Key market values for bottled wine in an emerging market: Product attributes or business strategy?

Rodrigo Romo-Muñoz
Business Management Department, Universidad del Bío-Bío, Avenida Andrés Bello 720, Casilla 447, CP: 3800708, Chillán, Chile. Email: rromo@ubiobio.cl

Rodrigo Monje-Sanhueza
Universidad del Bío-Bío, Avenida Andrés Bello 720, Casilla 447, CP: 3800708, Chillán, Chile. Email: rodmonje@gmail.com

Héctor Garrido-Henríquez
Universidad del Bío-Bío, Avenida Andrés Bello 720, Casilla 447, CP: 3800708, Chillán, Chile. Email: hgarrido@ubiobio.cl

José M Gil
Center for Agro-food Economy and Development (CREDA-UPC-IRTA), Parc Mediterrani de la Tecnologia, Edifici ESAB, Castelldefels, Barcelona, Spain. Email: chema.gil@upc.edu
Abstract
This article focuses on the emerging bottled Chilean red wine market and studies the main determinants of the consumer price of wine sold on the domestic market. A hedonic price function was estimated for a sample of 810 wines using a quantile regression (QR) model. The database contains three variables groups to explain price: objective variables (national, international, and vine quality designations), subjective variables (wine score), and business strategies used by wine producers. Results show that some objective variables have a greater impact on price than the wine score (a subjective variable) and business strategies, which vary for each quartile of prices analyzed. Finally, this information will allow companies to design and implement marketing strategies to inform the consumer about the importance of some variables in the price of their product.

Keywords: Red wine, Chile, Business strategy, Hedonic price, Quantile regression
1. INTRODUCTION

The average annual world wine production between 2012 and 2016 was 272 million hectoliters (MMhl). Europe leads market participation for both production and consumption, with 65% and 58%, respectively (International Organisation of Vine and Wine, OIV, 2017). Traditional or “Old World” European countries (Estrella et al., 2012) that lead production are Italy (19%), France (16%), and Spain (15%). As regards world consumption (241 MMhl), France is ranked first with 11%, followed by Italy (9%) and Germany (8%).

In recent years, “non-traditional” or emerging countries have become relevant for both production and consumption. This group of countries includes the United States, which leads production with a 9% market share, followed by Australia (5%) and China (4%). As regards consumption, the market share of the United States is 13%, followed by China (7%) and the United Kingdom (5%) (OIV, 2017).

Chile has positioned itself as a relevant emerging market in the last few years because of its exceptional natural conditions for wine production, such as the stability of the political and economic environment (Giuliani & Bell, 2005; Visser & De Langen, 2006; Felzensztein & Deans, 2013). This market represents 3% of the worldwide wine-growing area, 4% of wine production, and 1% of world consumption. It ranks as the fourth largest exporter (8%) (OIV, 2017) and has the sixth highest per capita consumption rate with 14 liters annually.

The evolution of the wine sector in Chile has undergone two major stages, which have influenced its development. The first stage, in the 1970s and ’80s, was aimed at the internal market, and there was a radical change in the ’90s because of investments in the sector, political changes, and external market opportunities (Troncoso & Aguirre, 2006; Gwynne, 2006). The second stage begins in the ’90s in Chile, in which Chile began being recognized internationally for the quality of its wines even though the sector’s business strategy was
focused on the low-priced wine segment (Giuliani & Rabellotti, 2012). International market competition in these segments prompted companies to implement business strategies to strengthen the internal market while simultaneously continuing to serve the international market (Melo et al., 2005). The Chilean wine market consists of approximately 400 firms, many of which currently use this double business strategy and are highly competitive wine producers that vie for market niches (internal and external) with wines of greatly differing species, quality, and sophistication. This has generated a diverse range of products, with varied price ranges and different objective and subjective attributes to serve a highly segmented market. The successful development of the domestic market sector largely depends on knowledge of the relationship between price and the implicit value of the various product attributes. Wine price plays a determining role in the exchange relationship between economic agents and the quantity demanded.

In this context, the price formation of wine bottled in the Chilean market is not only defined by different product attributes but also by the strategy adopted by the companies. Given the wide range of bottled wines available on the local market, product attributes and business strategies alike have a varying effect on the final price, depending on the analyzed price range. In this type of market, which has a wide heterogeneity of product categories (Costanigro et al., 2009; Rebelo et al., 2019), it is necessary to use a model that allows relating the implicit price to its attributes, and that determines how this varies at different price levels. The quantile regression (QR) model is able to make estimations in this framework (Costanigro & McCluskey, 2011) because it provides detailed information about the attributes for specific price ranges; for this reason, the model is used in the present study.
Therefore, the objective of our study is to analyze the extent to which the objective and subjective attributes of bottled wine and strategies adopted by the companies in this sector determine the price charged to the consumer in the local market.

