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RESEARCH ARTICLE

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Investigating the price effects of honey quality attributes in a European country: Evidence from a hedonic price approach

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Abstract

This study investigates the price effects of honey quality attributes in Spain. Price and product characteristics are collected from 264 honey labels found on the shelves of the main representative retail stores available in the national territory. The marginal effects and the implicit prices of honey characteristics are assessed through a hedonic price approach. Results show that the prices of honey are affected by leader brands sold in gourmet stores and hypermarkets in glass packages compared to producer brands sold in discounts stores and supermarkets in plastic packages. The organic production and the protected designation of origin quality labels generate positive marginal effects on the prices of honey, as well. Regarding the origin of honey, the highest relative and absolute consumer price premiums are received for honey coming from the European Union and Spain

Abbreviations: EU, European Union; PDO, protected designation of origin; PI, percentage impact; WTP, willingness to pay.

compared with blend honey coming from EU and non-EU countries. Consumer implicit prices are also influenced by mono-floral and gourmet honey with additional properties (e.g., ginseng) compared with the multifloral varieties. These findings are a useful source for a better understanding of the evolution of honey in the Spanish market. Spanish beekeepers who can differentiate their honey, may use these results as an orientation for their business strategies.

KEYWORDS

hedonic price, honey, market price effects, quality attributes, retail stores

1 | INTRODUCTION

Honey is an important source of food in many diets, including the Mediterranean diet (Battino et al., 2018; Crittenden, 2011; Pocol & Bolboacă, 2013). As consumers' health consciousness increases (Ballco et al., 2019; de-Magistris & Gracia, 2016) so does the demand of honey due to the nutritional benefits and of not being subjected to any high technological process (Cosmina et al., 2016; Pocol & Calin, 2012). Following this expansion in demand, the production of honey with differentiated attributes (organic, mono-floral floral varieties, and added properties [e.g., ginseng]) has also increased affecting thus the market prices. However, one of the key components of determining price is through the quality and the attributes that the product possesses, and despite this increase in consumption, Spanish beekeepers have not yet taken advantage in understanding the current market demand to increase their product satisfaction and earnings (Pulido, 2020).

From a production and trade point of view, the Spanish beekeeping sector represents about 0.17% of the agricultural production (honey, wax, and pollen) with an annual value of about €62 million. At the community level, Spain stands out for its beehive census (about 16% of the hives in the European Union [EU]), as well as for the fact that 80% are in the hands of professional beekeepers (who manage more than 150 hives). The degree of professionalization of beekeeping in Spain exceeds the EU average, with around 22% of professional beekeepers. Most of the beehive census of honey and wax production is concentrated in the regions of Andalusia (25.1%), Valencia (19.9%), Extremadura (14.6%), and Castilla y León (7.6%). These four regions account for more than 70% of total honey production in Spain (MAPA - Ministry of Agriculture, Fisheries and Food 2021).

The level of Spanish honey self-sufficiency in 2018 reached 85% compared to the 56% selfsufficiency of the EU (European Commission [EC], 2020; Migueláñez, 2021). Currently, China continues to be the main supplier of honey to Spain (with an increase of 2.7% in 2018 compared with 2017), followed by Argentina, Ukraine, and Uruguay. Honey exports have also increased gradually to consolidate the foreign market as a marketing line with its entity, despite the decline experienced in 2018 (Ávila, 2019; Migueláñez, 2021). As for the destination of the foreign trade, in 2018 most Spanish honey exports were destined to France, Germany, Italy, and Portugal, although with significant reductions in shipments to France and Germany, compared with 2017 (Migueláñez, 2021).

Even though the quality of Spanish honey can be exceptional, due to the Mediterranean climate, and the high expertise of the beekeepers (Rodriguez et al., 2019), some local and foreign fraudulent cases have imposed negative effects on the commercialization. A current problem that beekeepers in Spain and other countries face is that the packaging industry is opting for imported low-quality honey from Asian countries, which have been reported to be

subject to adulteration (Maté, 2016; Ritten et al., 2019). According to Moore et al. (2012), honey is third in the world in terms of the number of fraudulent cases, which most are traced back to the production from Asian countries (N. L. García, 2016, 2018). The European Commission monitoring plan in 2015, detected at least 15% of the honey samples imported from China as not meeting the standards imposed by the European single market (C. García, 2018). This has also led to important economic consequences to local beekeepers, which now highlight the concept of local production closely linked to the territory. This is being valued positively by consumers as well, who associate local purchases with positive contributions to the environment and the preservation of economic activities in their local and rural areas (Ribeiro et al., 2018; Khaoula et al. 2019; Pippinato et al., 2020; Vapa-Tankosić et al., 2020). Organic and protected designation of origin (PDO) are also important attributes that can help beekeepers to gain a better recognition of their product (Arvanitoyannis & Krystallis, 2006; Oliveira et al., 2018). All these production and trade considerations suggest that the current moment is marked by the need to specify important attributes in the labeling of honey and induce changes in the large imports of low-quality honey from other countries, which cheapen local honey at prices below production costs (Ávila, 2019).

Consequently, the Spanish honey market is characterized by many different product characteristics (see Table 1). Since the labeling of honey affects the production and consumption, we are particularly interested to reveal the current characteristics of honey in the Spanish market and examine not only the marginal costs of the product characteristics but also the marginal willingness to pay (WTP) in terms of consumer price premiums (implicit prices).

From a consumer's point of view, previous research from the last 11 years suggests that various honey characteristics affect the decision to purchase and consumers' WTP (see the detailed review on honey consumer studies from 2010 and onwards in Appendix A, Table A1). Recent, consumer studies show that honey produced in local origins affect preferences and the WTP of Danish (Jensen & Mørkbak, 2013), Italian (Blanc et al., 2021; Brun et al., 2020; Cosmina et al., 2016), German (Bissinger & Herrmann, 2021; Bissinger et al., 2019), Romanian (Pocol & Bolboacă, 2013), Slovenian (Kos-Skubic et al., 2017), Serbian (Vapa-Tankosić et al., 2020), Hungarian (Oravecz et al., 2020), Portuguese (Ribeiro et al., 2019), Argentinian (Kallas et al., 2017), American (Wu et al., 2015), Saudi Arabian (Zulail et al., 2014), and Australian (Batt & Liu, 2012) consumers. Besides origin, consumers in Italy and Slovenia attach a great value to honey with the European PDO quality certification (Di Vita et al., 2021; Kos-Skubic et al., 2017).

