Developing marketing strategies for Jiloca saffron: a price hedonic model

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Abstract

The paper examines the retail price structure of saffron currently marketed in the Spanish market, with special emphasis on the assessment of the region of origin and its certification as tools of differentiation. The motivation lies on the search for effective marketing tools for Jiloca saffron (Aragón) that in turn may contribute to preserve this traditional agricultural sector threatened by progressive abandonment. An hedonic price regression is estimated for this purpose, where the functional form is empirically determined. The prices and product characteristics have been collected from labels of saffron references either found on the shelves of representative retail shops in the main city of Aragon (Zaragoza) or on the internet shopping services that the main Spanish distribution chains offer. Results show that higher prices are attached for saffron distributed at supermarkets and Gourmet shops, marketed in threads, packaged in glass, and which carries a brand owned by a processor specialized in the processing and marketing of saffron. Currently, the recognition of Jiloca origin does not carry a premium, contrary to what happens to La Mancha, whilst the Protected Designation of Origin reinforces the economic value of La Mancha origin.

Additional key words: Box-Cox transformation, differentiation, hedonic prices, Protected Designation of Origin.

Resumen

Desarrollo de una estrategia de marketing para el azafrán del Jiloca: un modelo de precios hedónicos

El artículo examina la contribución de una serie de características en la formación de precios del azafrán que actualmente se comercializa en España, con especial énfasis en el origen y su certificación como elementos de diferenciación y generación de valor añadido. La motivación subyacente a esta investigación es la búsqueda de herramientas de marketing que permitan mejorar la comercialización del azafrán del Valle del Jiloca en Aragón, contribuyendo con ello a frenar el abandono de este cultivo tradicional. Con este fin, se ha estimado una regresión de precios hedónicos, donde la forma funcional se ha determinado empíricamente. Los precios y características del producto se han recopilado a partir de las referencias disponibles en todas las grandes cadenas de distribución alimentaria (y tiendas Gourmet) instaladas en el mercado urbano más próximo a la zona de producción (Zaragoza), así como a través del servicio de venta *on-line* de las principales cadenas de distribución en España. Los mayores precios implícitos corresponden a las referencias comercializadas a través de supermercados y tiendas Gourmet, en hebras, en frascos de cristal, y con marcas de fabricantes especializados en esta especie. Actualmente, el reconocimiento explícito del origen Jiloca no conlleva un sobreprecio, al contrario de lo que ocurre con el azafrán de La Mancha. En este último caso, además, la Denominación de Origen refuerza significativamente el valor económico aportado por el origen.

Palabras clave adicionales: Denominación de Origen Protegida, diferenciación, precios hedónicos, transformación Box-Cox.

Abbreviations used: MARM (Ministerio de Medio Ambiente y Medio Rural y Marino), OLS (ordinary least squares), PDO (Protected Designation of Origin).

Introduction

For centuries, Spain has played an important role in the saffron world markets. Currently, Spain is the main importer of this spice and the second most important exporter after Iran, accounting for 28.8% and 23.4% of world trade value of imports and exports, respectively, where Iran´s exports amount to 71% of world trade (ComTrade, 2008). These figures, however, mask the progressive abandonment of this agricultural activity, hence the sharp decline in domestic production. The 124,230 kg produced at the beginning of the XXth century (Ávila, 1999), have reduced to 1,330 kg in 2007 (MARM, 2007a), where the sharpest decline took place in the 90's. Besides, cultivation has been constricted basically to two geographical areas in the country, Castilla La Mancha, which amounts for 92% of the national production (MARM, 2007a), and Jiloca Valley (in the region of Aragón). The production process of saffron has hardly changed along time and remains highly labour intensive, making the Spanish production little competitive in costs in comparison with the producing leader, Iran, or other emerging countries, like India. Despite this fact, Spanish saffron still enjoys the reputation of high quality standards in international markets, built up along centuries thanks to the combination of natural and human factors. In order to maintain the identity and avoid imitations, Castilla la Mancha has taken the lead in the protection of the origin as an identifier of saffron, and reached the European Protected Designation of Origin (PDO) certification in 1999. Other producing areas in Europe, such as Kozanis in Greece, Aquila and San Gimignano, in Italy, followed, and got the PDO certification in 2005.