This article is structured as follows: Section 2 deals with the literature review, and Section 3 includes the material and methods. Section 4 provides the main results and discussion. Finally, the last section presents the conclusions of the study.
2. LITERATURE REVIEW

Most studies worldwide that analyze the relationship between price and the different implicit wine attributes have used a hedonic price methodology because of the perfect competition characteristics of the sector and because it is a product with multiple attributes that significantly influences the final price of the product (Estrella et al., 2012). This analysis originated in an agricultural economy, when Waugh (1928) published a study about the quality factors that influence the price of certain vegetables in Boston’s wholesale market. Since then, the hedonic approach has been used to estimate the implicit price of product attributes (Costanigro et al., 2010). This analysis is based on the premise that, in perfectly competitive markets with heterogeneous products, the market price is the sum of the implicit values of the product attributes (Rosen, 1974).

Wine is the most widely studied agri-food product using this methodology (Di Vita et al., 2015). Research studies can be classified into two groups; the first considers the attributes used in the studies, while the second uses applied econometric models. The studies in the first group are generally undertaken in countries that have a scant tradition in the wine market, such as Israel (Golan & Shalit, 1993), with Oczkowski (1994) analyzing the premium wine market in Australia, and Nerlove (1995) examining the Swedish wine market. These early studies began to define the first attributes that affect the final wine price. Some attributes are objective variables (quality designation, vine, production region, harvest year), subjective variables (color, aroma, bouquet, sweetness, acidity, astringency, mouth-feel, body, typicity, and general evaluation), and chemical variables (sugar content, alcohol content, density, volatile acidity, ethyl acetate, solid extract, and total acidity). Then studies in traditional markets began to appear, based on attributes defined in those earlier studies. Most of the studies developed between 1997 and 2010 were from France, and these mainly
incorporated objective and sensory variables. These studies focused on a price analysis of the domestic market in the most prestigious wine-producing regions such as Burgundy (Combris et al., 2000), Bordeaux (Combris et al., 1997; Landon & Smith, 1998; Cardebat & Figuet, 2004; Hadj & Nauges, 2007), and Alsace, Beaujolais, and Provence (Cardebat & Figuet, 2009). They also analyzed French wine prices in the British and Canadian markets (Steiner, 2004; Carew & Florkowski, 2010).

Between 2009 and 2017, the most complex studies in terms of attributes used in the analyses were conducted primarily in the Italian wine market. The first studies initially used the objective variables applied in earlier works (Benfratello et al., 2009; Boatto et al., 2011; Caracciolo et al., 2013). Other attributes are then incorporated, such as the chemical variables of wine (Brentari et al., 2011, 2015; Levaggi & Brentari, 2014). From 2013 onward, studies have tended to include new attributes found in other links of the wine marketing chain in Italy. These include attributes related to the producer (years in business, number of hectares, whether or not they are cooperatives, type of ownership, and size of the vineyard), company reputation, production process (participation of enologists or agronomists), and climatic variables (temperature and rainfall) (Roma et al., 2013; Cacchiarelli et al., 2016; Caracciolo et al., 2016). However, none of the above-mentioned applied business strategies have been considered to be determining factors of wine prices, which is one of the primary benefits of the present work as discussed in the Introduction.

As regards emerging countries, studies have been regularly conducted from 2001 onward, and publications alternate between the different markets of this group. These studies mainly include some of the objective and subjective variables defined in earlier research, which makes it necessary to conduct studies to deepen the knowledge of the attributes that influence the final wine prices in these markets. There are three groups of analyzed markets.
The first is the Australian wine market, which analyzes the incidence of price on some objective variables (region, variety, harvest year, and producer size and capacity) and subjective variables (vineyard rating, quality score) (Oczkowski, 2001; Schamel & Anderson, 2003; Oczkowski, 2010; Oczkowski, 2016). A second group focuses on analyzing the American and Canadian wine market, using objective variables (region, vine, quality designation, harvest year, quantity produced, and certification) and subjective variables (sensory rating and producer quality) (Schamel, 2006; Rabkin & Beatty, 2007; Costanigro et al., 2007; Costanigro et al., 2009; Kwong et al., 2011; Caudill & Mixon, 2016; Waldrop et al., 2017). Finally, the literature shows a group of studies conducted in Chile, which includes some attributes used in previous research, as well as some newer attributes such as bottle weight and membership in a wine producer association. The latter attribute is used as a proxy variable for the management efforts made by companies to promote the sector (Melo et al., 2005; Troncoso & Aguirre, 2006; González & Melo, 2008; Ortuzar-Gana & Alfranca-Burriel, 2010). The proxy variable is key for understanding price formation in a market because the price of a product is not only determined by its attributes; business strategy is also very important in the formation and determination of the market price as regards supply. This is the first contribution of the present study to the state of the art of hedonic prices of the bottled wine market.