Another important attribute that can help beekeepers gain better recognition in the market is to produce organically. Consumers attach a great importance to the organic production aspect of honey and are willing to pay price premiums in Denmark (Jensen & Mørkbak, 2013), Italy (Cosmina et al., 2016), Germany (Bissinger & Herrmann, 2021; Bissinger et al., 2019), and Serbia (Vapa-Tankosić et al., 2020). Alongside with the organic labeling, fairtrade is another alternative of differentiation for producers as consumers in Spain (Sama et al., 2019), and Germany (Bissinger & Herrmann, 2021; Bissinger et al., 2019) are willing to pay price premiums. Regarding the variety of honey consumers in Croatia (Brščić et al., 2017), Romania (Pocol & Bolboacă, 2013), the USA (Unnevehr & Gouzou, 1998), the Republic of Congo (Gyau et al., 2014), and Saudi Arabia (Zulail et al., 2014) prefer mostly monofloral rather than multifloral honey. Price remains one of the most important attributes that affect the purchase of honey in Italy (Cosmina et al., 2016), Hungary (Ványi et al., 2011), Poland (Kowalczuk et al., 2017; Roman et al., 2013a), Romania (Pocol & Bolboacă, 2013), Bosnia and Herzegovina (Kličković et al., 2017), and the Asian countries (Yeow et al., 2013). Simultaneously, preferences for other extrinsic characteristics of honey, linked to brand and reputation, have been reported to affect the purchase of honey in Australia (Batt & Liu, 2012), Denmark (Jensen & Mørkbak, 2013), the USA (Wu et al., 2015), and the Asian countries (Yeow et al., 2013) as well. Finally, different sensory attributes such as taste, color, and texture, among others, have been reported to affect consumers' WTP in Poland (Kowalczuk et al., 2017; Roman et al., 2013a, 2013b), Portugal (Ribeiro et al., 2019), Czech Republic (Šánová et al., 2017), and Australia (Batt & Liu, 2012).

Although there are many studies that identify the attributes that affect the demand and the WTP of honey in many countries, no research examines the effects of honey quality attributes in the market prices in Spain. This is the main contribution of this study. Hence, our main objective is to fill this gap and assess the market valuation for honey quality attributes in Spain and explain how honey characteristics affect market prices. To achieve the main

TABLE 1 Characteristics of the sample

Attributes category	Attribute levels	Observations (%)	Value
Price	€/kg	264 (100)	Scale (€ per kilogram)
Package size	Grams (g)	264 (100)	Scale (grams)
Brand	Producer	106 (40.2)	1 = Producer (Supermarket)
	Leader	158 (59.8)	0 = Leader brand
Origin	Blend EU and Non-EU (baseline [BL])	53 (20.1)	1 = Indicated; 0 = otherwise
	Spain	172 (65.1)	
	European Union (EU)[a]	10 (3.8)	
	Other (Non-EU)	29 (11.0)	
Protected designation of origin (PDO)		17 (6.4)	1 = Indicated; 0 = otherwise
Organic certification		28 (10.6)	1 = Indicated; 0 = otherwise
Honey variety	Multi-floral (BL)	112 (42.4)	1 = Indicated; 0 = otherwise
	Mono-floral	89 (33.7)	
	Gourmet[b]	63 (23.9)	
Retail channel	Hypermarkets		
	Alcampo (BL)	42 (15.9)	
	Carrefour	54 (20.4)	1 = Carrefour; 0 = otherwise
	Hipercor	37 (14.1)	1 = Hipercor; 0 = otherwise
	Discount stores		
	Simply (Baseline)	14 (5.3)	
	Dia	10 (3.8)	1 = Dia; 0 = otherwise
	Lidl	6 (2.3)	1 = Lidl; 0 = otherwise
	Supermarkets		
	Mercadona (BL)	7 (2.6)	
	El Corte Ingles	37 (14.1)	1 = El Corte I.; 0 = otherwise
	Eroski	6 (2.2)	1 = Ersoki; 0 = otherwise
	Gourmet stores		
	Alcampo, simply, mercadona (BL)		
	La Natural	51 (19.3)	1 = Gourmet; 0 = otherwise
	Polen		
	La Vida Sana		
	Koralium		
Package material	Glass	166 (62.9)	1 = Glass; 0 = Plastic
	Plastic	98 (37.1)	

	No. cases (%)	Mean	Std. dev.	Min	Max
Price	264 (100)	13.44€	6.18	3.85 €	40.08 €

TABLE 1 (Continued)

	No. cases (%)	Mean	Std. dev.	Min	Max
Package size mean 480 (g)					
250	53 (20.1%)	19.52 €	7.32	11.56 €	40.08 €
250–350	52 (19.7%)	13.88 €	5.82	8.26 €	26.03 €
350–500	115 (43.6%)	11.92 €	4.07	4.56 €	23.56 €
500–1000	44 (16.7%)	9.53 €	4.11	3.85 €	21.07 €

[a]European Union origin refers to honey coming from any member country, single country and/or blend honey from the EU.
[b]Gourmet refers to honey with additional properties (e.g., honey with ginseng, black garlic etc.).
Source: Own elaboration.

objective a hedonic price approach is used as the most appropriate analytical tool. The hedonic price approach uses real market data and considers demand and supply factors to allow the calculation of the marginal WTP (implicit prices) and the marginal costs of product characteristics. This approach has been widely used in wine where a lot of methodological improvements have been done (among others, Costanigro & McCluskey, 2011; Estrella Orrego et al. 2012; Ferro & Benito Amaro 2018; Levaggi & Brentari, 2014; Oczkowski, 2016, 2021). The outcomes of this study are expected to improve the knowledge related to the value of honey quality attributes and provide support to producers in the development of new products and the communication of their characteristics.

