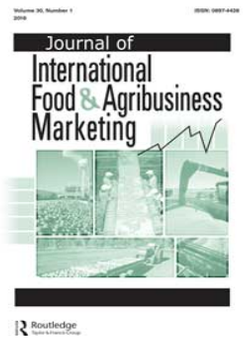

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The Effects of Extrinsic Cues on Olive Oil Price in Brazil

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ABSTRACT

Over the past two decades, world olive oil consumption registered an impressive growth. Although olive oil consumption remains concentrated in the main producer countries surrounding the Mediterranean Sea ("traditional" markets), it is also growing rapidly in many other countries all over the world, where olive oil is still largely perceived as a novelty food ("nontraditional" markets). This study focuses on the Brazilian market of olive oil, which is one of the most important nontraditional markets in terms of both its dimension and growth rates. A hedonic price model has been used to evaluate whether, and to what extent, extrinsic cues impact on the retail price of olive oil. Data were collected via direct observation of several e-shops where Brazilian consumers could purchase olive oil. Results show that the retail price of olive oil is highly influenced by extrinsic cues such as branding, labeling, and packaging.

KEYWORDS

Brazil; e-commerce; extrinsic cues; olive oil; price

Introduction

Over the past two decades, world olive oil consumption increased by 60%, from 1.85 million tons in 1995 to 2.99 million tons in 2015 (IOC, 2016). This impressive development of olive oil consumption has been driven by a combination of several factors such as population growth, rising incomes, changes in food habits, as well as the increasing reputation of the Mediterranean diet which is considered as one of the healthiest and most balanced diets in the world (Clodoveo, Camposeo, De Gennaro, Pascuzzi, & Roselli, 2014; Mili, 2006; Xiong, Sumner, & Matthews, 2014). Effectively, olive oil is one of the most important components of the Mediterranean diet, and it is increasingly appreciated worldwide for its proven health benefits (Estruch et al., 2013; Sofi, Cesari, Abbate, Gensini, & Casini, 2008; Tuck & Hayball, 2002).

Global olive oil consumption remains concentrated in the major producer countries that surround the Mediterranean Sea ("traditional" markets). Five

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countries, i.e., Spain, Italy, Greece, Turkey, and Tunisia, produce 78% and consume 48% of the world olive oil (IOC, 2016). However, in the last decades, olive oil consumption is also growing rapidly in many other countries all over the world, where olive oil is still largely perceived as a novelty food ("nontraditional" or "emerging" markets).

Among these emerging markets, Brazil is one of the most important in terms of both its dimension and growth rates. Over the past two decades, olive oil consumption in Brazil has more than tripled, from 19 thousand tons in 1995 to 66.5 thousand tons in 2015 (IOC, 2016). Because domestic production is practically absent (IOC, 2016), the increasing Brazilian consumption of olive oil is totally satisfied by imports. Therefore, the Brazilian market of olive oil offers great opportunities for foreign producers who are more export oriented as well as for domestic producers who are willing to invest in the olive oil sector.

However, there is lack of information about the Brazilian market of olive oil. Although an extensive literature on various aspects of olive oil consumption has been carried out for traditional markets (Caporale, Policastro, Carlucci, & Monteleone, 2006; Cicia, Del Giudice, & Scarpa, 2005; Dekhili & d'Hauteville, 2009; Del Giudice, Cavallo, Caracciolo, & Cicia, 2015; Di Vita, D'Amico, La Via, & Caniglia, 2013; Fotopoulos & Krystallis, 2001; Gázquez-Abad & Sánchez-Pérez, 2009; Scarpa & Del Giudice, 2004; Yangui, Costa-Font, & Gil, 2014), the results of these studies cannot be extended to the emerging markets without running the risk of being misleading. In Brazil, olive oil is substantially a novelty food, and it is only partially included in the population's daily diet (Deloitte, 2012). Most consumers may be not familiar with this product and not experienced enough to value intrinsic quality attributes such as sensory properties. Therefore, it is likely that extrinsic cues such as branding, labeling, and packaging are primarily used in purchasing choices by Brazilian consumers.

Policy makers and practitioners may find very useful to know how extrinsic cues impact on the retail price of olive oil. However, to our knowledge, so far no systematic research on this topic has been undertaken in Brazil. This study aims to contribute in filling this knowledge gap by carrying out a hedonic price analysis to investigate the role of the main extrinsic cues (branding, labeling, and packaging) in affecting the retail price of olive oil in Brazilian market. In particular, this study focuses on a specific retail channel represented by the e-commerce business-to-consumers (e-tailing), mainly because data collection from this channel is cheaper and faster than traditional methods of collecting data by visiting physical stores. In addition, recent studies (Cavallo, 2017; Cavallo & Rigobon, 2016) provided strong evidence that online prices are a representative source of retail prices, even if most transactions still take place offline.

