusion margin	57.6	74.8	51.4
Observations	2751	3525	3360

Notes. Presented are means of the brand-locality-quarter observations, weighted by the sales. Margins are defined as (p-mc)/p. Marginal cost and margins computed based on the full model reported on Table 6

Table 14 shows the results of price to cost pass-through rates, for every product under every assumption about the behavior of the producers in the market. Under single-product Nash Bertrand competence, the pass-through rates are 51.6% for oil, 44.3% for sauce and 56.5% for rice. As is expected and discussed in the introduction, under the collusion assumption the pass-through rates are the smaller on average for the three products, being 21.6% for oil, 10.6% for sauce and 21.4% for rice. Finally, also as expected, the pass-through rates with the observed ownership structure are in between those for single product and collusion assumptions. The exercise results indicate lower average pass-through rates than those predicted by linear demand with homogeneous products (of 100%). In addition, in general terms, the pass-through is also low when is compared to Table 8 of Kim and Cotterill (2008)[10]. This confirms the intuition discussed in the introduction, related to the fact that in economies with low intensity of competition, it is expected to find higher price levels and markups, which may cause cost shocks to be transmitted to final prices to a lesser extent.

Table 14: PASS-THROUGH RATE (%)

	Single product	Current ownership	Collusion
Oil	51.6	21.6	21.6
Sauce	44.3	43.3	10.6
Rice	56.5	52.3	21.4
MC shock	10	10	10

Notes. Presented are means of the brand-locality-quarter observations, weighted by the sales. pass-through rate defined as $\Delta p/\Delta mc$.

6 Conclusions

This paper estimates a demand system for differentiated products for oil, tomato sauce, and rice in small and medium-sized retailers. The estimates are used to compute marginal costs, margins, and pass-through ratios from cost to prices that are feasible under different assumptions about how producers compete in these markets. The work seeks to provide empirical evidence on price formation at the microeconomic level in Uruguay, market power and its origin, as well as the ability of producers to pass cost shocks to the final price of the item.

Regarding the elasticities of demand, consumers are highly sensitive to price increases and substitution patterns between varieties that are intuitive. On the other hand, it is observed that most of the decreases in the market share of a variety due to the rise in prices do not translate into increases in another of the varieties for which there is information, but instead, they stop buying those varieties in retailers for which information is available.

In relation to markups, similar levels are found for oil and tomato sauce, around 25% if competition is assumed to be a la Nash Bertrand with the observed ownership structure and 50% with collusion. For rice, there are higher margins, 36% under Nash Bertrand and 75% under collusion.

[10] This comparison is only as a general reference for another basic good.

The exercise carried out allows us to conclude that of the total margin that producers obtain under the Nash Bertrand competition assumption, approximately 65% is explained by their ability to differentiate products for oil and sauce, while 49% is explained by this reason in the case of rice, while the rest is explained by the ownership structure.

Regarding the pass-through from costs to prices, there are higher levels under Nash Bertrand competition than under collusion, but in both cases, they are relatively low levels, which in no case exceed 55%. These results are consistent with the intuition that in more concentrated markets and with high levels of market power, low levels of pass-through can be expected.

References

Anderson, S. P., de Palma, A., and Kreider, B. (2001). Tax Incidence in Differentiated Product Oligopoly. *Journal of Public Economics*, 81(2):173–192.

Berry, S., Levinsohn, J., and Pakes, A. (1995). Automobile Prices in Market Equilibrium. *Econometrica*, 63(4):841–890.

Berry, S. T. (1994). Estimating discrete-choice models of product differentiation. *The RAND Journal of Economics*, pages 242–262.

Berry, S. T. and Haile, P. A. (2014). Identification in differentiated products markets using market level data. *Econometrica*, 82(5):1749–1797.

Berto Villas-Boas, S. (2007). Vertical relationships between manufacturers and retailers: Inference with limited data. *The Review of Economic Studies*, 74(2):625–652.