This paper tries to address the question of how to improve the marketing of Spanish saffron and that produced in the Jiloca Valley, in particular, in the domestic market, under the hypothesis that marketing could act as a trigger for production. The maintenance of the agricultural activity, not only would provide a complementary income for the families in the area, but also and probably more importantly, would have the intangible effect of preserving the traditional scenery, social network and culture, developed historically around saffron.

Research in hedonic prices has been fuelled by the theory of the demand of characteristics by Lancaster (1971), and the theory of hedonic price functions by Rosen (1974). Lancaster's theory states that consumers do not obtain utility directly from the goods that they consume but from the combination of characteristics that the goods possess, whilst Rosen's (1974) approach, allows to obtain the implicit price for each of these characteristics. The hedonic price approach has been employed in a wide set of economic areas, such as housing and environmental services, whilst applications in agro-food products, have focused mainly on wine (with recent applications by Durham *et al.*, 2004; Haeger and Storchmann, 2006; Costanigro *et al.*, 2007), and meat (Loureiro and McCluskey, 2000; Gracia and Pérez-y-Pérez, 2004).

Using a price hedonic approach, the paper examines the retail price structure of saffron currently marketed in the Spanish market, and estimates the shadow prices of an array of attributes or characteristics, in order to investigate the degree of success of each of these attributes in differentiating the product, and accordingly, getting a better value in the market. In particular, the main interest of the paper is assessing the ability of the geographical origin and its guarantee through the PDO certification, as differentiation tools.

Although the literature on hedonic prices is extensive, to our knowledge, this is the first attempt in the spices segment. Likewise, there are not many studies based on this methodology with a particular focus on origin and its certification (exceptions include Gracia and Pérez-y-Pérez, 2004; Resano and Sanjuán, 2008), whereas this topic has received much more attention in the agro-food literature using other methodologies (*e.g.* Bonnet and Simioni, 2001; Van Ittersum *et al.*, 2007).

Material and methods

The hedonic price function

Under the realistic assumption that a good is heterogeneous or differentiated, each possible combination of characteristics defines a variety of a specific (perceived) quality. For instance, saffron carrying La Mancha PDO and sold in a flask of 0.5 g is a different variety from saffron produced in Iran, and marketed in a plastic capsule with 1 g weight. The hedonic price theory developed by Rosen (1974) expresses the price of a variety, P, as a function of an *n*-array of characteristics **c**, $\mathbf{c} = (c_1,\dots,c_n)$: $P = P(\mathbf{c})$. P is viewed as an aggregation that equals total expenditure of characteristics included in the variety. The partial derivative of the hedonic price function with respect to a particular attribute ($\partial P/\partial c_j$) provides its implicit or shadow price at equilibrium, which reflects both, the minimum price at which suppli-

ers are willing to sell according to their cost structure and the maximum price consumers are willing to pay for an additional unit of that particular attribute (when it is continuous, such as the quantity contents) or for the presence of that attribute (when it is categorical, such as being certified by a PDO), *ceteris paribus* the rest of characteristics.

The consumer chooses the optimal amount of characteristics by maximizing his/her utility U(**c**,**x**), where **x** is a vector of other homogeneous goods in the consumption basket, subject to the budget constraint: M = P$_x$ · **x** + + P(**c**), where M is income, and where it is assumed (for simplicity) that only one unit of the heterogeneous good is purchased. The first order constrained maximization leads to $\frac{\partial U / \partial c_j}{\partial U / \partial x} = \frac{\partial P(\mathbf{c})}{\partial c_j}$ which implies that the marginal rate of substitution between the characteristic c_j and the homogenous good equals the implicit price of the characteristic.