The paper is organized as follows: Section 2 overviews the Brazilian market of olive oil; Section 3 details the methodology employed (data collection, data

set, and hedonic price model); Section 4 presents and discusses the results; Section 5 summarizes the findings and highlights the main practical implications.

An overview of the Brazilian market of olive oil

Brazil is a newly industrialized country, which has become the 9th largest economy in the world and the most important in Latin America (World Bank, 2016). In recent years, Brazil also gained a leading position in the international trade of olive oil. In 2015, the Brazilian consumption of olive oil reached 66.5 thousand tons, the 12th highest in the world and the second highest among non-traditional consumer countries, after the USA (IOC, 2016). Because of the inexistent domestic production, the whole Brazilian consumption of olive oil is satisfied by imports. In fact, Brazil is the third largest olive oil importer in the world, after the USA (300 thousand tons) and the EU (132.5 thousand tons) (IOC, 2016). Most of the Brazilian olive oil imports are shipped from Portugal (60%) and, to a lesser extent, from Spain (19%), Argentina (9%), Italy (6%), Chile (5%), and Greece (1%) (UN COMTRADE, 2015). However, the Brazilian market of olive oil should still be considered as an "emerging" market. Household penetration rate of olive oil is only 12%, and the purchases of this product are concentrated during Christmas time (Deloitte, 2012). Therefore, the annual *per capita* olive oil consumption in Brazil (0.36 Kg) remains much lower than that of traditional consumer countries, such as Greece (13.55 kg), Spain (10.93 kg), or Italy (9.96 kg) (FAO, 2017). Conversely, the annual *per capita* consumption of other vegetable oils (in particular those domestically produced such as soybean oil, palm oil, and cottonseed oil) is rather high (17.49 kg).

One of the main barriers of olive oil consumption in Brazil remains the too high price, considering that the average price of olive oil is 400% higher than that of the other vegetable oils (Deloitte, 2012). This explains why olive oil consumption is concentrated in the largest and richest cities of Southern states (e.g., São Paulo, Río de Janeiro, Porto Alegre, Florianopolis), where there is also a wider presence of Europeans' descendants and immigrants, traditional consumers of olive oil (Pitta, 2014).

There are more than 50 foreign brands of olive oil in Brazilian market. However, the first three top brands (i.e., *Gallo, Andorinha,* and *Carbonell*) control about half (49%) of the national market (Pitta, 2014). Portuguese brands (*Gallo, Andorinha* and *Herdade do Esporão,* among the most important) are dominant with a cumulative market share of 58% (Pitta, 2014).

The success of olive oil in Brazil is also generating concerns about the management of public quality standards and compliance issues. In fact,

because the price of olive oil is significantly higher than that of the other vegetable oils, there have been cases of fraud where olive oil has been altered, e.g., by mixing olive oil with other vegetable oils or by labeling olive oil as extra virgin when it was not (Deloitte, 2012). For this reason, in 2012, Brazilian Ministry of Agriculture adopted mandatory grading standards for olive oil using the commercial grades of International Olive Council as benchmark (Ministério da Agricultura, Pecuária e Abastecimento, 2012).

Data and methodology

Hedonic price model

We built a hedonic price model to analyze the relationship between the price and the main extrinsic cues of the olive oil sold through e-tailing channel in Brazil. The hedonic price model has been successfully employed to analyze the market of several food products, including wine (Boatto, Defrancesco, & Trestini, 2011; Costanigro, McCluskey, & Mittelhammer, 2007; Panzone, 2011; Roberto Luppe, Fávero, & Belfiore, 2009; Schamel, 2006; Steiner, 2004), carbonated beverages (Martínez-Garmendia, 2010), apples (Carew, Florkowski, & Smith, 2012), beans (Mishili, Temu, Fulton, & Lowenberg-DeBoer, 2011), yogurt (Bimbo, Bonanno, Liu, & Viscecchia, 2016; Carlucci, Stasi, Nardone, & Seccia, 2013), coffee (Schollenberg, 2012; Teuber, 2010), tea (Deodhar & Intodia, 2004), milk (Bimbo, Bonanno, & Viscecchia, 2016), and bottled water (Carlucci, De Gennaro, & Roselli, 2016).

The hedonic approach is borrowed from Lancaster's (1966) theory of demand, which states that consumers derive utility directly from the quality attributes embedded in a product rather than from the product itself. In other words, any differentiated product can be considered a bundle of several quality attributes that are independently valued by consumers at the time of purchase. Successively, Rosen (1974) developed a theoretical model demonstrating that the observed price of a product can be considered as the sum of the prices associated with each of its quality attributes. Although these prices are not explicitly expressed by the market, they can be estimated by employing a regression equation, i.e., the hedonic price model, which expresses the price of a product (directly observable) as a function of its attributes (directly or indirectly observable).