2 | MATERIALS AND METHODS

2.1 | Data collection

To determine the presence of honey quality attributes, a database that collected information regarding honey products available between September and October 2018 was created. Table 1 summarizes the attributes included in this study and the descriptive statistics of variables.

The sample included 264 products marketed in four types of stores (hypermarkets, discount stores, supermarkets, and gourmet stores) present in the national territory that sum 54.4% of the sector's market share (F. Garcia, 2019).[1] It is worth mentioning that while in countries like the United Kingdom a handful of large operators control more than 80% of the market, in Spain the local chains and small distribution companies still distribute about 45% of the pie (As shown in Table 1, honey prices vary depending on package size from a minimum of €3.85 to a maximum of €40.08 with an average price of €13.44 per kg. It is worth mentioning that the average price for a kilogram of honey is relatively high because we include honey from gourmet stores. The average price of honey, excluding the items from the gourmet stores is €11.42 per kg. The package size content varies between 250 and 1000 g with an average weight of 480 g. The most common packaging size found is 350–500 g (43.6%), sold in glass package (62.9%), followed by 250–350 g (19.7%). The hypermarkets provide around 50% of the total number of items followed by the gourmet stores (19.3%), supermarkets (18.8%), and discount stores (11.4%). Honey is mostly marketed under the processor's leader brands (59.8%) in comparison to the own distributor's producer brands (40.2%). In terms of the origin, most of the honey is originated from Spain (65.1%), followed by mixed origins from the EU and Non-EU countries (20.1%), honey from non-EU countries (11%), and honey from the EU countries (a single country or a blend from EU countries [3.8%]). Regarding the varieties of honey, most of the

[1]It is worth mentioning that while in countries like the UK a handful of large operators control more than 80% of the market, in Spain the local chains and small distribution companies still distribute about 45% of the pie (Ballco & de-Magistris, 2018).

honey is marketed under the multifloral variety (42.4%), followed by mono-floral (33.7%), and gourmet honey (23.9%). Finally, 10.6% of the honey had the organic EU quality certification and 6.4% the PDO certification.

2.2 | Hedonic price approach

The hedonic price model comes from the theory of demand by Lancaster (1966), which states that the utility that a consumer can derive from a product depends on the characteristics that the product possesses. Under the assumption of perfect competition, the theory suggests that consumers WTP depends on the quality attributes that are independently valued by consumers at the moment of purchase. Considering that consumers choose an optimal bundle of attributes to maximize utility, subjected to a budget constraint, Rosen (1974) further developed this theory to obtain the standard hedonic price model. In this model, the observed market price of a product is the sum of implicit prices paid for each quality attribute (Rosen, 1974). The implicit prices can be estimated by employing the hedonic price model, which is a regression model capable of expressing the observable price of a product as a function of the attributes it possesses. This theoretical model assumes a general economic equilibrium in a perfect competitive market. Therefore, consumers maximize utility by choosing available products under their budget constraint, while firms maximize profits given the available technology and factor prices (Rosen, 1974). Because implicit prices are related to both supply and demand conditions, they cannot be considered as indicators of consumer preferences (Oczkowski, 1994; Rosen, 1974; Schamel, 2006). Furthermore, in a situation of imperfect competition, implicit prices are also affected by the choices of producers who consider their own market power, price elasticity of demand for each attribute, and the costs of incorporating each attribute in the final product (Hassan & Monier-Dilhan, 2006; Seccia et al., 2017).

Rosen (1974) demonstrated that any estimated hedonic price represents both the marginal utility of characteristics to consumers (demand) and the marginal cost of producing foods with several characteristics (supply). The demand curve is identified when consumers have similar preferences but producers' different costs of production (e.g., organic vs. nonorganic). Following Rosen (1974), the set of the characteristics of the product driven by the demand and the supply of these characteristics can be represented by a vector k of attributes:

$$z = (z_{1,}\, z_{2,\,\ldots,}\, z_k). \tag{1}$$

According to Lancaster (1966), consumers obtain utility directly from these attributes. The utility function for a representative consumer is then expressed as:

$$U = U(z_{1,}\, z_{2,\,\ldots,}\, z_k;\ \alpha), \tag{2}$$

where z_k is the quantity of the k^{th} attribute contained in market goods and α is a parameter of consumer preferences. The level of the n^{th} attribute achieved by a consumer will depend on the quantity (Qi) of different goods consumed. Units are related to z_k through the variable x_{jk} that represents the amount of the k^{th} attribute contained in one quantity of the j^{th} product. Under this assumption:

$$Z_k = f_n(Q_{1,}\, Q_{2,\,\ldots,}\, Q_{n,}\, x_{1k,}\, x_{2k,\,\ldots,}\, x_{nk}). \tag{3}$$

Considering Equations (2) and (3), an individual's level of utility is based on the level of attribute per quantity of the product and the number of products consumed:

$$U = U(Q_{1,}\, Q_{2,\,\ldots,}\, Q_{n,}\, x_{1t,\,\ldots,}\, x_{nk};\alpha). \tag{4}$$

As the economic theory states, consumers will maximize utility (4) subject to a budget constraint, defined as:

$$M = \sum_{j=1}^{n} P_j \times Q_j, \tag{5}$$

where P_j is the price of the market good j^{th}. As result the maximization issue is given as:

$$P_j = f(x_{j1,}\, x_{j2,\,\ldots,}\, x_{jk}), \tag{6}$$

where, x_{jk} is the quantity of attribute k associated with a unit of Q_j. Finally, this approach assumes that the market is in perfect competition, thus in the long-run equilibrium the implicit price of each attribute can be read into the value consumers place on each attribute (Combris et al., 1997). Expression (6) can adopt different functional forms. However, since the economic theory does not solve the problem as to which is the most suitable functional form of the hedonic price function, it is a decision that researchers must make empirically.