Besley, T. and Rosen, H. S. (1999). Sales Taxes and Prices: An Empirical Analysis. *National Tax Journal*, 52(2):157–78.

Bet, G. (2021). Market power in the us airline industry. *Available at SSRN 3913695.*

Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics Letters*, 10(1):87–92.

Bresnahan, T. F., Stern, S., and Trajtenberg, M. (1997). Market segmentation and the sources of rents from innovation: Personal computers in the late 1980s. *The Rand Journal of Economics*, 28:S17.

Brum, C., Ogliarusso, S., and Salmieri, S. (2012). Competitividad del sector aceite comestible en el uruguay. el impacto del mercosur y sus perspectivas. *Monografía de grado, Universidad de la República (Uruguay). Facultad de Ciencias Económicas y de Administración.*

Brunner, D., Heiss, F., Romahn, A., and Weiser, C. (2017). Reliable estimation of random coefficient logit demand models. Technical report, Heinrich Heine University Düsseldorf, Düsseldorf Institute for Competition .

Bulow, J. I. and Pfleiderer, P. (1983). A Note on the Effect of Cost Changes on Prices. *Journal of Political Economy*, 91(1):182–185.

Chamberlain, G. (1982). Multivariate regression models for panel data. *Journal of econometrics*, 18(1):5–46.

Chidmi, B. and Lopez, R. A. (2007). Brand-supermarket demand for breakfast cereals and retail competition. *American Journal of Agricultural Economics*, 89(2):324–337.

Conlon, C. and Mortimer, J. H. (2021). Empirical properties of diversion ratios. *The RAND Journal of Economics*, 52(4):693–726.

Czarnievicz, D. and Zipitría, L. (2018). Concentración y precios en cinco mercados minoristas. Documentos de Trabajo (working papers) 0618, Department of Economics - dECON.

De Loecker, J., Goldberg, P. K., Khandelwal, A. K., and Pavcnik, N. (2016). Prices, markups, and trade reform. *Econometrica*, 84(2):445–510.

De Loecker, J. and Scott, P. T. (2016). Estimating Market Power Evidence from the US Brewing Industry. Working Paper 22957, National Bureau of Economic Research.

De Loecker, J. and Warzynski, F. (2012). Markups and firm-level export status. *American economic review*, 102(6):2437–71.

Delipalla, S. and Keen, M. (1992). The Comparison between Ad Valorem and Specific Taxation under Imperfect Competition. *Journal of Public Economics*, 49(3):351–367.

Doraszelski, U. and Jaumandreu, J. (2019). Using cost minimization to estimate markups. *Available at SSRN 3496603*.

Duarte, M., Magnolfi, L., Sølvsten, M., and Sullivan, C. (2021). Testing firm conduct. Technical report, working paper, University of Wisconsin-Madison.

Froeb, L., Tschantz, S., and Werden, G. (2005). Pass-Through Rates and the Price Effects of Mergers. *International Journal of Industrial Organization*, 23:703–715.

Hall, R. E. (1988). The Relation between Price and Marginal Cost in U.S. Industry. *Journal of Political Economy*, 96(5):921–947.

Hausman, J. A. (1996). Valuation of new goods under perfect and imperfect competition. In *The economics of new goods*, pages 207–248. University of Chicago Press.

Horta, R., Jung, A., and Garbarino, P. (2017). La industria oleaginosa en uruguay desde un enfoque estratégico. *Montevideo: Universidad Católica del Uruguay. Instituto de Competitividad.*

Karp, L. S. and Perloff, J. M. (1987). Estimating Market Structure and Tax Incidence: The Japanese Television Market. Technical Report 6095, University of California, Berkeley, Department of Agricultural and Resource Economics.

Katz, M. L. and Rosen, H. S. (1983). Tax Analysis in an Oligopoly Model. Technical Report 1088, National Bureau of Economic Research, Inc.