According to the Rosen's (1974) formulation, a hedonic price model can be specified as follows:

$$P(Z) = P\left(z_1, z_2, \ldots, z_j, \ldots, z_n\right) \tag{1}$$

where P is the price of a product and $Z = z_1, z_2, \ldots z_j, \ldots, z_n$ is a vector of n objectively measured attributes that completely describe product quality.

After estimating the hedonic price equation, a partial derivative with respect to the attribute *j*, $\partial P(Z)/\partial z_j$, can be interpreted as the "implicit" or "shadow" price of the specific attribute *j*.

This theoretical model is based on the assumption that the market is in equilibrium, and there is perfect competition. In this situation, consumers maximize utility by choosing available products under budget constraints, and firms maximize profits given the available technology and factor prices (Rosen, 1974). Consequently, being related to both supply and demand conditions, implicit prices cannot be considered merely as indicators of consumers' preferences (Costanigro & McCluskey, 2011).

The hedonic price model has been also used to analyze the olive oil market in different countries. Carlucci, De Gennaro, Roselli, and Seccia (2014) estimated the effects of packaging, olive variety, organic certification, geographical indications (PDO/PGI), and extraction method on the price of extra-virgin olive oil sold through the virtual stores of Italian firms (farms, mills, and bottlers). The study showed that the price of extra-virgin olive was mainly affected by PDO/PGI designations. Another Italian study (Cicia et al., 2013) investigated how the price of extra-virgin olive oil was related to the attributes detectable by observing the bottle (packaging, organic certification, geographical indications, country of origin, brand) and sensory features rating provided by an expert panel. The study highlighted a clear discrepancy, as olive oils with high sensory profile had lower prices than olive oils with neutral taste. In Greece, Karipidis, Tsakiridou, and Tabakis (2005) used data obtained by observing olive oil labels on the shelves of representative retail stores to estimate a hedonic price model. Results showed that the retail price of olive oil was strongly affected by the type of packaging, product category (virgin/extra-virgin), extraction method, organic certification, and taste information, whereas PDO/PGI designations resulted nonsignificant. Ribeiro and Santos (2005) estimated a hedonic price model to analyze the relation between the price of olive oils sold in a Portuguese retail chain and their attributes (acidity, organic certification, PDO designations, addition with herbs, and brand). The main finding was that Portuguese olive oils with PDO designations were better priced than olive oils without any indication of the region of origin. In Chile, Muñoz, Moya, and Gil (2015) estimated the implicit prices of the most relevant attributes of olive oil (packaging, acidity, country of origin, and brand) sold in Chilean retail chains and showed that all the considered attributes influenced the price of olive oil both positively and negatively. Finally, Roselli, Carlucci, and De Gennaro (2016) investigated the role of the main extrinsic cues (packaging, product category, organic certification, geographical indications, country of origin, and brand) in affecting the price of olive oil sold in the U.S. market. Results showed that all the considered extrinsic cues had a significant impact on the price of olive oil, especially the type of packaging and brand.

Data collection

Data on the prices and characteristics of olive oils sold in Brazil were collected via direct observation of the websites of several e-shops where Brazilian consumers could purchase olive oil.[1] Data search and collection were carried out during Christmas time (November and December 2015) when the purchases of olive oil are more frequent, and there is a larger assortment of products available for sale.

We focused on e-tailing channel mainly because online data collection is cheaper and faster than traditional methods of collecting data by visiting physical stores. In addition, the range of products available for sale on the websites of e-shops is larger than that available in physical stores. However, the share of retail transactions which take place online remains relatively low (only 4%), considering in particular food products category (Ecommerce Foundation, 2017). Therefore, a fundamental question is whether online prices are similar to the prices that can be collected in physical stores. However, recent studies (Cavallo, 2017; Cavallo & Rigobon, 2016), based on a large-scale comparison of online and offline prices, provided strong evidence that there is little difference between online and offline prices.[2] The authors concluded that online prices are a representative source of retail prices, and they can be used successfully in macro-economic analysis, even if most transactions take place offline.