The linear form implies that the implicit prices are constant meaning that the additional price of an attribute is not influenced by the acquired amount (A. Gracia et al., 2004), and it is only possible if consumers can compose the set of attributes at theory own discretion (A. Gracia & Perez y Perez, 2004). The Box-Cox transformation is usually applied as a first step to identify possible functional forms. In addition, heteroskedasticity and multicollinearity are common issues in hedonic models and should be addressed when choosing a specification (Costanigro & McCluskey, 2011). This approach (Box & Cox, 1964) nests alternative functional forms, by adding nonlinear parameters, θ and λ on the dependent and independent variables expressed as:

$$P_k^{(\theta)} = \begin{cases} \dfrac{P^{\theta} - 1}{\theta} if & \theta \neq 0 \\ \ln \theta \quad if & \theta = 0 \end{cases} z_k^{(\lambda)} = \begin{cases} \dfrac{Z^{\lambda} - 1}{\lambda} if & \lambda \neq 0 \\ \ln \lambda \quad if & \lambda = 0 \end{cases}. \tag{7}$$

The Box-Cox transformation provides four possible functional outcomes: (i) linear, when $\theta = \lambda = 1$; (ii) semilogarithmic, when $\theta = 0$ and $\lambda = 1$; (iii) double-logarithmic, $\theta = \lambda = 0$ and (iv) linear-logarithmic, $\theta = 1$ and $\lambda = 1$. However, individual, and joint tests on the Box-Cox parameters may lead to un-conclusive results, as in our case. As in previous studies using this approach in hedonic price models (Ballco & de-Magistris, 2018; Ballco & Gracia, 2020; Cabrera et al., 2015; Sanjuán-López et al., 2009), the Vuong test (Vuong, 1989) may be applied in continuation after the Box-Cox approach to select the functional form that best fits the data. The Vuong test determines the predicted probabilities of two models, choosing the best values in terms of log-likelihood and the variance estimate of their difference. For each functional form i, the likelihood ratio is expressed as:

$$LR^i = (\lambda_j\, \theta_j, \lambda_k\, \theta_k) = ll_j^i - ll_k^i, \tag{8}$$

where j, k is one of any of the four models (m) defined by the Box-Cox transformation and the ll_m is the log-likelihood function for observation i evaluated at the parameter estimates of the model m. The Vuong test is given by:

$$\text{Vuong} = \frac{\sqrt{n}\left[\frac{1}{n}\Sigma_{i=1}^{n} LR_i\right]}{\sqrt{\frac{1}{n}\,\Sigma_{i=1}^{n}(LR_i - \overline{LR_i})^2}}, \tag{9}$$

where n is the number of observations. The Vuong test is distributed asymptotically as a standard normal, thus, values larger than the critical $N_{\alpha/2}$ (with α the significance level) favor model j, negative values $-N_{\alpha/2}$ are in favor of model k and Vuong ≤ $N_{\alpha/2}$ indicates no significant differences between the two models. Nevertheless, in a hedonic price approach, explanatory variables are commonly introduced as dummy variables, thus the use of the semi-logarithmic form is very common in many agri-food studies (Bissinger & Herrmann, 2021; Bissinger et al., 2019; Combris et al., 1997; Pippinato et al., 2020).

3 | RESULTS

The first step includes the estimation of the Box-Cox regression. Table 2 provides the results indicating that two possible functional forms are not rejected (lin-log and log-log).

To further analyze the results from the Box-Cox transformation and choose the most suitable functional forms, Vuong's test was applied (Table 3).

If we consider that a joint linear transformation is always rejected, then the results of the Vuong test confirms that the semi-logarithmic (log-lin) and the double-logarithmic (log-log) functional forms are both suitable. In line with the previous literature, additional statistical parameters are performed to select the functional form that best fits the model (Ballco & de-Magistris, 2018; Ballco & Gracia, 2020; Cabrera et al., 2015; Muñoz et al., 2015). Two likelihood-ratio statistics are performed to verify if the semi-logarithmic (log-lin) functional form is significantly preferred to a double-logarithmic (log-log) specification, respectively.[2] The adopted functional form (log-log) is superior to the other alternative. Goodness-of-fit (R^2 = 0.78) and the adjusted R^2 (R^2 = 0.77) is higher and significant (F-statistic < 0.01). In addition, the model shows no problem with the normality of residuals (probability of Jarque-Bera p-value = 0.00). The heteroscedasticity is tested by the Breusch-Pagan-Godfrey and White test statistic and the null hypothesis in the error term is rejected (probability F-statistic < 0.01), which indicates heteroscedasticity problems. White's robust estimation strategy to obtain the parameter standard errors is used to solve this problem. Estimation results for the double-logarithmic functional form are presented in Table 4.

When analyzing, the magnitude of the coefficients can be estimated as the percentage change of the price variable in view of the change in a unit of the independent variable (Halvorsen & Palmquist, 1980). In the case of a scale variable, this percentage change can be determined as:

$$(\partial P/\partial Z_K)(1/P) = (\partial LnP/\partial Z_K) = \beta_m, \tag{10}$$

while, in the case of a dummy variable it is estimated as 100 × βm (third column of Table 4). The percentage impact of a dummy variable is estimated following Kennedy (1981):

$$100 \times (\exp[\beta_m - 0.5Var(\beta_m)] - 1), \tag{11}$$

where $Var(\beta_m)$ is the estimated variance of parameter m. All the percentage variations for each of the attributes used in the estimation model are shown in the fourth column of Table 4 (Percentage impact [PI] that each dummy variable has over price or elasticity for package size). Values appearing in the fifth column are the result of applying the percentage impact on a reference price, in this case, the average price of the sample (€13.44 1^{-1}), so implicit prices are calculated.