The functional form of the hedonic price function P(.) cannot be derived from the form of the consumer's utility, U(.) function, but rather it is an empirical question. This statement is better understood when considering the price hedonic function as a price contour or boundary of the choice set of characteristics available. Thus, for each market price of a differentiated good, consumers with different tastes choose different combinations of characteristics. Therefore, the functional form will depend on how consumers are spread over the space of characteristics (Tripplett, 2004).

The Empirical hedonic function and the Box-Cox transformation

As the economic theory does not inform about the most convenient functional form, the researcher needs to choose the functional form that best fits the data. The Box-Cox transformation has usually been applied for this purpose (Box and Cox, 1964). This approach, nests alternative functional forms, by adding non-linear parameters, θ and λ, on the dependent and independent variables, respectively. In the price hedonic application, the regression is expressed as:

$$P_i^{(\theta)} = \boldsymbol{\beta}'\mathbf{c}_i^{(\lambda)} + \boldsymbol{\gamma}'\mathbf{z}_i + \varepsilon_i \quad E[\varepsilon_i] = 0, \text{Var}[\varepsilon_i] = \sigma^2 \quad [1]$$

where P_i is the price variable for each variety i; $\mathbf{c}_i$ is a vector of continuous characteristics; $\mathbf{z}_i$ is a vector of categorical characteristics; e_i are the residuals, that satisfy

the usual restriction of homoskedasticity; and θ and λ indicate the Box-Cox transformation, such as:

$$P_i^{(\theta)} = \begin{cases} \dfrac{P_i^{\theta}-1}{\theta} & \theta \neq 0 \\ \ln P_i^{\theta} & \theta = 0 \end{cases} \text{ and } \mathbf{c}_i^{(\lambda)} = \begin{cases} \dfrac{\mathbf{c}_i^{\lambda}-1}{\lambda} & \lambda \neq 0 \\ \ln c_i^{\lambda} & \lambda = 0 \end{cases} \quad [2]$$

Four possible functional outcomes of the Box-Cox transformation are: linear, when θ=λ=1; semi-logarithmic, when θ=0 and λ=1; double-logarithmic, θ=λ=0; and linear-logarithmic, θ=1 and λ=1. Very often, however, individual and joint tests on the Box-Cox parameters lead to un-conclusive results. Complementarily, the Vuong test (Vuong, 1989) can be applied in order to select among the four aforementioned functional forms. Let us define, for each individual observation *i*, the likelihood ratio:

$$LR^i(\lambda_j\theta_j, \lambda_k\theta_k) = ll_j^i - ll_k^i \quad [3]$$

where *j*, *k* refers to any of the four alternative models (*m*) defined by the Box-Cox transformation (*m*=linear, semi-log, double-log, lin-log), and ll_m is the log-likelihood function for observation *i*, evaluated at the parameters estimates of model *m*. The Vuong's test is given by:

$$Vuong = \frac{\sqrt{n}\left[\dfrac{1}{n}\sum_{i=1}^{n} LR_i\right]}{\sqrt{\dfrac{1}{n}\sum_{i=1}^{n}\left(LR_i - \overline{LR_i}\right)^2}} \quad [4]$$

where n is the number of observations. The Vuong test is distributed asymptotically as a standard Normal. Positive values larger than the critical value N$_{\alpha/2}$ (with α the significance level) favour model *j*; negative values smaller than -N$_{\alpha/2}$, favour model *k*; and |Vuong|≤ N$_{\alpha/2}$ indicates no-significant differences between the two models.

The data

The empirical applications of hedonic price functions in the agro-food sectors have collected data, either from reported purchases in questionnaires addressed to consumers (Loureiro and McCluskey, 2000; Gracia and Pérez-y-Pérez, 2004); from the product labels exposed on the shelves of retail outlets (Karipidis *et al.*, 2005); or in the case of wines, from specialised guides that include, amongst other characteristics, retail prices (Haeger and Storchmann, 2006).