Kim, D. and Cotterill, R. W. (2008). Cost Pass-Through in Differentiated Product Markets: The Case of U.s. Processed Cheese*. *The Journal of Industrial Economics*, 56(1):32–48.

Mahoney, N. and Weyl, E. G. (2017). Imperfect Competition in Selection Markets. *The Review of Economics and Statistics*, 99(4):637–651.

Miller, N. H., Sheu, G., and Weinberg, M. C. (2021). Oligopolistic price leadership and mergers: The united states beer industry. *American Economic Review*, 111(10):3123–59.

Miller, N. H. and Weinberg, M. C. (2017). Understanding the price effects of the millercoors joint venture. *Econometrica*, 85(6):1763–1791.

Miraballes Iguiní, M. (2021). Posicionamiento del arroz uruguayo en el mercado de latinoamérica y el caribe. *Tesis de grado.*

Moorthy, S. (2005). A general theory of pass-through in channels with category management and retail competition. *Marketing Science*, 24(1):110–122.

Nevo, A. (2000). A practitioner's guide to estimation of random-coefficients logit models of demand. *Journal of economics & management strategy*, 9(4):513–548.

Nevo, A. (2001). Measuring Market Power in the Ready-to-Eat Cereal Industry. *Econometrica*, 69(2):307–342.

Raval, D. (2020). Testing the production approach to markup estimation. *Available at SSRN 3324849.*

Slade, M. E. (2004). Market power and joint dominance in u.k. brewing. *The Journal of Industrial Economics*, 52(1):133–163.

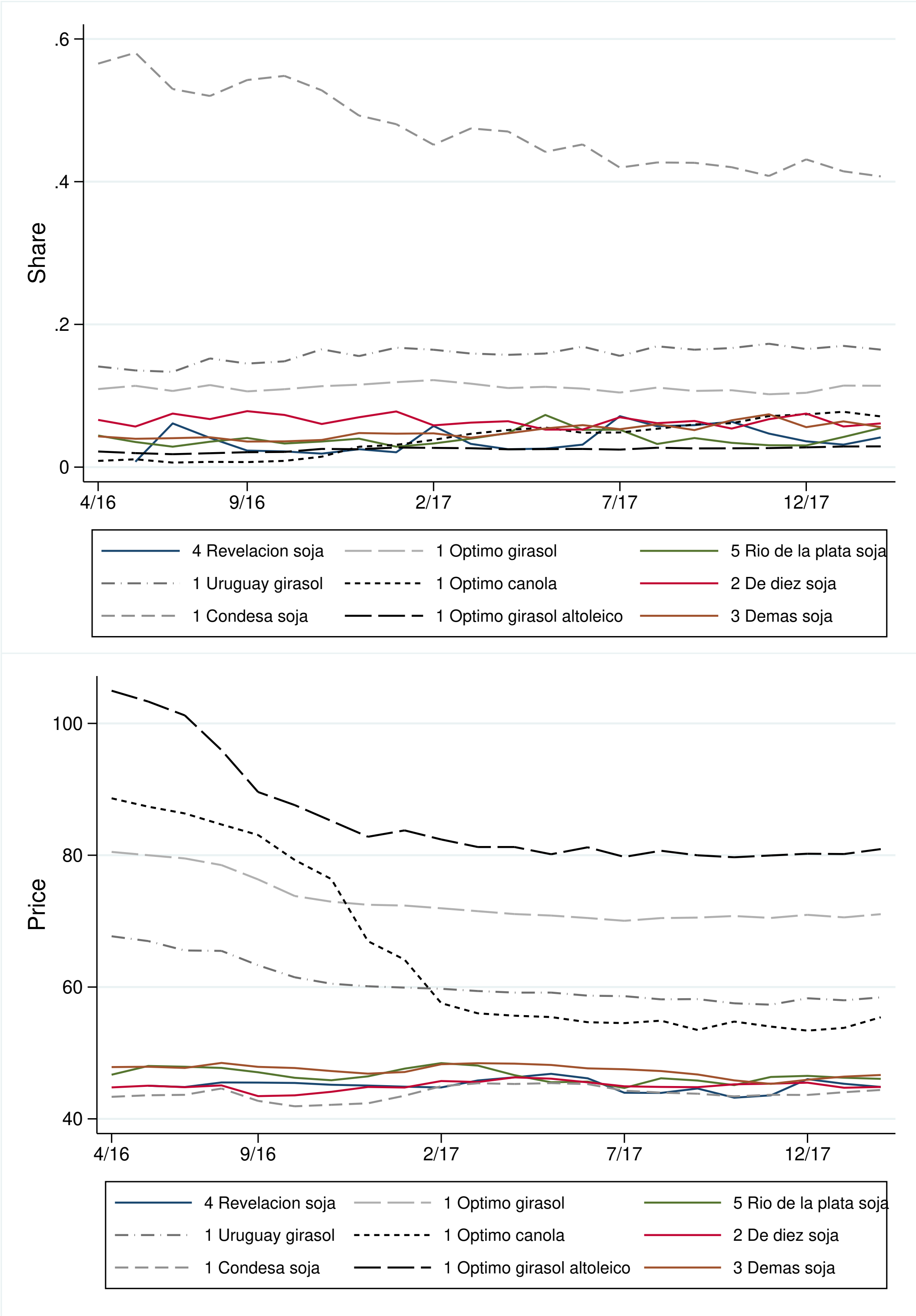
Stern, N. (1987). The Effects of Taxation, Price Control and Government Contracts in Oligopoly and Monopolistic Competition. *Journal of Public Economics*, 32(2):133–158.