For data collection in this study, we started from the homepage of Buscapé[3] (www.buscape.com.br), the most popular "price comparison website" in Brazil (Alexa, 2016), and we typed the keyword *azeite de oliva* in its search toolbar. Buscapé's search engine returned a list of products and the relative sellers. In this way, we built a list of e-shops selling olive oil in Brazil. Then, we visited the websites of all these e-shops and typed the keyword *azeite de oliva* in each of their search toolbars. For each of the selected e-shops, we adopted a "snapshot-type" procedure for data collection: each e-shop was visited just once, when we directly and simultaneously recorded the prices and the characteristics of all olive oils available for purchasing. Because, in some cases, the same product was offered by different e-shops at different prices, each item was always considered as a separate and independent observation. We only excluded flavored olive oils (i.e., oils infused with spices or herbs such as garlic, basil, chilli pepper, lemon, rosemary, and truffle) because they were considered as a specific food category with a different function compared with nonflavored olive oils. The selected e-shops always provided a picture, a readable copy of the label, and a synthetic datasheet for each product available for sale. Product details were carefully extracted from these sources and then recorded in a database. We also simulated the purchase of each product to verify its real availability for sale, obviously without concluding with payment.

Data set

Using the criteria described above, we collected a data set containing 631 observations. Each observation was related to a specific olive oil available for sale with the following information: price per bottle, bottle size, bottle material, product category, country of origin, geographical indications, organic certification, olive variety, brand, other claims, and type of retailer.

The price of olive oil (excluding shipping and sales taxes) was expressed in Brazilian Real (R$) and referred to the bottle available for sale. We distinguished two product categories of olive oil: "extra virgin" when this mention was clearly indicated on the label, and "other categories," otherwise. Two types of origin labels were also considered: "country of origin" and "geographical indications." The country of origin was recorded only when it was clearly specified on the label with statements such as "made in," "product of," "imported from" or by using adjectives such as "Portuguese," "Spanish," "Italian," and "Greek." Geographical indications were identified according to the Regulation (EU) No. 1151/2012 by searching for "Protected Designation of Origin" (or PDO) and "Protected Geographical Indication" (or PGI). Note that, compared with the country of origin, geographical indications are certified designations that denote a smaller geographical area of origin (e.g., Cordoba in Spain, Tuscany in Italy) as well as specific features of the product derived from a special link with the area of production ("terroir"). According to olive variety, we distinguished three types of olive oils: "monovarietal" when just a variety was indicated, "multivarietal" when more than one variety was indicated, and olive oils without any specification of variety. The remaining attributes (i.e., bottle size, bottle material, organic certification, brand, and other claims) were recorded according to the information specifically provided on the label. Finally, we distinguished three categories of e-shops selling olive oil: "multichannel large retailers" selling both offline and online a large variety of food and no food products (*Pão de Açúcar, Angeloni, Sonda Delivery, Zona Sul*), "multichannel gourmet retailers" selling both offline and online specialty food products (*Banca do Ramon, Hippo, Rua do Alecrim*), and "online-only retailers."

A preliminary analysis of the data set was carried out by calculating descriptive statistics regarding both the total sample and specific subsamples grouped according to particular cues (Table 1).

First, a wide variability in price was detected in the overall sample considering that the unit price of olive oil ranged from a minimum of 15.98 R$/L to a maximum of 120 R$/L, with a mean of 44.21 R$/L. The average price of olive oils sold in smaller (<0.50 L) and glass containers was substantially higher than olive oils sold, respectively, in larger (>0.50 L) and tin containers. Moreover, the average price of olive oils with specific cues such as "extra

Table 1. Summary statistics of the sample.

	Obs.		Price/L*			
	No.	%	Min	Max	Mean	Std. dev
Total sample	631	100.0	15.98	120.00	44.21	21.20
Bottle size						
<0.50 L	105	16.6	23.95	107.12	51.33	22.41
0.5 L	483	76.5	15.98	120.00	43.02	20.66
>0.50 L	43	6.8	17.83	113.32	40.25	20.53
Bottle material						
Glass	547	86.7	16.96	120.00	45.64	21.90
Tin	84	13.3	15.98	114.00	34.95	12.51
Brand						
Gallo	108	17.1	21.96	83.90	38.94	11.55
Andorinha	41	6.5	19.97	53.50	33.46	7.70
Carbonell	37	5.9	23.16	43.96	32.57	5.17
Herdade do Esporão	32	5.1	39.80	120.00	72.25	17.71
Borges	18	2.9	17.83	44.52	27.44	6.96
Colavita	16	2.5	36.00	107.12	54.50	15.68
Crudo	12	1.9	63.80	85.80	75.14	6.73
Asaro	17	2.7	50.00	113.32	71.52	17.69
Cocinero	13	2.1	16.96	107.00	46.76	30.60
Other brands	337	53.4	15.98	119.80	43.66	22.06
Country of origin						
Portugal	134	21.2	15.98	119.80	41.57	19.96
Italy	75	11.9	17.16	119.80	51.40	27.94
Spain	70	11.1	16.98	43.96	30.00	5.18
Greece	21	3.3	27.80	114.00	55.27	27.01
Chile	15	2.4	20.96	89.80	50.62	25.66
Origin not specified	316	50.1	16.96	120.00	45.74	19.63
Geographical Indications						
PDO or PGI	22	3.5	44.60	119.80	82.35	21.43
Without PDO or PGI	609	96.5	15.98	120.00	42.83	19.87
Product category						
Extra virgin	560	88.7	16.96	120.00	46.05	21.71
Other categories	71	11.3	15.98	43.58	29.71	6.33
Production method						
Organic	21	3.3	27.90	107.00	66.92	25.43
Conventional	610	96.7	15.98	120.00	43.43	20.60
Variety						
Monovarietal	99	15.7	19.80	119.80	61.47	24.12
Multivarietal	243	38.5	19.97	120.00	43.29	18.58
Not specified	289	45.8	15.98	107.12	39.08	19.05
Commercial claims						
Riserva	22	3.5	31.88	95.76	45.94	12.65
Premium	20	3.2	29.88	113.32	76.01	24.00
Without commercial claims	589	93.3	15.98	120.00	43.07	20.50
Type of retailer						
Multichannel large retailers	178	28.2	17.83	90.28	36.15	13.96
Multichannel gourmet retailers	131	20.8	20.00	120.00	56.74	26.47
Online-only retailers	322	51.0	15.98	119.80	43.57	19.70