In this paper, prices and product characteristics have been collected from labels of saffron references either found on the shelves of representative retail shops in the main city of Aragon (Zaragoza) or on the internet shopping services that the main Spanish distribution chains offer. Both sources of data were consulted in March-April 2008.

Dry food purchases are mainly concentrated in supermarkets (57.1%) and hypermarkets (22.9%) while traditional shops are losing weight every year (11.6%) (BICE, 2008). On the contrary, the Internet is gaining prominence as food retail distributor and 4.6% of Spanish consumers (3.4% in Aragón) have used this shopping channel in 2006 (MARM, 2007b). Accordingly, in this study, 15 distribution chains have been visited, that include hypermarkets (three), discount shops (three) and supermarkets (nine). Data collected through the Internet come from a total of nine distribution chains, which jointly account for 58% of the national market share of food distribution (BICE, 2008), and from which, five are nationally widespread and have also been visited *in-situ*, while four are settled down beyond the geographical boundaries of Aragón. Additionally, four Gourmet establishments were included in the data collection process, in order to account for specific market niches focused on typical and high value food products, in which saffron can be included.

A total of 122 references were collected with characteristics encompassing the retail channel (in-shop or internet); the type of retail outlet (hyper-, supermarket, discount or Gourmet); the format of presentation (either in threads or powder); the package (glass, either in flask or attached to cardboard, plastic capsule, rigid plastic box or sachet); the quantity contents (in grams); brand (either owned by the distributor or the processor); origin (undetermined, La Mancha or Jiloca); and the certification as Protected Designation of Origin La Mancha. In Table 1, the distribution of these characteristics in the records is presented.

About 64% of the observations have been collected *in-situ*. Supermarkets provide around 67% of the total number of references, and hypermarkets 24%. Discount and Gourmet shops, market a much lower number of references than the big-distribution chains, and accordingly their contribution to the total number of observations is low (around 4% each).

Records imply that saffron is mainly marketed in threads (70% of observations), and either within sachets (normally made of plastic or paper) or within a plastic capsule attached to cardboard (39-38% of observa-

Table 1. Data description

Characteristic	% of observations
Price (€/per unit)	100
Retail channel	
-Internet	34.96
-In-shop aisle	64.23
Type of retail chain	
-Hypermarket	24.39
-Discount	4.07
-Gourmet shop	4.07
-Supermarket	66.67
Form	
-Thread	69.92
-Powder	30.08
Package	
-Glass	18.70
-Plastic Capsule	38.21
-Plastic Box	2.44
-Sachet	39.84
Brand	
-Own distributor's	8.13
Premium	3.25
Price leader	4.88
-Processor's	91.06
Saffron Non-specialized	40.65
Saffron Specialized	50.41
Origin	
-La Mancha	20.33
-Jiloca	4.88
-Iran	2.46
-Undetermined	72.33
PDO La Mancha	13.01

Quantity per unit	% of observations	Weight
≤ 0.50 g	60.0	
≤ 2 g	90.0	
Minimum (g)		0.10
Maximum (g)		8
Mean (g)		1.08

tions). The least spread package over the collected data is rigid plastic box (2%) while glass flasks, either in isolation or attached to cardboard, are found in almost 19% of the references. The quantity contents vary between 0.10 g and 8 g, with an average weight of 1.08 g, being 0.5 g the most common size found; 60% of observations correspond to contents below half a gram, and 90% are under 2 g.

The dataset contains references to 23 different brands. From these, seven are owned by the distributor. The distributor's brand is further segmented into 'premium', when either the retailer is positioned at the top of

the range, or a brand differentiation strategy is in place, to distinguish high grade products from the rest (*e.g.* 'De Nuestra Tierra' by Carrefour *versus* the brands Carrefour or N1). The latter are identified as 'price leader' brands. Around 8% of the references carry a distributor's brand, from which, around 40% are classified as 'premium'. The remaining 92% of observations carry a processor's brand. Again, these brands are segmented depending on the exclusivity or not of the processor with respect to saffron. Thus, from the 16 brands owned by the processors, half of them correspond to firms specialized in saffron, while the rest, market a whole range of spices (and other products in some cases) with the same brand. Specialized brands of saffron account for 50% of the total number of observations in the database.