Sullivan, D. (1985). Testing Hypotheses about Firm Behavior in the Cigarette Industry. *Journal of Political Economy*, 93(3):586–598.

Weyl, E. G. and Fabinger, M. (2013). Pass-Through as an Economic Tool: Principles of Incidence under Imperfect Competition. *Journal of Political Economy*, 121(3):528–583.

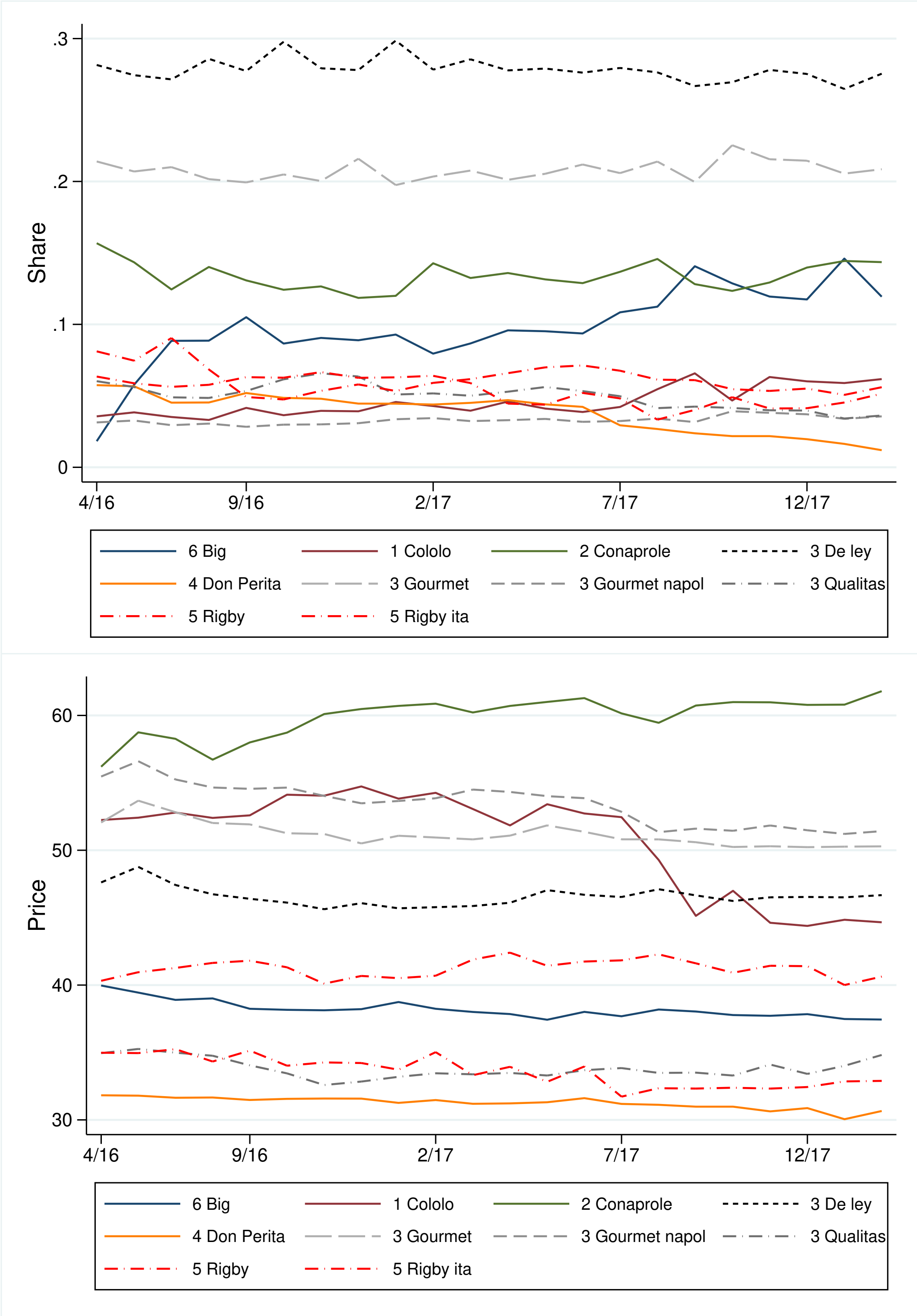
A Appendix

Figure A.1: Evolution of shares and prices by brand: oil



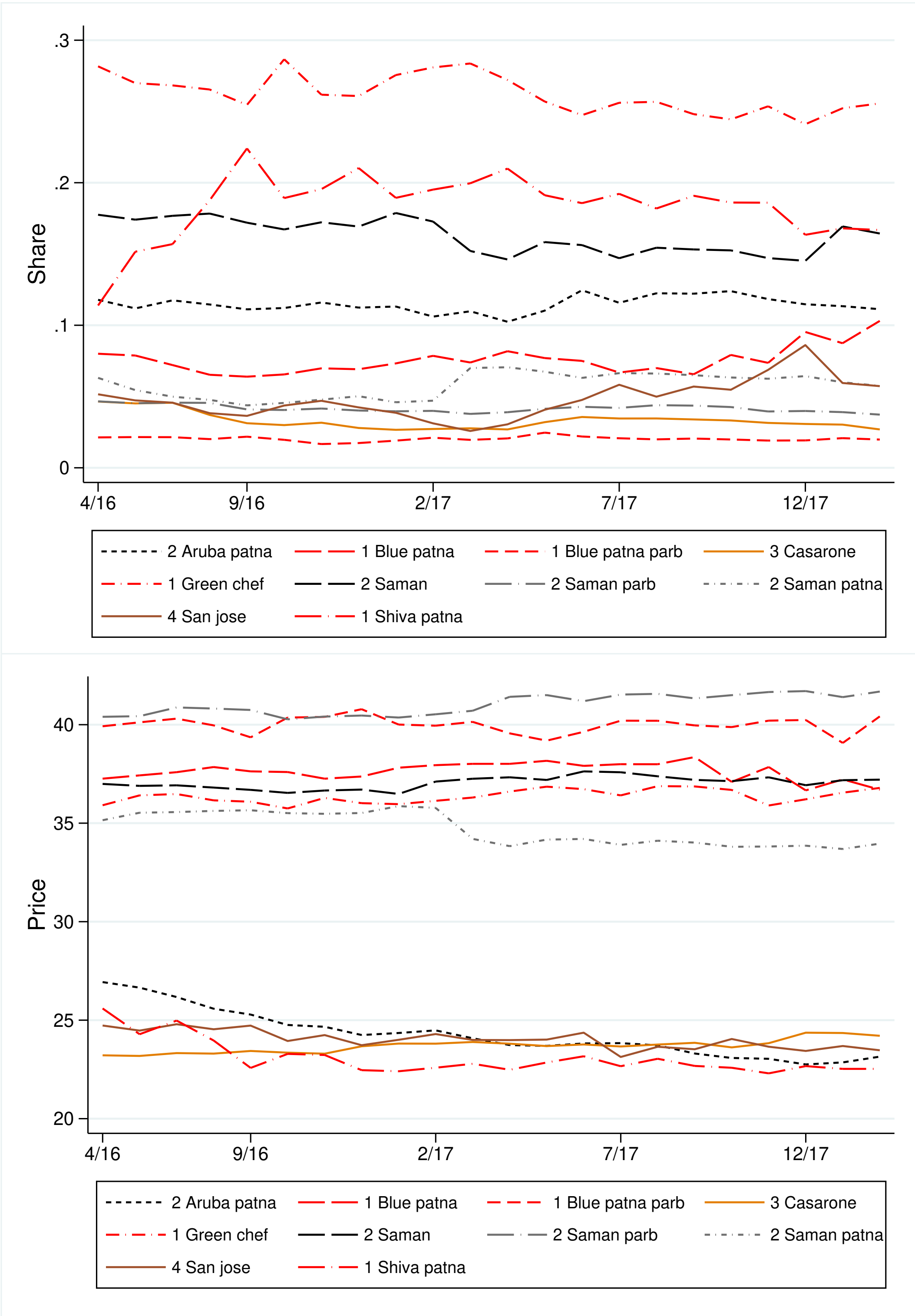
Notes. The upper graph shows the monthly evolution of the shares in all available stores, of each variety of the product with at least a 2% of share in the study period. The lower graph shows the evolution of the average price (per kilo in uruguyan pesos) in all available stores, of each variety of the product in the period studied.

Figure A.2: Evolution of shares and prices by brand: sauce



Notes. The upper graph shows the monthly evolution of the shares in all available stores, of each variety of the product with at least a 2% of share in the study period. The lower graph shows the evolution of the average price (per kilo in uruguyan pesos) in all available stores, of each variety of the product in the period studied.

Figure A.3: Evolution of shares and prices by brand: rice



Notes. The upper graph shows the monthly evolution of the shares in all available stores, of each variety of the product with at least a 2% of share in the study period. The lower graph shows the evolution of the average price (per kilo in uruguyan pesos) in all available stores, of each variety of the product in the period studied.