*Prices are expressed in R$ (Brazilian Real).

virgin", "organic", geographical indications (PDO/PGI), the specification of olive variety ("monovarietal" or "multivarietal") as well as olive oils with the commercial claims "Riserva" and "Premium" were higher than products without these cues. Finally, we found that there were large price differences

among olive oils with different brands and country of origin, or sold by different types of retailers.

Empirical model

We used a stepwise procedure to specify a hedonic price model that was estimated through the Ordinary Least-Squares (OLS) method with robust standard errors. The hedonic price model can be written in its general form as

$$P_i = \alpha + \sum_{j=1}^{m} \beta_j z_{ji} + \varepsilon_i \quad (2)$$

where P_i is the price of the product i, α is the constant term, β_j are estimates of the marginal value of the characteristics z_j ($j = 1, 2, \ldots, m$), and ε_i is the error term.

The specific variables included in the empirical model are detailed in Table 2.

Table 2. Variables of the empirical models.

Variables	Type	Description
Dependent variable		
Price	Continuous variable	Price per bottle (expressed in Brazilian Real)
Independent variables		
Bottle size	Continuous variable	Size of bottle (expressed in litres)
Bottle material	Dummy	Tin = 1; otherwise = 0
Brand:	Categorical variable	
Andorinha	Dummy	Andorinha = 1; otherwise = 0
Carbonell	Dummy	Carbonell = 1; otherwise = 0
Herdade do Esporão	Dummy	Herdade do Esporão = 1; otherwise = 0
Borges	Dummy	Borges = 1; otherwise = 0
Colavita	Dummy	Colavita = 1; otherwise = 0
Crudo	Dummy	Crudo = 1; otherwise = 0
Asaro	Dummy	Asaro = 1; otherwise = 0
Cocinero	Dummy	Cocinero = 1; otherwise = 0
Other brands	Dummy	Other brands = 1; otherwise = 0
Country of origin	Categorical variable	
Portugal	Dummy	Portugal = 1; otherwise = 0
Italy	Dummy	Italy = 1; otherwise = 0
Spain	Dummy	Spain = 1; otherwise = 0
Greece	Dummy	Greece = 1; otherwise = 0
Chile	Dummy	Chile = 1; otherwise = 0
GIs	Dummy	PDO or PGI = 1; otherwise = 0
Extra virgin	Dummy	Extra virgin = 1; otherwise = 0
Organic	Dummy	Organic = 1; otherwise = 0
Variety	Categorical variable	
Monovarietal	Dummy	Monovarietal = 1; otherwise = 0
Multivarietal	Dummy	Multivarietal = 1; otherwise = 0
Commercial claims	Categorical variable	
Riserva	Dummy	Riserva = 1; otherwise = 0
Premium	Dummy	Premium = 1; otherwise = 0
Type of retailer	Categorical variable	
Multichannel large retailer	Dummy	Multichannel large retailer = 1; otherwise = 0
Multichannel gourmet retailer	Dummy	Multichannel gourmet retailer = 1; otherwise = 0

Table 3. Box–Cox transformation tests.