The origin is not always indicated on the labels, in fact, in 73% of the observations, the origin of the crop is not explicit, and only a reference to Spain, as host country of the processor is indicated (except in three references, where the Iranian origin of both, crop and final product, is mentioned). The two main producing Spanish regions of saffron are represented in the dataset: 20% of the references refer to saffron from La Mancha and around 5% from Jiloca. Nevertheless, not all the saffron marketed with origin La Mancha carries the PDO certification, which is only found in 13% of the observations.

Model specification

As in most of the applications of hedonic prices, a price dependent model is specified. Price is measured in € g^{-1}. The explanatory variables are the characteristics of the products currently marketed. The quantity contents in each unit is measured in grams and enter the model as a continuous variable. The rest of characteristics are classified into categories, and within each characteristic, each possible level is specified as an effect code (also known as deviation with respect to a reference level). The effect codes, in contrast with dummy variables, allow the direct estimation of the shadow price for one specific level. The shadow price of the level used as reference can then be obtained by changing the sign of the sum of the remaining levels within the category.[1] Note that the log-transformation among the explanatory variables is only suitable for the quantity variable. In Table 2, the variables used in the estimation of the hedonic price function are described.

Results

First, the Box-Cox regression is estimated. The results on individual and joint tests on the Box-Cox parameters are shown in Table 3[2]. Individual tests on the transformation parameter λ conclude in favour of a logarithmic transformation for the independent variable Quantity. On the contrary, individual tests on θ, reject both, a linear and logarithmic form, being the estimated coefficient 0.211. The joint tests of both possible transformations for the dependent variable Price together with a logarithmic transformation of Quantity, are always rejected. Therefore, the Box-Cox tests provide enough evidence in favour of including Quantity in logs, while there is not a preference between linear and logarithmic for the dependent variable. These un-conclusive results, otherwise very common in the empirical literature of hedonic prices, motivate the use of the Vuong's test, in order to choose among the four alternative functional forms[3]. Results are shown in Table 4.

The Vuong test shows that models with the dependent variable transformed into logs are preferred over linear specifications in the dependent variable. Likewise, the Vuong test is conclusive in pointing at the double-logarithmic functional form as preferred over any other alternative specification. Accordingly, both price and the quantity-format variables are transformed into logs, and a double-logarithmic model is estimated as follows:

$$lPrice = Constant + \beta_1 \cdot lQuantity + \beta_2 \cdot C\_internet + \beta_3 \cdot R\_hyper + \beta_4 \cdot R\_discount +$$
$$+ \beta_5 \cdot R\_gourmet + \beta_6 \cdot F\_thread + \beta_7 \cdot P\_glass + \beta_8 \cdot P\_capsule + \beta_9 \cdot P\_box +$$
$$+ \beta_{10} \cdot B\_distQ + \beta_{11} \cdot B\_distL + \beta_{12} \cdot B\_procS + \beta_{13} \cdot O\_Mancha + \beta_{14} \cdot O\_Jiloca +$$
$$+ \beta_{15} \cdot O\_Iran + \beta_{16} \cdot PDO\_Mancha + \varepsilon_i \qquad [5]$$

The estimation is carried out with Ordinary Least Squares (OLS), and White's robust errors variance correction is calculated in order to account for possible heteroscedasticity that would lead to problematic inference on the significance of parameters.

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[1] An effect code is equivalent to the application of the normalization suggested by Suits (1984) to dummy variables, and applied among others by Gracia and Pérez-y-Pérez (2004).
[2] The Box-Cox regression, subsequent tests and estimation, have been carried out in LIMDEP.
[3] The Vuong's test has been computed by the authors in GAUSS.