The methodological approaches used are all based on estimating a regression between the price of the product and the studied attributes. Most studies use a functional semi-logarithmic form because it allows the analysis of percentage changes in the presence of changes in the investigated attribute levels (Oczkowski, 1994; Combris et al., 1997; Schamel & Anderson, 2003; Steiner, 2004; Carew & Florkowski, 2010; Levaggi & Brentari, 2014). In some cases, more flexible functional forms have been used, such as the transformed Box-
Cox regression model, which allows the statistical selection of the most suitable functional form (Benfratello et al., 2009; Panzone, 2011). The most frequently used estimation methods are the ordinary least squares (OLS) or generalized least squares (GLS), depending on heteroscedasticity. In some cases, in which the dependent variable is not continuous but categorical, hedonic regression is specified as a multinomial logit model (Angulo et al., 2000; Caracciolo et al., 2013; Cacchiarelli et al., 2016). Finally, non-parametric approaches such as local polynomial regression clustering have been used marginally (Costanigro et al., 2009).

However, it is unlikely that prices are distributed according to a normal distribution because most products are low- to medium-priced, and a significantly smaller proportion is high-priced. It is possible that the impact of the different price attributes differs according to price level, a question that would not be addressed in a traditional regression analysis (Davino et al., 2015). The use of QR (Koenker & Bassett, 1978) has therefore become popular recently in hedonic price studies. The application of QR to the wine sector has been scarce in the literature, with only two applications in Italy as a traditional market (Di Vita et al., 2015; Caracciolo et al., 2016), and two applications in the United States as an emerging market (Rabkin & Beatty, 2007; Costanigro et al., 2010); this is the second contribution of the present study.
3. MATERIAL AND METHODS

To achieve the objectives proposed in the present study, a unique database consisting of 810 bottled red wines available on the Chilean market and provided by the Wine Lovers’ Club (Club de Amantes del Vino, CAV) was used. The CAV has an excellent reputation among wine buyers in Chile, and has become one of the most relevant wine retailers in the local market, combining its own outlets in most important Chilean towns with sales on the Internet. Data from CAV is relevant for this study for three reasons: 1) it has the largest number of wine references among all retailers—clearly larger than in most important supermarkets; 2) wine prices are identical among outlets (and on the Internet), while in most supermarket chains, price discrimination is part of the business strategy (different prices for the same wine in different locations); and 3) the database also provides wine ratings by experts.

The present study focused its analysis only on red wines and did not include white wines. The first of two main reasons to choose red wines is that red and white wines have different sensory characteristics and different price ranges, which excludes analyzing them together (Durham et al., 2004). Secondly, red wines have the largest share of the domestic market, that is, 80%. On this basis, it was relevant to consider the other attributes used in the study. Oczkowski (1994) indicates that any variable that influences consumer decisions or producer costs is a candidate to be included as a variable in the function. In this regard, attribute selection in the present study considered attributes compiled in the literature, as well as the specific attributes reported by Chilean producers on their bottles. This made it possible to include objective attributes such as national quality designation (Melo et al., 2005), international quality designation (Costanigro et al., 2009), vine (Waldrop et al., 2017), and geographic origin (Caudill & Mixon, 2016). Some subjective attributes were also mentioned such as the wine score provided by tasters (Oczkowski, 2016), the age of wine (Cacchiarelli
et al., 2016), and the vineyard’s business strategy. Table 1 summarizes the attributes included in the present study.