Type of Box–Cox model	Test H0:	Restricted log likelihood	LR statistic chi^2	*P*-value Prob > chi^2
Both sides with same parameter	Lambda = −1	−1975.48	166.74	0.00
	Lambda = 0	−1900.57	16.92	0.00
	Lambda = 1	−2220.04	655.86	0.00
Left-hand side only	Lambda = −1	−2347.44	181.05	0.00
	Lambda = 0	−2257.10	0.38	0.54
	Lambda = 1	−2438.71	363.60	0.00
Right-hand side only	Lambda = −1	−2782.40	687.99	0.00
	Lambda = 0	−2631.69	386.57	0.00
	Lambda = 1	−2438.71	0.61	0.43

In particular, the price per bottle of olive oil is the dependent variable, which is a continuous variable. Just one explanatory variable, the size of bottle, is also a continuous variable, whereas because the other explanatory variables are categorical, they were transformed into one or more dummy variables. Because the appropriate functional form for a hedonic price equation cannot be specified on theoretical grounds (Halvorsen & Pollakowski, 1981), we performed a Box–Cox test suggesting that the log-linear functional form should be preferred (Table 3).

The final hedonic price equation in log-linear formulation is as follows:

$$lnP_i = \alpha + \beta_1 bottle\_size_i + \sum_{j=2}^{m} \beta_j z_{ji} + \varepsilon_i. \quad (3)$$

Results

The estimation results are reported in Table 4, whereas the most important performance indicators of the model and statistical tests are summarized in Table 5. The model shows a good overall significance (F-statistic with a *P*-value much lower than 0.01) and a high capability to explain the variability of the data set (adjusted *R*-squared equal to 0.70). Checks for heteroscedasticity (Breusch-Pagan test) and multicollinearity (Variance Inflation Factors) ruled out the existence of such statistical problems.

The estimation results show that all the considered extrinsic cues impact on the price of olive oil. First, bottle size is a significant variable with a coefficient equal to +0.57. Taking into account the log-linear form of the equation, the coefficient of a continuous explanatory variable measures the relative change in the dependent variable resulting from an absolute change in the explanatory variable. Therefore, the positive coefficient of the variable "bottle size" means that an increase in the size of olive oil bottle leads to an increase in its price as expected. Also the kind of material used for the bottle has a significant effect on the price of olive oil. Considering the functional form of the equation, the coefficient of a dummy variable can be transformed into

Table 4. Estimation results: OLS regression.

	Coefficient	Standard error	Marginal effect
Constant	2.2913***	0.0587	N/A
Bottle size	0.5752***	0.0330	N/A
Bottle material			
Tin	−0.1381***	0.0445	−12.9%
Brand			
Andorinha	−0.1128*	0.0624	−10.7%
Carbonell	0.0004	0.0717	N/A
Herdade do Esporão	0.5406***	0.0727	71.7%
Borges	−0.1098	0.0916	N/A
Colavita	0.5198***	0.0982	68.2%
Crudo	0.3898***	0.1126	47.7%
Asaro	0.6048***	0.0973	83.1%
Cocinero	−0.3228***	0.1076	−27.6%
Other brands	0.0903*	0.0496	9.5%
Country of origin			
Italy	−0.0325	0.0460	N/A
Spain	−0.2048***	0.0471	−18.5%
Portugal	−0.0859**	0.0370	−8.2%
Greece	0.1104	0.0755	N/A
Chile	0.0871	0.0889	N/A
Gls	0.4708***	0.0771	60.1%
Extra virgin	0.0897*	0.0545	9.4%
Organic	0.2531***	0.0747	28.8%
Variety			
Multivarieties	0.2117***	0.0380	23.6%
Monovariety	0.3969***	0.0430	48.7%
Commercial claims			
Riserva	0.3027***	0.0763	35.3%
Premium	0.4647***	0.0764	59.2%
Type of retailer			
Multichannel large retailer	−0.0648**	0.0313	−6.3%
Multichannel gourmet retailer	0.2106***	0.0361	23.4%

Notes: ***, **, and *denote significance at the 1, 5, and 10% levels, respectively.

Table 5. Estimation checks.

Type of check	OLS
Goodness of fit	Dependent variable = ln price F (25/605) = 58.87 P-value (F) < 0.0001 R^2 = 0.71 Adjusted R^2 = 0.70 Log likelihood = −139.74 Akaike information criteria = 331.47 Bayesian information criteria = 447.10
Heteroscedasticity	Breusch–Pagan/Cook–Weisberg test for heteroscedasticity H_0: the variance is constant H_1: the variance is not constant Chi-square (1) = 1.20 p-value = 0.2739
Multicollinearity	Variance Inflation Factor (VIF) for independent variables: Bottle_size: 1.12; Tin: 1.44; Andorinha: 1.43; Carbonell: 1.71; Herdade do Esporão: 1.53; Borges: 1.41; Colavita: 1.46; Crudo: 1.44; Asaro: 1.51; Cocinero: 1.41; Other brands: 3.64; Italy: 1.35; Spain: 1.34; Portugal: 1.40; Greece: 1.12; Chile: 1.12; Gls: 1.21; Extra virgin: 1.81; Organic: 1.09; Multivarietal: 2.07; Monovarietal: 1.48; Riserva: 1.18; Premium: 1.09; Multichannel large retailer: 1.21; Multichannel gourmet retailer: 1.33 *(VIF greater than 10 indicates a multicollinearity problem)*