Table 2. Description of variables used in the estimation of the hedonic price function

Characteristics category	Characteristics level	Variable	Value
Price		Price	continuous (€ per unit)
Quantity		Quantity	continuous (grams)
Channel	Internet	C_internet	= 1 if retail channel for data collection is internet; = -1 if retail channel for data collection is in shop
Retailer	Hypermarket	C_hyper	= 1 if retail chain is a hypermarket = -1 if retail chain is a supermarket = 0 otherwise
	Discount	R_discount	= 1 if retailer is a discount type supermarket = -1 if retailer is a supermarket = 0 otherwise
	Gourmet shop	R_gourmet	= 1 if retailer is a Gourmet shop = -1 if retailer is a supermarket = 0 otherwise
Form	Thread	F_thread	= 1 if saffron is delivered in threads = -1 if saffron is delivered as powder
Package	Glass	P_glass	= 1 if saffron is packaged in glass = -1 if saffron is packaged in sachets = 0 otherwise
	Plastic Capsule	P_capsule	= 1 if saffron is packaged in plastic capsules = -1 if saffron is packaged in sachets = 0 otherwise
	Plastic Box	P_box	= 1 if saffron is packaged in a rigid plastic box = -1 if saffron is packaged in sachets = 0 otherwise
Brand	Own distributor's, Premium	B_distQ	= 1 if the product carries a premium distributor's brand = -1 if the product carries a non-specialized producer's brand = 0 otherwise
	Own distributor's, Price leader	B_distL	= 1 if the product carries a price-leader distributor's brand = -1 if the product carries the brand owned by a non-specialized processor = 0 otherwise
	Processor's, Specialized in saffron	B_procS	= 1 if the product carries the brand owned by a specialized processor of saffron = -1 if the product carries the brand owned by a non-specialized processor = 0 otherwise
Origin	La Mancha	O_Mancha	= 1 if region of origin for saffron crop is La Mancha = -1 if region of origin for saffron crop is unspecified = 0 otherwise
	Jiloca	O_Jiloca	= 1 if region of origin for saffron crop is Jiloca = -1 if region of origin for saffron crop is unspecified = 0 otherwise
	Iran	O_Iran	= 1 if country of origin for saffron crop is Iran = -1 if region of origin for saffron crop is unspecified = 0 otherwise
Certification	PDO La Mancha	PDO_Mancha	= 1 if the product carries the certification 'PDO La Mancha' = -1 if origin La Mancha is not certified as 'PDO La Mancha'

Table 3. Tests on Box-Cox transformation parameters

Hypothesis on λ (Quantity)	Hypothesis on θ (Price)	t-statistic (p-value)	Wald-statistic (p-value)	Conclusion
$\lambda = 0$	---	-0.021 (0.983)	---	Quantity log
$\lambda = 1$	---	---	39.83 (0.000)	Quantity no-linear
---	$\theta = 0$	2.346 (0.019)	---	Price no-log
---	$\theta = 1$	---	76.61 (0.000)	Price non-linear
$\lambda = 0$	$\theta = 0$	---	37.54 (0.000)	No double-log
$\lambda = 0$	$\theta = 1$	---	97.43 (0.000)	No lin-log

Estimation results are shown in Table 5. For each attribute, the coefficient for the level used as reference is calculated as explained above. In the last column, the exponential of the coefficients is shown. Due to the effect coding, these are directly the shadow or implicit prices of each characteristic expressed in percentage over the average price [which is estimated as exp(Constant) = exp(0.805) = €2.237 g^{-1}][4].

The explanatory variables included are jointly significant (F-test <0.01) and explain 89% of the total variation of the log-price. Most of the variables are individually significant at 5% (p<0.05). At 10% significance level, only three variables are not significant: C_internet, B_distQ, and O_Iran. Therefore, saffron prices on the internet are not significantly different from those found *in-situ*, *ceteris paribus*. More than half of the online shops were also visited personally. Accordingly, the lack of significance may be a result of common price strategies of retail food distributors, un-respectively of the shopping channel. The shadow price for those brands owned by the distributor (B_distQ) and attached to premium quality products, is not significantly diffe-

rent from brands owned by processors non-specialized in saffron. Both types of brand have in common that are attached to a wide range of products, and the results point out that more specialized brands (B_procS) enjoy a higher implicit price.