(Insert Table 1 around here)

As previously mentioned, one of the main contributions of this study is that it considered the strategies adopted by the wine-producing companies among the explanatory variables of wine prices. The classification of strategic groups proposed by Oliva, Chanqueo, and Carrasco (2005) was used to define four business groups in the Chilean wine sector. The first group is defined as “exclusive emerging” (30.2% of the sample), which is comprised of companies characterized as being relatively new in the sector and identified as “young emerging,” smaller-sized niche companies that have low production capacity and are focused on the medium- to high-priced wine segment. The second group of companies is defined as low- to medium-priced (18.4%). It consists of companies that are characterized by a longer participation in the industry compared with the former group, which has allowed them to be identified in the market; they are medium-sized companies with production and storage capacities close to the industry average and are aimed at mainstream low- and medium-priced wine segments. Companies included in this group follow an “intermediate” strategy because they neither completely focus on exploiting the fine wine segment nor generate a segment diversification strategy. The third group of companies is defined as “grand traditional” (20.5%). They are characterized as being the stakeholders with the longest participation in the sector, are large-sized and have the greatest production and storage capacity in the wine industry, and are focused on market diversification. The companies included in this group follow a strategy that allows them to diversify in different market segments. The fourth group is defined as “other companies” (30.9%), and includes all the other companies not classified in the other three groups.
Once the attributes to be used in the study were defined, the next step was to define the econometric model and its functional form to perform the estimation. For this analysis, a QR was estimated, as well as an OLS model, which was used as a benchmark to compare the results. The estimation of the QR models was based on econometrics from the stochastic formulation of the hedonic equation for the \( w \)th wine estimate defined as:

\[
Q_{p_w}(\tau | X_w) = \alpha(\tau) + X_w \beta(\tau) + \varepsilon(\tau)
\]  

(1)

Equation 1 expresses the quantiles of the conditional distribution of wine prices, \( Q_{p_w}(\tau | X_w) \), as a linear function of the vector \( X_w = \{x^1_w, ..., x^R_w\} \) where \( 0 < \tau < 1 \) represents the index of the respective quantiles.

The \( \tau \)th estimator \( \beta(\tau) \) minimizes the following objective function by the Barrodale and Roberts (1973) algorithm.

\[
\sum_w |p_w - \alpha(\tau) + X_w \beta(\tau)| h_w
\]

(2)

where \( h_w \) is a factor defined as:

\[
h_w = \begin{cases} 
2\tau & \text{si } (p_w - \alpha(\tau) + X_w \beta(\tau)) > 0 \\
2(1 - \tau) & \text{other case}
\end{cases}
\]

(3)

The functional form defined to estimate the model is the semilogarithmic form. It is appropriate when the distribution of the dependent variable is heterogeneous and there is a wide price distribution (Caracciolo et al., 2016). Moreover, this functional form allows the interpretation of coefficients such as the percentage change in price for a specific attribute (Rabkin & Beatty, 2007).
4. RESULTS AND DISCUSSION

As a step prior to model estimation, a graphic analysis of the database used in the study was performed; it included the frequency distribution of the Chilean wine prices in the sample (Figure 1). A significant portion of the distribution was concentrated in low-priced wines. The average price (in Chilean pesos) was $14,911, the median was $8,545, and the maximum price was $160,000.

Table 2 displays the estimated results obtained by the QR model. Likewise, model estimations by OLS were included as benchmarks. The estimation interpretation must consider the coefficient sign, the magnitude, and the significance for each model of one of the QR model quartiles. As regards quality, positive and significant values were obtained for all the designations in the OLS estimation. The magnitude of the coefficients in this model increased as it passed from one quality designation category to another, ranging from the “Grand Reserve” designation, with a coefficient of 0.466 to the “Icon” category, with a coefficient of 1.899.

The QR model estimation obtained results similar to those of the OLS estimation; however, there were some differences in the coefficient magnitude of each model, depending on the analyzed quartile. When the wines were in higher price ranges, the differential impact of the first two quality designations (Grand Reserve and Premium) decreased. Quartile 1 (low-priced wines) obtained the highest coefficient values, which decreased from one quartile to the other (as wine price increased). For the Super Premium and Icon designations, there was a positive relationship between quality designation and price in the different quartiles. The lowest coefficient values were for quartile 1 (low-priced wines), which increased from one quartile to the other (as wine price increased). This positive and
significant relationship in the quality designations was also obtained in studies conducted in France (Combris et al., 1997; Combris et al., 2000), the United States and Canada (Costanigro et al., 2009; Kwong et al., 2011; Caudill & Mixon, 2016; Waldrop et al., 2017) Czech Republic (Zelený, 2017), and a study in Chile (Melo et al., 2005).

The different vines included in the present study were not significant, in either the OLS or the QR estimation; this suggests that none of the vines has a significant impact on the final price of bottled wine. The wine–price relationship shows different results in the studies available in the literature. Thus, in traditional countries, only the Cabernet Sauvignon vine is significant in Italy (Roma et al., 2013; Levaggi & Brentari, 2014). In emerging countries, the Cabernet Sauvignon and Merlot vines are significant and positive in most studies conducted in the United States (Costanigro et al., 2009; Kwong et al., 2011; Caudill & Mixon, 2016).