the percentage change in price due to the presence of a given quality attribute (marginal effect) applying the formula of Halvorsen and Palmquist (1980). It follows that, compared with olive oil in glass bottles, olive oil in tin containers has a significant discount price equal to −12.9%. This was also expected given that tin containers should be cheaper than glass bottles and consumers usually perceive olive oils in tin containers to be of lower quality. In Chile, Muñoz et al. (2015) found a similar effect of tin package on the price of olive oil.

The price of olive oil is strongly related to brand. Compared with *Gallo* (Portugal), the most popular brand of olive oil in Brazil, almost all the brand dummies are statistically significant with both positive and negative coefficients. Specifically, four brands, i.e., *Asaro* (Italy), *Herdade do Esporão* (Portugal), *Colavita* (Italy), and *Crudo* (Italy) have relevant premium prices equal to +83, +72, +68, and +48%, respectively. Other brands, i.e., *Cocinero* (Argentina) and *Andorinha* (Portugal), offer discount prices equal to −28, and −11%, respectively. *Carbonell* (Spain) and *Borges* (Spain) do not have significant price differences compared with *Gallo*. However, it is difficult to explain the price variability related to brands because many factors may be involved, e.g., brand equity, market share, and positioning strategies.

Conversely, the price of olive oil seems to be little influenced by the country of origin indicated on the label. Compared with the olive oils without any specified country of origin, products from Italy, Greece, and Chile do not have any significant premium or discount price, whereas Spanish and Portuguese olive oils (the most popular in Brazil) show discount prices equal to −18 and −8%, respectively. Therefore, it is possible to argue that Brazilian consumers seem to be little interested in the country of origin probably because it is considered scarcely important in affecting the quality of olive oil.

When investigating the other extrinsic cues, product category, organic certification, geographical indications, and olive variety also show a substantial influence on price.

In particular, extra-virgin olive oils have a significant premium price equal to +9%, compared with olive oils of other categories. This can be explained considering both the higher production costs of extra-virgin olive oils and the higher willingness to pay of consumers who prefer extra-virgin olive oil for its objective superior quality.

Organic olive oils also have a relevant premium price (+29%) compared with the products without this cue. The premium for organic olive oils can be explained by considering, in addition to the relative higher production costs, the preferences of consumers who consider organic olive oils of superior quality in term of naturalness.

Olive oils with geographical indications (PDO/PGI) obtain one of the highest premium prices (+60%). In addition, this premium could be related to both additional production costs and the preferences of consumers who are more interested in buying olive oil with a specific origin and quality

standards. It is interesting to note that the high premium price we found for olive oils with geographical indications was not expected for a non-EU country like Brazil. Thus, this result provide evidence that some Brazilian consumers recognize a superior quality for olive oils with PDO/PGI designation similarly to EU consumers (Del Giudice et al., 2015). A possible explanation is that, because Brazilian consumers have a more consolidated tradition in wine consumption, they became quite familiar with geographical indications often associated with the best wines imported largely from European countries (Evaldo Fensterseifer, 2007).

The indication of olive variety also affects the price of olive oil considerably. Specifically, compared with the olive oils without any specification of olive variety, both monovarietal and multivarietal olive oils gain premium prices although different in terms of magnitude (+49% and +24%, respectively). Considering that the specification of olive variety does not strongly affect production costs, this result may be mainly related to the preferences of Brazilian consumers who consider this cue as an important indicator of better quality. Also in this case, it is possible to highlight a parallelism with wine sector: two hedonic studies carried out in Brazil (Panzone, Simões, Campregher, Oliveira, & Freitas, 2011; Roberto Luppe et al., 2009) pointed out that the indication of grape variety is one of the characteristics that most influences the price of wines.

Similarly, the use of particular commercial claims, such as *Riserva* and *Premium,* widely used for wines but concretely not codified by any public standard for olive oil, gains both relevant premium prices equal to + 35% and +59%, respectively.

Finally, the type of retailer also affects the price of olive oil significantly. In particular, olive oil sold by multichannel large retailers has a discount price of −6% compared with olive oil sold by online-only retailers used as the baseline. On the other hand, olive oil sold by multichannel gourmet retailers shows a relevant premium price equal to +23%. These price differences may be related to the different pricing strategies adopted by retailers. Intuitively, it is possible to argue that multichannel large retailers implement more aggressive pricing strategies, whereas multichannel gourmet retailers apply premium pricing to encourage a favorable perception of products' quality among buyers.