Table A.1: Descriptive statistics of demographics

Departamento	Localidad	Municipio	Age	Education years	Sex
Artigas	Artigas		45.91	8.684	0.455
Artigas	Bella Union		44.76	8.305	0.507
Canelones	Barros Blancos		43.29	7.678	0.478
Canelones	Canelones		46.06	8.961	0.464
Canelones	La Paz		44.92	8.688	0.454
Canelones	Las Piedras		43.92	8.214	0.443
Canelones	Pando		43.90	8.575	0.480
Canelones	Parque Del Plata		47.59	9.508	0.447
Canelones	Paso Carrasco		43.04	8.821	0.487
Canelones	Pinar		43.67	10.46	0.491
Canelones	Progreso		43.56	7.864	0.480
Canelones	Salinas		46.75	9.780	0.468
Canelones	San Ramon		46.75	7.972	0.499
Canelones	Santa Lucia		46.43	8.699	0.474
Canelones	Sauce		45.54	8.363	0.469
Canelones	Solymar		46.04	10.93	0.466
Canelones	Toledo		42.67	8.001	0.471
Cerro Largo	Melo		46.87	8.392	0.442
Colonia	Carmelo		47.23	8.436	0.466
Colonia	Colonia		46.64	9.127	0.454
Durazno	Durazno		46.22	8.534	0.465
Flores	Trinidad		48.69	8.035	0.500
Florida	Florida		47.19	8.720	0.453
Lavalleja	Minas		48.57	8.523	0.450
Maldonado	Maldonado		44.67	8.553	0.468
Maldonado	Piriapolis		48.53	9.397	0.470
Maldonado	Punta Del Este		47.46	11.98	0.465
Maldonado	San Carlos		44.03	8.524	0.457
Montevideo	Montevideo	A	45.83	8.123	0.454
Montevideo	Montevideo	B	43.90	12.21	0.449
Montevideo	Montevideo	C	47.37	11.01	0.451
Montevideo	Montevideo	CH	48.02	13.07	0.437
Montevideo	Montevideo	D	45.32	8.490	0.444
Montevideo	Montevideo	E	47.31	11.62	0.486
Montevideo	Montevideo	F	44.06	8.211	0.471
Montevideo	Montevideo	G	46.38	8.897	0.424
Paysandu	Paysandu		46.62	9.071	0.472
Rio Negro	Fray Bentos		45.36	8.844	0.481
Rio Negro	Young		44.51	7.978	0.529
Rivera	Rivera		45.52	8.432	0.433
Rocha	Rocha		46.88	8.710	0.456
Salto	Salto		44.77	8.739	0.467
San Jose	Ciudad Del Plata		41.76	7.740	0.468
San Jose	Libertad		45.09	7.983	0.470
San Jose	San Jose De Mayo		46.42	8.555	0.484