In Chile, the Merlot, Carménère, and Assemblages are the positive and significant vines (Troncoso & Aguirre, 2006), and the Cabernet Sauvignon and Merlot vines are negative and significant (Ortuzar-Gana & Alfranca-Burriel, 2010).

(Insert Table 2 around here)

When analyzing the two most important wine-producing valleys in the country, that is, Valle del Maipo and Valle de Colchagua, only the Valle de Colchagua is significant. For both the OLS and QR models, the valley has a negative impact on final consumer price. This suggests that wines from these two valleys do not generate a large difference in the price of the final product. In almost all studies, whether in traditional or emerging countries, the designation of origin associated with the production valleys or territories was positive and significant; this suggests the importance of this variable to explain wine price (Di Vita et al., 2019). As regards a study conducted in Chile in the Valle del Colchagua, it was positive and significant (Troncoso & Aguirre, 2006).
There was a convex relationship between price and score, which indicates that the importance of score decreases up to the point at which price starts to increase. As regards the OLS estimation, the threshold was 85.6 points, while for the QR estimations it was 92.4, 88.5, and 84.5 points for quartiles 1, 2, and 3, respectively; this shows quite a significant relationship between the score variable and wine price. Only two of the analyzed studies have a negative and significant score (Landon & Smith, 1998; Brentari et al., 2011), while all other studies, including those conducted in Chile, are positive. For the incorporation of the squared score, this is recently reported in only one study with a positive and significant impact on the United States market (Waldrop et al., 2017) and one study in Norway (Thrane, 2019). The age variable was only relevant in the case of high-priced wines, and the relationship was concave. That is, a positive relationship first existed between both variables, but past the age threshold (9.4 years), the wine price started to decrease. The influence of age in other studies is similar to that observed for score, that is, it is negative in only two studies (Carew & Florkowski, 2010; Oczkowski, 2016). The incorporation of age squared is recently reported in only one study of the United States market (Waldrop et al., 2017), in which it is positive and significant.

One aspect to highlight is the heterogeneous impact of business strategies on wine price. In the OLS model estimation, only companies classified as “grand traditional” had a significant and negative effect on the final price of wine. The QR estimation indicated that the effect of each business strategy on wine price was related to determined quartiles. In this way, the “exclusive emerging” strategy showed a differential positive and significant effect for wine prices located in the second quartile (medium-priced wines). For the “low- to medium-priced” strategy, there was a positive and significant impact on wine prices located in the first quartile (low-priced wines). The “grand traditional” strategy had a negative and
significant effect on the final price of wine for both the first and third quartiles (low- and high-priced wines, respectively). These first results provide evidence that suggests that, in emerging markets such as the Chilean market, objective variables have the greatest impact on the final consumer price over other variables under consideration.

To obtain the differential impact on price of a variation of those categorical attributes on price, the approach proposed by Halvorsen and Palmquist (1980) was used with the following identity:

\[
100 \times e^{[\hat{\beta}_j - 0.5\text{var}(\hat{\beta}_j)]} - 1
\]

(4)

Table 3 shows the effect on price of a variation of some of the previously defined categorical attributes. The greatest impact on wine price when going from a Reserve wine to Grand Reserve was in quartile 1, which implies a price increase of approximately 68%; this is replicated in the case of going from a Grand Reserve to Premium (145%), Super Premium (224%), and Icon (599%). Wine produced in the Valle del Maipo has a limited effect on price, whereas wine produced in the Valle de Colchagua has a negative effect, albeit a small one. Once again, the impact of objective variables on the final price was greater than the impact of other variables, such as valleys or business strategies.

(Insert Table 3 around here)

Figure 2 shows the behavior of the coefficients over the entire price distribution. The differential impact of the Grand Reserve quality designation loses influence on price to the extent that the consumer finds wines that are more expensive. A similar phenomenon occurred with Premium category wines, although the relationship was inverted for wines in the higher price range. The quality designation with the highest valuation as wine becomes more expensive is the Icon category. Furthermore, all the quality designations are significant
for all the analyzed price distributions. On the other hand, for wines in the low- to medium-priced category, a higher valuation in the lower price range was observed, but the significance of impact decreases as price increases. A similar phenomenon occurred in the case of “exclusive emerging,” although for intermediate-priced wines. Score also had the most important growth rate as wine became more expensive, which indicates that the valuation of this attribute is more relevant. Regarding age, the attribute valuation was predominantly linear to the extent that price increased, which indicates that a higher age is synonymous with a higher price.