Conclusion

Brazil is one of the most important nontraditional olive oil consumer countries in the world. Brazilian consumption of olive oil is totally satisfied by imports mainly from Mediterranean countries. Despite the dynamism that olive oil has recently been experiencing in the Brazilian market, this product continues to be relatively new for most consumers, and it is only partially included in the population's daily diet. Moreover, in this market, the price of olive oil is rather high compared with that of other vegetable oils, and thus,

olive oil is probably considered a "delicacy" or "luxury food" mainly used for special purposes such as salad dressing or for preparation of gourmet recipes.

This study measured whether and to what extent extrinsic cues such as branding, labeling, and packaging affect the retail price of olive oil with a special focus on a specific retail channel represented by the e-commerce business-to-consumers.

We estimated a hedonic price model demonstrating that extrinsic cues have a strong impact on the price of olive oil. In fact, the unit price of the product shows a wide variability, ranging from a minimum of 16 R$/L to a maximum of 120 R$/L.

Packaging (size and material of bottles) affects the price of olive oil because the product is mostly sold in small containers (0.5 L or less) that are ideal for a limited and occasional consumption. On the other hand, tin containers are shortly popular and provide a discount on the olive oil price.

The higher premium prices have been detected for geographical indications (60%), some prestigious brands (up to +83%), monovarietal specification (+49%), and the commercial claims *Riserva* (+35%) and *Premium* (+59%). This can be explained considering that, because olive oil is largely perceived as a luxury food, these extrinsic cues are effective in improving the image of the product that may appear more sophisticated, peculiarly distinctive, and definitively, more desirable. It is worth noting that these extrinsic cues are not specific for olive oil, but they are well appreciated and widely adopted for wines. This reflection also comes from the observation that olive oils sold through e-tailing channel in Brazil are often proposed by gourmet retailers, which are mainly specialized in selling wine. Paradoxically, we observed that the only specific quality signal for olive oil, the extra-virgin mention, gains a relatively limited premium price (only +9%) which confirms that Brazilian consumers are still not well knowledgeable about the objective quality of olive oil.

These results can provide useful insights for both practitioners and policy makers. First, all firms (producers, traders, and retailers) interested in selling olive oil in Brazil, being aware of their production costs, can use implicit prices to devise an optimal mix of attributes and more profitable marketing strategies. For example, we found that the country of origin indication slightly affects the price of olive oil, whereas olive oils with geographical indication (PDO/PGI) show a relevant premium price. This is an important insight for deciding which of the two origin label (country of origin or geographical indications) is more effective and profitable in Brazilian market of olive oil. Moreover, we found high premium prices associated with cues related to "credence" attributes (extra-virgin, organic, PDO/PGI, olive variety and some commercial claims). These premium prices take into account production cost differentials as well as reputation effects. Because consumers cannot assess the quality of olive oil even after consumption, but they are aware that a large range in quality and prices exists, quality assurance policies are needed to

provide consumers with clear and truthful information and discourage producers from making false claims to save on production costs and take advantage of the reputation effect. For example, the commercial claims *Riserva* and *Premium* gain relevant premium prices, but it is not clear what really they mean. Policy makers should, therefore, standardize these claims and ensure a proper use through effective compliance control measures.

Further research is needed to investigate more in-depth consumers' preferences toward olive oil attributes in Brazil by using proper analytical approaches.

Notes

1. A recent report (Ecommerce Foundation, 2017) shows that, in Brazil, internet users have been growing rapidly in the last years and, currently, they accounts for 64% of the total population (over one hundred million people). The number of e-shoppers also reached 18% of the total population (nearly 40 million people), whereas total online sales more than doubled in few years from R$24 million in 2012 to R$50 million in 2016.
2. Cavallo (2017) reported detailed results of a large-scale comparison of online and offline prices carried out in 10 countries: Argentina, Australia, Brazil, Canada, China, Germany, Japan, South Africa, UK, and the United States. The main findings were as follows: i) 76% of the products sampled offline were also found online; ii) identical products had identical online-offline prices in 72% of observations, and the average size of the online–offline price differences was only 1%; iii) for food products, 52% of observations had identical online–offline prices, and the average size of the online–offline price differences was only 1%; and iv) comparing online-only retailers and multichannel retailers (selling both online and offline), identical products had identical prices for 38% of observations, and the average size of the price differences was only 5%.
3. Buscapé is a vertical search engine that Brazilian shoppers can use to filter and compare products based on price, features, and other criteria. It aggregates product listings from many different retailers but does not directly sell products itself. Retailers who want to list their products on the Buscapé can supply their own lists of products and prices, and these are matched against a unique database.

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