Soriano	Dolores		45.12	8.309	0.476
Soriano	Mercedes		46.46	8.997	0.457
Tacuarembo	Paso De Los Toros		46.97	7.785	0.468
Tacuarembo	Tacuarembo		45.53	8.298	0.436
Treinta Y Tres	Treinta Y Tres		47.46	8.862	0.474

Notes. Average age, education years and sex by region, obtained from Census 2011.

A.1 First stage of logit model

Table A.2: First stage logit model

VARIABLES	(1) Price	(2) Price	(3) Price
1 instrument	0.445	-1.358**	-0.925
	(1.659)	(0.617)	(0.757)
2 instrument	4.180**	-0.472	0.184
	(1.954)	(0.916)	(0.870)
3 instrument	-2.835	-2.300**	-0.924
	(2.281)	(1.119)	(0.854)
4 instrument	-0.242	-2.603**	-0.131
	(2.109)	(1.053)	(0.833)
5 instrument	5.547***	0.126	-0.982
	(1.748)	(0.988)	(0.799)
6 instrument	-0.337	-4.553***	-1.382*
	(1.753)	(1.020)	(0.740)
7 instrument	1.671	4.101***	-1.207
	(1.655)	(1.354)	(0.783)
8 instrument	-2.049	-2.596**	1.204
	(1.556)	(1.193)	(0.985)
9 instrument	-0.717	-4.024***	0.477
	(1.540)	(1.105)	(1.086)
10 instrument	0.024	-1.671	-1.187
	(1.494)	(1.240)	(1.006)
11 instrument	-4.362*	-0.551	-5.691***
	(2.639)	(1.334)	(1.012)
12 instrument	3.932	-2.726**	1.724*
	(2.394)	(1.285)	(0.984)
13 instrument	4.796*	0.689	-2.821***
	(2.723)	(1.047)	(0.819)
14 instrument	-6.215**	-9.480***	3.870***
	(2.700)	(1.214)	(0.762)
15 instrument	-9.771***	0.672	-1.565*
	(3.138)	(1.244)	(0.893)
16 instrument	6.969*	-3.335***	-1.694*
	(3.675)	(1.039)	(0.969)
17 instrument	-4.161	-0.796	-1.092
	(3.364)	(0.986)	(0.930)
18 instrument	8.269***	-5.024***	-1.944**
	(3.007)	(1.105)	(0.982)
19 instrument	-7.032**	-0.798	3.950***
	(2.856)	(1.169)	(0.977)
20 instrument	3.507	-1.116	-1.770*
	(2.396)	(1.235)	(1.050)
21 instrument	-3.059*	-1.131	-3.549***
	(1.613)	(1.374)	(0.822)
22 instrument	-4.876**	-1.477	-2.410***
	(2.288)	(1.218)	(0.665)
Observations	2,751	3,360	3,525
R-squared	0.826	0.926	0.937
Product	Oil	Sauce	Rice