The identification of the origin of saffron as Iranian (O_Iran) does not affect significantly price. Nevertheless, caution is needed as the number of observations found that share this origin is low (note also that the parameter of the sign is negative).

The quantity contents of the package affects price positively. As both, price and quantity are expressed in logs, the estimated coefficient can be interpreted as an elasticity. Therefore, an increase of 1% in the amount of saffron included in the package increases the price by 0.79%.

With respect to the type of retail chain, supermarkets offer saffron at slightly higher prices, followed by Gourmet shops (24 and 21% over the mean, respectively), while discount type supermarkets offer saffron around 40% cheaper.

Saffron in threads receives a premium of around 9% over the mean price, while in powder is penalized by the same amount.

Among the alternative packages available currently at the market place, glass is valued higher (35% over the mean), followed by the plastic capsules (+19%). The least valued package is plastic boxes, with a shadow price around 40% lower than average. Sachets, on the other hand, occupy an intermediate position.

In terms of brands, the lowest prices are attached to the price leader distributors' brands, with a shadow price 17% lower than the average. Those specialized brands, exclusive to saffron, benefit from the highest implicit prices, around 8% over the average. Multi-product brands, on the other hand, either owned by non-specia-

Table 4. Vuong's test results

Ho:	Vuong Statistic
Linear *vs* Lin-log	5.957*
Linear *vs* **Log-lin**	-5.410*
Linear *vs* **Double log**	-8.670*
Linear-log *vs* **Log-lin**	-9.320*
Linear-log *vs* **Double log**	-14.447*
Log-linear *vs* **Double log**	-4.166*

* indicates rejection of the null of no-differences among both models at 5% significance level. Critical values are 1.96 and -1.96, for positive and negative values of the test, respectively. In bold, the model selected by the Vuong test in each pair-comparison.

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[4] The correction suggested by Kennedy (1981) and applied among others by Gracia *et al.* (2007), which consists of calculating: exp$^{(coeff - 0.5\ Var(Coeff.))}$ leads to marginal changes on the third decimal of the percentage over mean price, and it is not included in Table 5.

Table 5. Parameters estimates of the price hedonic equation

Characteristic	Variable	Coefficient	Standard error	p-value	% over mean price	% importance
Quantity	Constant	0.805	0.067	0.000	2.237	
	lquantity	0.794	0.065	0.000		
Channel	C_internet	-0.044	0.032	0.176	0.957	3.52
	C_inshop	0.044	---	---	1.045	
Retailer	R_hyper	0.084	0.048	0.080	1.088	25.51
	R_discount	-0.497	0.056	0.000	0.608	
	R_gourmet	0.197	0.071	0.007	1.218	
	R_super	0.216	---	---	1.241	
Form	F_thread	0.086	0.037	0.021	1.090	6.96
	F_powder	-0.086	---	---	0.917	
Package	P_glass	0.303	0.060	0.000	1.354	30.20
	P_capsule	0.175	0.055	0.002	1.191	
	P_box	-0.502	0.068	0.000	0.605	
	P_sachet	0.024	---	---	1.024	
Brand	B_distQ	0.067	0.059	0.263	1.069	10.06
	B_distL	-0.187	0.050	0.000	0.829	
	B_procS	0.076	0.037	0.041	1.079	
	B_procNS	0.045	---	---	1.046	
Origin	O_Mancha	0.154	0.066	0.021	1.166	15.66
	O_Jiloca	-0.251	0.089	0.006	0.778	
	O_Iran	-0.042	0.070	0.548	0.959	
	O_Unspec.	0.140	---	---	1.150	
Certification	PDO_Mancha	0.100	0.051	0.054	1.105	8.09
	No PDO_Mancha	-0.100	---	---	0.905	
	N Obs	122				
	R^2	0.89				
	F-test	53.64 (0.00)				

Note: p-values calculated with robust standard errors

lized processors or high grade distributors, as well as distributors' gourmet or premium brands, are also a differentiation tool, although with less impact, with implicit prices between 4.6 and 6.9% over the mean.