(Insert Figure 2 around here)
5. CONCLUSIONS

The objective of this study was to analyze to what extent the objective and subjective attributes and strategies adopted by bottled wine companies determine the final consumer price in the local market. The present study contributes to the existing literature from three viewpoints: 1) the incorporation of business strategies to determine prices in the winemaking sector, 2) the limited QR applications to estimate the implicit prices of wine attributes, and 3) the lack of empirical work on this topic in Chile. The methodological approach was based on the estimation of a hedonic price model using data provided by a prestigious wine retailer in Chile. Given that price dispersion was high, a quartile regression was estimated because price drivers can differ depending on the quartile under consideration.

The results indicate that there are certain differences when comparing results from previous studies in traditional markets with those in emerging markets such as the Chilean market. The main reason is that the degree of consumer knowledge about product attributes is still limited in emerging markets. Objective attributes, such national and international quality designations, have a greater impact on the final price. Some attributes that are relevant in traditional markets, such as the designation of origin or production valleys, have a null or negative impact on the Chilean market. This result is consistent with Chile being an emerging market. Promotion campaigns have been based on the country of origin to position Chilean wines in the domestic market. As the market is becoming more mature, public policies and private investments will start to differentiate wines based on regions or valleys, especially in the segment of premium wines. Some consumer studies have shown that this trend is becoming increasingly important.

As regards business strategies—one of the main contributions of the present study—these explain the formation of wine price, but their importance varies depending on the type
of strategy used by the companies and the analyzed price level. At this point, the vineyards can generate marketing strategies that strengthen the reputation of the brand, especially in younger vines, to compete in high price segments.

The model has proven to be appropriate, with good performance, for analyzing the incidence of many different attributes in different price levels. Therefore, when comparing the results obtained with the ordinary least squares (OLS) model, it can be observed that, with the quantile regression (QR) estimation, the magnitude of the coefficients changes for different price levels, with some coefficients being significant even though the OLS model does not report them.

The obtained information can be relevant for companies of the sector to conduct marketing campaigns that reveal some important attributes such as vine and, above all, the designation of the grape’s origin or the valleys in which they are located, which has had a negative impact on price. Other variables such as environmental certifications, sensory scores, and some climatic variables can be included in future studies.

To remove the limitations in this work, future studies should consider some taking the following approaches: 1) increase wine sample size, especially in the high-priced wine segment; 2) analyze white and sparkling wine together, to determine if the results can be generalized to the entire wine market; and 3) include other attributes in the study, such as label color and design or organic attributes of the product. This would offer a more global view of the different attributes affecting the final price of wine.
REFERENCES

Angulo, A.M., Gil, J.M., Gracia, A., and Sánchez, M. (2000). Hedonic prices for Spanish red quality wine. *British Food Journal, 102*, 481–493.

Barrodale, I., and Roberts, F. D. (1973). An improved algorithm for discrete l_1 linear approximation. *SIAM Journal on Numerical Analysis, 10*, 839–848.

Benfratello, L., Piacenza, M., and Sacchetto, S. (2009). Taste or reputation: What drives market prices in the wine industry? Estimation of a hedonic model for Italian premium wines. *Applied Economics, 41*, 2197–2209.

Boatto, V., Defrancesco, E., and Trestini, S. (2011). The price premium for wine quality signals: Does retailers’ information provision matter? *British Food Journal, 113*, 669–679.

Brentari, E., Levaggi, R., and Zuccolotto, P. (2011). Pricing strategies for Italian red wine. *Food Quality and Preference, 22*, 725–732.

Brentari, E., Levaggi, R., and Zuccolotto, P. (2015). A hedonic price analysis for the Italian wine in the domestic market. *Quality and Quantity, 49*, 999–1012.

Box, G. E. P., and Cox, D. R. (1964). An analysis of transformations. *Journal of the Royal Statistical Society. Series B (Methodological), 26*, 211–252.

Cacchiarelli, L., Carbone, A., Esti, M., Laureti, T., and Sorrentino, A. (2016). Assessing Italian wine quality and prices: De gustibus non disputandum est. *British Food Journal, 118*, 1006–1024.

Caracciolo, F., Cembalo, L., and Pomarici, E. (2013). The hedonic price for an Italian grape variety. *Italian Journal of Food Science, 25*, 289–294.

Caracciolo, F., D’Amico, M., Di Vita, G., Pomarici, E., Dal Bianco, A., and Cembalo, L. (2016). Private vs. collective wine reputation. *International Food and Agribusiness Management Review, 19*, 191–210.