Notes. First stage of IV regressions reported in Table 5

Table A.3: Margins by product for oil

	Single product	Current ownership	Collusion
Condesa soja	22.2	36.4	55.8
Diez soja	12.8	12.8	23.3
Demas soja	98.1	98.1	192.5
Optimo canola	8.4	32.3	49.7
Optimo girasol	10.6	24.3	36.0
Optimo girasol altoleico	-22.6	-8.8	1.2
Revelacion soja	12.1	12.1	57.2
Rio de la plata soja	11.3	11.3	51.2
Uruguay girasol	11.4	27.5	42.5

Notes. Presented are means of the brand-locality-quarter observations, weighted by the sales. Margins are defined as (p-mc)/p. Margins computed based on the full model reported on Table 6.

Table A.4: MARGINS BY PRODUCT FOR SAUCE

	Single product	Current ownership	Collusion
Cololo	6.0	6.0	37.5
Conaprole	9.2	9.2	31.3
De Ley	24.9	35.8	50.0
Don Perita	12.3	12.3	61.0
Gourmet	16.9	28.4	42.1
Gourmet napolitana	16.9	35.7	50.5
Qualitas	13.7	42.3	62.4
Rigby	16.4	19.8	70.5
Rigby italiana	15.1	19.8	60.0
Pure de tomate Big	13.9	13.9	54.7

Notes. Presented are means of the brand-locality-quarter observations, weighted by the sales. Margins are defined as (p-mc)/p. Margins computed based on the full model reported on Table 6.

Table A.5: Margins by product for rice

	Single product	Current ownership	Collusion
Aruba patna	16.2	35.3	72.8
Blue patna	12.7	30.4	44.5
Blue parna parboiled	11.0	29.6	41.1
Casarone	14.2	14.2	67.7
Green chef	21.2	31.0	45.6
Saman blanco	15.0	21.3	44.8
Saman Parboiled	12.2	21.6	42.5
Saman patna	12.2	24.4	49.4
San jose	15.0	15.0	68.8
Shiva patna	20.3	46.5	68.8

Notes. Presented are means of the brand-locality-quarter observations, weighted by the sales. Margins are defined as (p-mc)/p. Margins computed based on the full model reported on Table 6.

A.2 Appendix: Demand estimation details

The implementation of the estimation of the model proposed by Berry et al. (1995) requires determining a method to approximate the integral, an optimization algorithm, initial values, and convergence criteria. Brunner et al. (2017) discuss implementation alternatives so that the estimation results are adequate and the R package "BLPestimatematoR" is provided, used in the present work to carry out the estimation.

Regarding the simulation to approximate the integral of the market shares, 200 MLHS (latin hypercube sampling draws) draws are used. The sensitivity of the results to increasing the number of extractions to 1000 is tested, corroborating no relevant differences in the results. The number of extractions cannot be greater than the number of extractions of the observable characteristics of the individuals. The algorithm used for optimization is BFGS (Broyden–Fletcher–Goldfarb–Shanno).

Regarding the iterations of the contraction, a maximum of 5000 iterations is set or until it is less than 1e-06. Finally, following Nevo (2000) and Chidmi and Lopez (2007), as starting guesses for the average utility vector (γ) the results obtained in the logit model are used.