The only scale variable (package size) is negative and statistically significant with a coefficient of −0.655. Considering the log-log form of the equation, the coefficient of a scale variable can be directly interpreted in terms of elasticities. Hence, a negative coefficient that is less than one means that an increase in the total amount of the product contained in the package leads to a less-than-proportional decrease in its price. This is an expected result since a low price is usually paid when a large package size of product is purchased. The remaining variables in the hedonic price model are introduced as dummy variables. Positive implicit prices might arise both from additional production costs and from a high consumer valuation. Conversely, low prices can be caused as much by particularly low costs of production as by a reduced preference for honey with quality attributes (e.g., producer brand).

Regarding the origin, honey coming from non-EU countries does not affect prices. Surprisingly, the results depict a higher price premium for honey produced in the EU (19.5%), rather than honey produced in Spain (18.5%), with a slight difference in the implicit price (0.13 €/kg). From the supply side, it seems plausible that Spanish honey leads to an increased price level compared to a blend of EU and non-EU countries but a slight decrease in price level compared

[2]Its are available upon request.

TABLE 2 Box-cox transformation

Functional form	θ value	λ value	Statistic (*p*-value)	Result
Log-lin	0	1	5.84 (0.01)	Rejected
Lin-log	1	0	1.39 (0.24)	Not Rejected
Lin-lin	1	1	8.41 (0.00)	Rejected
Log-log	0	0	17.12 (1.00)	Not Rejected

Source: Own elaboration.

TABLE 3 Vuong's test results

Ho:	Vuong statistic	Accepted form
Log-lin versus lin-log	3.46[a]	Log-lin
Log-lin versus lin-lin	−0.00	-
Log-lin versus log-log	−3.42[a]	Log-log
Lin-log versus lin-lin	−0.00	-
Lin-log versus log-log	−0.00	-
Lin-lin versus log-log	0.00	-

[a]Indicates the values are higher or lower than the critical values of 1.96 and −1.96 respectively, rejecting the null hypothesis of no-differences among functional forms.

Source: Own elaboration.

with EU honey. This might be expected since the prices of Spanish honey have been lately affected by the large imports of low-priced honey (C. García, 2018). On the demand side, many consumers chose honey from Spain and the EU instead of a blend of EU and non-EU and are willing to pay price premiums. These preferences for nationally produced honey are in line with the results of previous research (Bissinger et al., 2019). In terms of honey variety, gourmet and mono-floral varieties receive significant price premiums (27.5% and 5.4%, respectively) compared with multifloral honey. From the supply side, adding value to the initial product by introducing ingredients such as ginseng, black garlic, or cinnamon, and locating bees to pasture from mono-floral varieties yields additional costs for producers. From the demand side, it can be seen that gourmet and mono-floral varieties significantly affect the prices of honey. This means that consumers compensate the efforts of producers by paying a price premium of 3.70 €/kg for the gourmet honey and 0.73 €/kg for honey that is produced from a mono-floral variety.

The EU organic certification of honey and the PDO quality certifications are two important quality cues that affect the market prices of honey as well. More precisely, the EU organic certification has a higher percentage impact on price of 10.7% compared to a conventional honey, while the PDO certification has a higher percentage impact on price of 9.9% compared to a jar of honey without this label. From the supply side, exceeding EU organic legislation and being part of a PDO consortium imposes additional costs, high-quality standard requirements, and membership fees from beekeepers. However, on the demand side, organic and PDO conscious consumers value these quality attributes and are willing to pay a price premium of 1.44 €/kg for organic honey and 1.32 € for a kilo of honey with the PDO label.

The different types of chains where the honey is sold significantly affect product prices. In particular, the gourmet stores (87.2%) receive a price premium of 11.72 €/kg compared with hypermarkets, discount, and supermarkets. Honey sold in hypermarkets (Hipercor (15.5%) and Carrefour (12.6%) compared with Alcampo) also affected market prices more than the discount stores (Dia (6.2%) compared with Simply) and supermarkets (El Corte

TABLE 4 Parameters estimates of the price hedonic equation

Double-logarithmic (log-log)					
	Coefficient	Standard error	Marginal effect (%)[a]	PI (%) or elasticity[b]	Implicit price (€/kg)[c]
Constant (α)	6.109***	0.29	–	–	–
Package size	−0.655***	0.05	−48.06	−49.34	−6.63
Origin					
Mixed EU and Non-EU (baseline [BL])					
Spain	0.190***	0.04	20.92	18.53	2.49
European Union[d]	0.218**	0.08	24.36	19.48	2.62
Other (Non-EU)	0.070	0.06	–	–	–
Variety					
Multi-floral (BL)					
Mono-floral	0.068***	0.03	7.04	5.44	0.73
Gourmet[e]	0.268***	0.05	30.73	27.51	3.70
Retail channel *(Hypermarkets)*					
Alcampo (BL)					
Carrefour	0.139***	0.04	14.91	12.64	1.70
Hipercor	0.164***	0.04	17.82	15.49	2.08
Retail channel *(Discount stores)*					
Simply (BL)					
Dia	0.085*	0.05	8.87	6.18	0.83
Lidl	−0.093	0.06	–	–	–
Retail channel *(Supermarkets)*					
Mercadona (BL)					
Eroski	0.116	0.08	–	–	–
El Corte Ingles	0.135***	0.04	14.45	12.19	1.64
Retail channel *(Gourmet stores)*					
Hypermarkets, discount stores, and supermarkets (BL)					
Gourmet stores	0.657***	0.06	92.90	87.20	11.72
Brand					
Producer	−0.341***	0.03	−28.89	−29.95	−4.03
Quality certification					
PDO	0.124***	0.06	13.20	9.86	1.32
Organic	0.127***	0.05	13.54	10.74	1.44

TABLE 4 (Continued)

Double-logarithmic (log-log)					
	Coefficient	Standard error	Marginal effect (%)[a]	PI (%) or elasticity[b]	Implicit price (€/kg)[c]
Package material					
Glass	0.113***	0.04	11.96	9.75	1.31

Note: ** and *** denotes statistical significance at the 5% and 1% level (*p*-values calculated with robust HC3 standard errors).