Cardebat, J.M., and Figuet, J.M. (2004). What explains Bordeaux wine prices? *Applied Economics Letters, 11*, 293–296.

Cardebat, J.M., and Figuet, J.M. (2009). Estimation of a hedonic price equation for Alsace, Beaujolais and Provence wines. *Applied Economics Letters, 16*, 921–927.
Carew, R., and Florkowski, W. J. (2010). The importance of geographic wine appellations: Hedonic pricing of Burgundy wines in the British Columbia wine market. *Canadian Journal of Agricultural Economics, 58*, 93–108.

Caudill, S. B., and Mixon, F. G. (2016). Estimating class-specific parametric models using finite mixtures: An application to a hedonic model of wine prices. *Journal of Applied Statistics, 43*, 1253–1261.

Combris, P., Lecocq, S., and Visser, M. (1997). Estimation of a hedonic price equation for Bordeaux wine: Does quality matter? *The Economic Journal, 107*, 390–402.

Combris, P., Lecocq, S., and Visser, M. (2000). Estimation of a hedonic price equation for Bordeaux wine. *Applied Economics, 32*, 961–967.

Costanigro, M., and McCluskey, J. (2011). Hedonic price analysis in food markets. In *The Oxford Handbook of the economics of food consumption and policy*, edited by J. Lusk, J. Roosen, and J. Shogren. Oxford University Press, Oxford.

Costanigro, M., McCluskey, J., and Goemans, C. (2010). The economics of nested names: Name specificity, reputations and price premia. *American Journal of Agricultural Economics, 92*, 1339–1350.

Costanigro, M., McCluskey, J., and Mittelhammer, R. (2007). Segmenting the wine market based on price: Hedonic regression when different prices mean different products. *Journal of Agricultural Economics, 58*, 454–466.

Costanigro, M., Mittelhammer, R., and McCluskey, J. (2009). Estimating class-specific parametric models under class uncertainty: Local polynomial regression clustering in a hedonic analysis of wine markets. *Journal of Applied Econometrics, 24*, 1117–1135.

Davino, C., Romano, R., and Naes, T. (2015). The use of quantile regression in consumer studies. *Food Quality and Preference, 40*, 230–239.

Di Vita, G., Caracciolo, F., Cembalo, L., Pomarici, E., and D’Amico, M. (2015). Drinking wine at home: Hedonic analysis of Sicilian wines using quantile regression. *American Journal of Applied Sciences, 12*, 679–688.

Di Vita, G., Pappalardo, G., Chinnici, G., La Via, G., and D’Amico, M. (2019). Not everything has been still explored: Further thoughts on additional price for the organic wine. *Journal of Cleaner Production, 231*, 520-528.
Durham, C., Pardoe, I., and Vega-H, E. (2004). A methodology for evaluating how product characteristics impact choice in retail settings with many zero observations: An application on restaurant wine purchase. *Journal of Agricultural and Resource Economics, 29*, 112–131.

Estrella, M. J., Defrancesco, E., and Gennari, A. (2012). The wine hedonic price models in the “Old and New World”: State of the art. *Fca Uncuyo, 44*, 205–220.

Felzenszttein, C., and Deans, K. (2013). Marketing practices in wine clusters: Insights from Chile. *Journal of Business & Industrial Marketing, 28*, 357–367.

Giuliani, E., and Bell, M. (2005). The micro-determinants of meso-level learning and innovation: Evidence from a Chilean wine cluster. *Research Policy, 34*, 47–48.

Giuliani, E., and Rabellotti, R. (2012). Universities in emerging economies: Bridging local industry with international science—Evidence from Chile and South Africa. *Cambridge Journal of Economics, 36*, 679–702.

Golan, A., and Shalit, H. (1993). Wine quality differentials in hedonic grape pricing. *Journal of Agricultural Economics, 44*, 311–321.

González, J., and Melo, O. (2008). Uso de modelos hedónicos y de búsqueda para el análisis de precios de vinos en supermercados. *Revista Economía Agraria, 12*, 1–14.

Gwynne, R. (2006). Export-orientation and enterprise development: a comparison of New Zealand and Chilean wine production. *Tijdschrift voor Economische en Sociale Geografie, 97*, 138–156.

Hadj, H., and Nauges, C. (2007). The pricing of experience goods: The example of EN PRIMEUR wine. *American Journal of Agricultural Economics, 89*, 91–103.

Halvorsen, R., and Palmquist, R. (1980). The interpretation of dummy variables in semilogarithmic equations. *American Economic Review, 70*, 474–475.