Jiloca origin is not acting as a strong differentiation attribute, and the implicit price for this characteristic is 78% of the mean price. On the contrary, the origin la Mancha and its certification through a PDO, contributes positive and significantly to the retail price structure. The origin La Mancha enjoys the highest implicit values among the alternative origins (almost 17% over the general mean price) while the PDO La Mancha adds a 10% in value over the product with identical origin but without any quality label. The lack of explicit mention of the origin for the crop, benefits from an 11% premium.

Inspired by the common practice in conjoint analysis, a weight of each categorical characteristic on the determination of the price structure is calculated. First, for each category of characteristics, a rank is obtained as the difference between the highest and lowest relative implicit price (column 6 in Table 5). Then, these ranks are added up for the seven characteristics. Finally, each category rank is expressed as a percentage of the total sum. The result is included in the last column in Table 5[5]. Package and the Retailer are the most significant influences in the retail price structure of saffron, with respective weights of 30% and 25%. Interestingly, origin plays a significant role, contributing with a 15%. The type of brand impacts the price formation with a 10%, while certification and format of presentation,

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[5] Calculus based on the coefficients instead led to very close percentages of importance, and identical ranking.

explain around 8% and 7%, respectively. The least important characteristic, according to these results, is the shopping channel.

Discussion

The estimation of an hedonic price model based on actual data describing saffron currently marketed in the Spanish market provides valuable information for producers and marketers, especially for those involved with Jiloca saffron. Thus, the paper investigates what is the current implicit value of this specific origin and provides additional insights onto which variables to act upon in order to get better value added.

Currently, the explicit recognition of Jiloca origin is not acting as an effective differentiation tool, and in fact, its implicit price is even lower than any other unspecified origin. The origin La Mancha, on the contrary, is highly valued by the market, especially when certified with a PDO. Thus, the PDO adds an extra 10% over the mean price of La Mancha saffron, which is also 16% over the average. Origin can act as an effective differentiation tool, but it needs to be accompanied by sufficient recognition and penetration in the market, and helped by promotional activities that emphasize on the specificity and superior quality of the product. In this sense, using the price hedonic approach, Gracia and Pérez-y-Pérez (2004) also find the quality certification as a relevant attribute in the price formation of beef-meat, while Loureiro and McCluskey (2000) find that this is the case when the certification is attached to superior quality cuts; Resano and Sanjuán (2008), in the case of cured-ham, find that the quality certification is successful in getting a higher implicit price only in combination with a well known and highly reputed origin.

To enrol in the pursue of an origin or quality certification would be an interesting strategy for economic agents involved with Jiloca saffron, not only because as the results show, a PDO may get a price premium, but also because the certification label may help to improve the conditions of market access, through the guarantee of superior quality and its control, the potential benefits of generic promotion, or the higher notoriety enjoyed by the label itself as it is attached to a wide variety of food products.

Nevertheless, the identification of the origin and its certification, though relevant, is not the only marketing tool available for producers and processors to differentiate their product. Thus, the type of package seems to be the main influence on the determination of retail prices, being glass the packaging with the highest implicit value, around 35% over the mean price. Different brand strategies also lead to distinct price premium which is maximum for brands owned by processors specialized in the processing and marketing of saffron. Finally, the presentation in threads also enjoys a higher implicit price in comparison to powder. Part of the Jiloca saffron production that goes through the retail circuit in the regional urban market is already being commercialized with these characteristics, and accordingly future marketing should continue on this route, whereas trying to engage a larger proportion of the total production. Among the alternative distribution channels, Jiloca saffron producers could benefit of higher prices by using the supermarket and Gourmet circuit.

Acknowledgments

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