[a]The percentage impact of the independent variable on the dependent one is estimated according to Halvorsen and Palmquist (1980) as $100 \times (e^{\beta} - 1)$, for example, for the Gourmet variable: $100 \times (e^{0.268} - 1) = 30.7\%$.

[b]The percentage impact (PI) of a dummy variable or the elasticity of a scale variable is estimated according to the approach of Kennedy (1981) $100^{*}(e^{(\beta - 0.5V(\beta))} - 1)$, which leads to consistent and (almost) unbiased estimations of the price effect (Van Garderen & Shah, 2002).

[c]Compared with the baseline (BL) variables: implicit prices are calculated using the mean price of 13.44 €/kg and the price effect according to Kennedy's approach. Implicit prices are shown only if the coefficients are significantly different from zero at the 90% level at least.

[d]European Union origin refers to honey coming from any member country, single country and/or blend honey from the EU.

[e]Gourmet refers to honey with additional properties (e.g., honey with ginseng, black garlic etc.).

Source: Own elaboration.

Ingles [12.2%] compared with Mercadona). Honey sold at Lidl and Eroski do not influence the prices significantly. When investigating the other extrinsic characteristics of honey, the estimation results of the hedonic analysis shows that producer brands yield a markdown compared with leading brands. More precisely, producer or supermarket brands experience a lower percentage impact on price of −29.9% compared with the leader or the brands of the producer. On the supply side, additional branding costs arise from leader brands as producers invest to be identified in the market. Hence, it seems consistent to reason that a low price for producer brands, compared to leader brands, comes from lower input costs. On the demand side, it is apparent that consumers face a lower price (−4.03 €/kg) when purchasing honey with a producer brand.

In terms of packaging material, the prices of honey are positively affected by honey sold in glass packages (9.7%) than in plastic packages. Plastic packaging requires less input from the supply side, and less transportation and storage costs. However, from the demand side, consumers associate honey with a natural product and storing it in a glass package looks better and it is perceived to preserve the quality of the product (Balzarotti et al., 2015). This might be also one reason that consumers are willing to pay a price premium of 1.31 € for a kilo of honey sold in a glass package.

4 | DISCUSSIONS

The main objective of this study was to assess the market valuation for honey quality attributes in the Spanish market. Results showed that honey was a highly differentiated food product. The market competition was based on quality attributes related to package size, brand, packaging material, type of retailer, variety of honey, origin, production method, and quality certification. The applied hedonic function provided a measure of the market value of these attributes and investigated some important features of the Spanish honey industry to offer insights into certain competitive strategies. The estimation of implicit prices for honey characteristics yielded more market transparency. It captured the price effect of honey characteristics under ceteris-paribus conditions, which were not available from any statistical source in Spain. Beekeepers and other individual producers, who can differentiate their production method and switch to other types of honey, may use implicit prices of honey characteristics as an orientation for their strategies.

The results showed that the prices of honey were positively affected by leader brands sold in gourmet stores in glass packages compared with producer brands sold in plastic packages. Some hypermarkets (Carrefour and Hipercor compared with Alcampo) affected the prices of honey in the Spanish market. One supermarket (El Corte Ingles) and one discount store (Dia) yielded positive percentage impacts on price, as well. Conversely, one discount store (Lidl) and one supermarket (Eroski) did not affect the prices of honey. Storing honey in a glass package added value to the product as consumer studies reported that a glass package looks better and preserves the quality of the product (Balzarotti et al., 2015). This finding is consistent with the previous research as well (Bissinger & Herrmann, 2021; Ványi et al., 2011; Wu et al., 2015). A brand is an important tool when choosing a product as it is associated with the company's reputation related to the product. Giving a higher value to leader brands compared with producer brands is consistent with the previous findings who report higher price premiums for honey produced under leader brands than generic or store brands (Batt & Liu, 2012; Bissinger & Herrmann, 2021; Blanc et al., 2021; Di Vita et al., 2021; Oravecz et al., 2020; Unnevehr & Gouzou, 1998; Yeow et al., 2013). From the supply side, these results pointed out the importance that retail channels have on the prices of honey in Spain and identified the specific retail channels to be considered by Spanish honey producers. From the demand side, consumers were willing to pay a price premium for honey that was sold in hypermarkets and gourmet stores. These stores sell many mono-floral and gourmet varieties of honey under leading brands compared to supermarkets and discount stores, which mainly sell low-priced multifloral honey under the supermarkets' brand name (San Esteban 2017). The increase in preferences for gourmet honey can be also linked with consumers' interest in healthy eating. Ismaiel et al. (2014) illustrated that the trend of consuming honey as a healthy food with additional nutritional properties has been steadily increasing. These preferences are consistent with our results as gourmet honey with additional properties received the highest price premium compared with all attributes. The results of giving higher price premiums to the mono-floral variety compared with the other varieties is consistent with the findings of previous research in other countries as well (Bissinger & Herrmann, 2021; Bissinger et al., 2019; Brščić et al., 2017; Gyau et al., 2014; Pocol & Bolboacă, 2013; Unnevehr & Gouzou, 1998; Zulail et al., 2014). The increase in the demand for high-quality honey is also reflected in the positive percentage impacts that organic and honey with the PDO quality certifications generate in the Spanish market. More specifically, results showed that the organic honey positively affected prices with a percentage impact on price of 10.7% and an implicit price of 1.44 €/kg, while honey with the PDO quality certification generated a positive impact of 9.9% with an implicit price of 1.32 €/kg. These results are in line with previous studies that find positive preferences and WTP for organic honey in different countries (Bissinger & Herrmann, 2021; Bissinger et al., 2019; Cosmina et al., 2016; Jensen & Mørkbak, 2013; Vapa-Tankosić et al., 2020). Regarding the PDO quality label, the results are in line with the findings of two previous studies in Italy and Slovenia, which find a positive relation between a PDO label and the preferences of consumers in buying honey with PDO (Di Vita et al., 2021; Kos-Skubic et al., 2017). On the supply side, switching production from conventional to organic, being part of a consortium to provide a PDO certification, adding additional properties (e.g., truffle), and moving bees to pasture from mono-floral areas increase costs. However, we found that these efforts were compensated as they yielded price premiums. Therefore, producers who can make this shift of production can get an orientation from these results.