International Organisation of Vine and Wine, OIV. (2017). *World vitiviniculture situation*. Recuperado de https://www.oiv.int/public/medias/5479/oiv-en-bilan-2017.pdf

Koenker, R., and Bassett, G. (1978). Regression quantiles. *Econometrica, 46*, 33–50.

Koenker, R., and Hallock, K. (2001). Quantile regression. *Journal of Economic Perspectives, 15*, 143–156.

Kwong, L. M. K., Cyr, D., Kushner, J., and Ogwang, T. (2011). A semiparametric hedonic pricing model of Ontario wines. *Canadian Journal of Agricultural Economics, 59*, 361–381.
Landon, S., and Smith, C. (1998). Quality expectations, reputation, and price. *Southern Economic Journal, 64*, 628–647.

Levaggi, R., and Brentari, E. (2014). The hedonic price for Italian red wine: Do chemical and sensory characteristics matter? *Agribusiness, 30*, 385–397.

Melo, O., Buzeta, J., and Marshall, M. (2005). Determinantes del precio del vino en el mercado chileno: Un estudio de precios hedónicos. *Asociación de Economistas Agrarios de Chile, 9*, 58–74.

Nerlove, M. (1995). Hedonic price functions and the measurement of preferences: The case of Swedish wine consumers. *European Economic Review, 39*, 1697–1716.

Oczkowski, E. (1994). A hedonic price function for Australian premium table wine. *Australian Journal of Agricultural Economics, 38*, 93–110.

Oczkowski, E. (2001). Hedonic wine price functions and measurement error. *The Economic Record, 77*, 374–382.

Oczkowski, E. (2010). Hedonic wine price predictions and nonnormal errors. *Agribusiness, 26*, 519–535.

Oczkowski, E. (2016). Hedonic wine price functions with different prices. *Australian Journal of Agricultural and Resource Economics, 60*, 196–211.

Oliva, I., Chanqueo, F., and Carrasco, R. (2005). Grupos estratégicos en la industria vitivinícola chilena. *Revista de Economía & Administración, 149*, 21-26.

Ortuzar-Gana, J. C., and Alfranca-Burriel, O. (2010). Current and regular prices hedonic models for the wine industry. *Spanish Journal of Agricultural Research, 8*, 873–886.

Panzone, L. A. (2011). The lost scent of Eastern European wines in Western Europe. *British Food Journal, 113*, 1060–1078.

R Core Team (2016). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rabkin, D., and Beatty, T. (2007). Does VQA certification matter? A hedonic analysis. *Canadian Public Policy, 33*, 299–314.
Rebelo, J., Lourenço-Gomes, L., Gonçalves, T., and Caldas, J. (2019). A hedonic price analysis for the Portuguese wine market: Does the distribution channel matter? *Journal of Applied Economics, 22*(1), 40-59.

Roma, P., Di Martino, G., and Perrone, G. (2013). What to show on the wine labels: A hedonic analysis of price drivers of Sicilian wines. *Applied Economics, 45*, 2765–2778.

Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy, 82*, 34–55.

Rossetto, L., and Galletto, L. (2019). Retail strategies for rosé wines in Italy: A hedonic price analysis. *International Journal of Wine Business Research, 31*(3), 282-302.

Schamel, G. (2006). Geography versus brands in a global wine market. *Agribusiness, 22*, 363–374.

Schamel, G., and Anderson, K. (2003). Wine quality and varietal, regional, and winery reputations: Hedonic prices for Australia and New Zealand. *The Economic Record, 79*, 357–369.

Steiner, B. (2004). French wines on the decline? Econometric evidence from Britain. *Journal of Agricultural Economics, 55*, 267–288.

Thrane, C. (2019). Expert reviews, peer recommendations and buying red wine: Experimental evidence. *Journal of Wine Research, 30*(2), 166-177.

Troncoso, J. L., and Aguirre, M. (2006). Short communication. Price determinants of Chilean wines in the US market: A hedonic approach. *Spanish Journal of Agricultural Research, 4*, 124–129.

Visser, E., and De Langen, P. (2006). The importance and quality of governance in the Chilean wine industry. *GeoJournal, 65*, 177-197.

Waldrop, M., McCluskey, J., and Mittelhammer, R. (2017). Products with multiple certifications: Insights from the US wine market. *European Review of Agricultural Economics, 44*, 658–682.

Waugh, F. (1928). Quality factors influencing vegetables prices. *Journal of Farm Economics, 10*, 185–196.

Zelený, J. (2017). A relationship between price and quality rating of wines from the Czech Republic. *Journal of International Food & Agribusiness Marketing, 29*(2), 109–119.