Concerning the origin of honey, the results showed that the highest price premium was received when honey was originated from the EU and Spain than when it was a blend coming from EU and non-EU countries. Honey that came from other origins (e.g., outside the EU) did not affect market prices. One possible explanation is the general current trend toward the purchasing of local products, where environmental concern is one reason behind this trend (Adalja, 2015). Honey consumers perceive products from their local territory as being environmentally friendly due to the reduction of transport costs and "food miles" (Cosmina et al., 2016; Wu et al., 2015). Besides supporting the local economy (Wu et al., 2015), previous studies suggest that the consideration of food-safety is another factor that affects the preference of local honey (Bissinger & Herrmann, 2021; Bissinger et al., 2019). Food fraud has risen significantly due to honey adulteration (C. García 2018), and honey laundering (Pippinato et al., 2020; Ritten et al., 2019). Hence, it seems reasonable for consumers to pay a price premium for regional, local, or honey from countries with an established reputation to avoid health risks and fraud (Bissinger & Herrmann, 2021). Our results can be compared with the consumer study of Sama et al. (2019) who showed that the utility of the Spanish consumer increased when the honey was produced

in Spain (regional/local) compared to honey that came from outside of Europe (e.g., China, America). The origin of honey was also an important attribute that determined its quality, according to the results of previous studies (Batt & Liu, 2012; Bissinger & Herrmann, 2021; Bissinger et al., 2019; Blanc et al., 2021; Brun et al., 2020; Cosmina et al., 2016; Jensen & Mørkbak, 2013; Kallas et al., 2017; Kos-Skubic et al., 2017; Oravecz et al., 2020; Pocol & Bolboacă, 2013; Ribeiro et al., 2019; Šánová et al., 2017; Vapa-Tankosić et al., 2020; Wu et al., 2015; Zulail et al., 2014). Of special interest was the fact that honey coming from the EU generated a slightly higher implicit price over honey produced in Spain. One reason that might explain this result comes from the fact that we did not include producer prices in our database. Although in small volumes, Spanish producers sell directly to consumers and about 19% of consumers purchase honey from producers (Intermiel Interprofesional de la Miel y los Productos Apícolas, 2018). Capturing these price effects might have slightly increased the effect of the Spanish origin attribute over price. Another reason that the EU origin leads to a higher price premium might come from the higher transport costs of honey coming from the EU countries.

5 | CONCLUSIONS

In a quantitative analysis based on Spanish market price data for honey, we examined how honey characteristics affected prices. The results of the present research gave solid knowledge of the current situation in the real market of honey and indirectly informed producers, retailers, and researchers on the available honey attributes that consumers face in the Spanish market. Considering all the observations, the findings indicated that honey is a highly differentiated product. The hedonic price analysis revealed that many characteristics led to a consumer price premium compared to standard honey available in the market. Consumers' price premiums were high, such as for gourmet varieties with additional properties (e.g., black garlic), mono-floral varieties, leader brands, and glass packages. Among the retail channels, gourmet stores, some hypermarkets, discount, and supermarkets were included. EU certified organic honey and those with a PDO certification received price premiums as well. Regarding origin, the hedonic model suggested that consumers paid a price premium for EU and Spanish origins rather than blend honey coming from EU and non-EU countries.

Local beekeepers and commercial producers may develop new marketing strategies and emphasize the health and medical benefits of their honey since consumers' interest in honey characteristics with additional properties (e.g., ginseng and black garlic) that promote health has increased. Apart from using organic methods of production, an emphasis of the local and EU origin of honey may result in increasing demand. Labeling honey under a PDO quality certification can also be a good strategy since it received a considerable positive implicit price and overall consumers have positive attitudes toward PDO labels.

Our analysis raises some general questions for future research. The question arises whether including Spanish producers' prices into the hedonic model will increase the price effect of the Spanish origin attribute. It might also occur that the consumer price premium for national origin might be even more diversified between Spanish regions rather than as a national origin. In addition, could a new Spanish regulation on food labeling origin prevent consumers from being misled by the quality aspects when honey fraud is so widespread? In other words, are the current labels well communicated to the consumer and do they reduce honey fraud, or should they be combined with labeling systems that involve digitalization (e.g., QR codes and smart packaging) to be more effective? Does the combination of the hedonic price approach with other methods (e.g., real choice experiments) related to price structures provide further guidance for local beekeepers? Further research along these lines in other markets appears worthwhile.

Some limitations of our research merit emphasis. The first limitation is that the sample used was based on products available at the main supermarket, hypermarkets, and gourmet stores where consumers habitually purchase their entire food basket, but it did not consider that many producers sell directly from the farm. For this reason, in addition to the selected price range, other available prices (probably cheaper) might have been neglected. Another aspect is related to the territorial limitation. Even though we considered supermarkets and hypermarkets that can be found anywhere in Spain, due to organizational and funding reasons, this study was conducted only in

one Spanish region (Zaragoza – Aragón). It would be interesting to compare the results obtained in other regions, areas of influence, and with other honeys with similar characteristics. The theoretical model used is based on the presumption that supply and demand for individual honey characteristics are in equilibrium. The theoretical basis appeared sound as the coefficients of the model were plausible and could be explained with the supply-side and/or demand-side characteristics. An interesting question for future research would be to test the market power as opposed to the market equilibrium hypothesis. For honey with strong brands and/or attributes, firms might set prices above marginal costs; hence, their implicit price may include some market power. Finally, the implicit prices provided in this study may vary over time and they have been estimated for a specific period. Although we compared the results with the empirical findings of current research, we did not find any hedonic price study conducted in Spain to compare the results from the price effects. Although the study's interest is limited in the market of one country, the methodology can be replicated in other countries.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX A

(Table A1)

TABLE A1 Previous research (within the last 11 years), exploring consumer preferences for honey quality attributes and their key findings

Reference	Country	Analytical method	Key findings
Ványi et al. (2011)	Hungary	Survey	The most important criteria when purchasing honey were quality, price, type of honey, and packaging quality. Older people consider the price, name of the producer, and size of packaging attributes when purchase honey.
Batt and Liu (2012)	Australia	Survey	Three factors that influence the consumer's decision to purchase honey were brand reputation, origin, and value for money. The taste was the most influential attribute when purchasing honey. Most potential buyers do show a marked preference for Australian honey as well.
Jensen and Mørkbak (2013)	Denmark	Online survey	High perception of organic or local products' gastronomic quality was directly and positively associated with the propensity to choose these respective product varieties.
Pocol and Bolboacă (2013)	Romania	Survey	The most popular types of honey were acacia, poly-floral honey, and linden honey. Respondents preferred to buy honey from a local producer and had more confidence in domestic honey than in imported honey.
Roman et al. (2013a)	Poland	Survey	More than half of respondents indicated the high or very high price of honey. Buying honey directly from the beekeeper was widespread among respondents. Some respondents stated that they do not consume honey at all, but price cuts and the opportunity to taste test honey at the point of sale would be an incentive for them.
Roman et al. (2013b)	Poland	Survey	Consumers stated that the honey from beekeepers was better than that offered in the stores. Packaging and visual features did not affect the purchase of honey, while the origin and quality certifications were the most important factors when purchasing honey. The most common varieties of honey preferred were multifloral, linden, rapeseed, and acacia.
Yeow et al. (2013)	China	Survey	The four factors that influence the consumers purchasing behavior of honey are medical conditions, the quality of the product, the brand reputation, and the price of honey.
Gyau et al. (2014)	Republic of Congo	Survey	Results show that married consumers with secondary education have a strong preference for local forest and savannah honey. Those between the ages of 30 and 50 do not prefer honey from beekeeping but would rather have it imported.

TABLE A1 (Continued)

Reference	Country	Analytical method	Key findings
Zulail et al. (2014)	Saudi Arabia	Hedonic pricing	Locally produced honey was preferable due to its quality. The most important quality characteristics of locally produced varieties of honey are good flora and attractive packaging, as they add a significant retail price premium to the base price.
Wu et al. (2015)	USA	Auction experiment	Consumers' demand varies based on the geographic location of the honey's production, product packaging, and product information. Locally produced honey is preferred, especially when provided information about fraudulent aspects of internationally produced honey.
Cosmina et al. (2016)	Italy	Choice experiment	The organic attribute was more important than the place of production but less important than the country of origin; local Italian honey was preferred to foreign honey. Respondents showed a higher WTP for honey from their country of origin versus the production method used.
Brščić et al. (2017)	Croatia	Online survey	Honey is mainly consumed for its health and medical benefits. The respondents prefer acacia rather than floral and meadow honey. Honey is mainly purchased directly from the producers.
Kallas et al. (2017)	Argentina	Choice experiment	Consumers prefer local honey with solid texture and light color and reveal rejection for a dark honey. Consumers are mainly WTP a price premium for honey with local origin.
Kličković et al. (2017)	Bosnia and Herzegovina	Survey	The consumer's choice to buy honey is highly influenced by the quality followed by the price.
Kowalczuk et al. (2017)	Poland	Survey	Primary factors considered during the purchase were the type of honey (preferred types being lime, poly-floral and acacia), price, and color.
Šánová et al. (2017)	Czech Republic	Survey	Consumers are interested primarily in the price and origin of honey. An important parameter for buying honey is the (non)crystallization. Although it does not affect objective quality parameters of honey, it affects the consumers' subjective perception of honey quality during purchase.
Kos-Skubic et al. (2017)	Slovenia	Online survey	Price is the most powerful driver for honey, followed by local origin. Honey bearing the national PDO and PGI labels were more desired than honey carrying the EU PDO and PGI labels.
Bissinger et al. (2019)	Germany	Hedonic pricing	The findings suggest that organic production and certification, fairtrade and regional origin influence consumers' willingness to pay and suppliers' costs of production respectively. No significant effects concerning the packaging material can be verified.

(Continues)

TABLE A1 (Continued)

Reference	Country	Analytical method	Key findings
Ribeiro et al. (2019)	Portugal	Survey	Taste, color, origin, and certification label were the characteristics that affected the consumer's decision to purchase honey.
Sama et al. (2019)	Spain	Survey	Consumers prefer Fairtrade honey to the conventional one. The profile of the individual who has a greater probability of consuming Fairtrade honey is women, with high income, and consumers who are sensitized and who are consumers of Fairtrade food.
Brun et al. (2020)	Italy	Survey	Consumers have a positive attitude toward "mountain" honey. An appreciable relationship was observed between mountain products and local products, suggesting that the mountain quality label could be a useful tool for the valorization of honey.
Oravecz et al. (2020)	Hungary	Survey	Consumers consider the local origin of honey very important, and they prefer to honey directly or indirectly from the beekeepers. Well-informed consumers consider the region of origin, brand, producer name, and certification labels significantly more important than uninformed consumers.
Vapa-Tankosić et al. (2020)	Serbia	Survey	Consumers were WTP more for organic honey than for local honey. Consumers with a high monthly household income and education are WTP for organic and local honey.
Bissinger and Herrmann (2021)	Germany	Hedonic pricing	Consumer price premiums are high for mono-floral honey, and certain brands. Fairtrade certification, organic production, regional origin as well as environmentally friendly packaging affected the prices of honey.
Blanc et al. (2021)	Italy	Survey	The most important attributes during the purchase of honey are local production and origin.
Di Vita et al. (2021)	Italy	Survey	Consumers who prefer honey associate this label with aspects linked to environmental sustainability and its organic production. Consumers trust the brand and its persuasive capacity, only until this translates into a possible price increase.