

**The hedonic price model for the wine market:
A systematic and comparative review of the literature**

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Abstract:

This paper carries out a thorough review of the literature on the estimation of hedonic price functions for the wine market, compiling and carefully documenting all research work on the subject. The review analyses the main methodological decisions taken by the different authors, as well as the typology of the available databases: identification of the relevant market, specification of the price function, sources and types of prices, econometric methodology and type of publication. All of these are shown to have important implications for the results obtained, which are also analysed in detail.

Keywords: hedonic price model, wine prices, market definition, wine attributes.

JEL codes: D46, L70, Q11

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1. INTRODUCTION

One of the most interesting issues in the wine market has been the analysis of price formation in the sector (Golan and Shalit, 1993; Oczkowski, 1994 and Nerlove, 1995). This literature has faced recurrent problems arising from the use of Rosen's (1974) model as a theoretical reference. This model does neither establish the functional form nor the concrete specification of the model to be estimated. In addition, there are some other problems such as the lack of procedures to identify, segment or delimitate markets as well as a variety of econometric issues.

Consequently, none of the review papers on this precise topic offer clear conclusions to guide future research. Precisely, this is the main purpose of this paper through a remarkable effort of bibliographic compilation and summary, to identify the reasons and the implications of the implementation of certain methodological decisions.

To this end, the following section briefly reviews the main aspects of the hedonic price model. The third section then describes the procedure carried out to search for the bibliographical references that have served as the basis for this research. The fourth section analyses the different methodological options and data typologies, as well as the implications they entail. The paper ends with some conclusions and considerations on the carried out review.

2. THE HEDONIC PRICE MODEL

As is often the case in other fields of economics, empirical results precede theoretical models and they are the latter that again drive applications. Hedonic price theory has followed this same sequence. As Goodman (1998) points out, the pioneer in this type of analysis was Court (1939) when he constructed a price index for automobiles¹. His proposal was popularised and extended by Stone

¹ However, there are some earlier works that already proposed this type of analysis in more rudimentary terms, e.g. Taylor (1916) investigating price differences associated with different qualities of cotton, Haas (1922) fitting price-location functions for land, and Waugh (1928) estimating price-characteristic functions for asparagus.

(1956) and, especially, by Griliches (1961 and 1971) who applied it to the analysis of prices in multiple markets.

At the same time, there is a succession of theoretical contributions that develop a model of consumer behaviour that derives utility from the characteristics of goods. The first contributions in this sense are due to Court (1941) who could be considered the precursor, together with Houthakker (1952), of a new consumer theory (Becker, 1965; Lancaster, 1966 and Muth, 1966).

Based on these approaches, and focusing on price formation, Rosen (1974) completes these previous contributions by analysing the equilibrium between the decisions of consumers and producers. Specifically, the market equilibrium condition in his model is that the marginal utility obtained by a consumer from the quantity of each of the attributes of which it is composed, is equal to the marginal cost borne by the producer of the variety of that good. The possibility of decomposing the utility function in terms of the characteristics of the good, allows identification of the implicit marginal price of each characteristic by differentiating the price function with respect to each characteristic. However, applications of hedonic price models have been dominated by the demand-side approach and are therefore considered by some authors to be inconsistent with Rosen's theoretical framework (Outreville and Le Fur, 2020). Precisely, in the context of the wine market, Oczkowski (2022) has recently implemented a two-stage method to include the supply side.

Rosen's (1974) model is based on several theoretical assumptions. One of the basic assumptions is the perfect identification of the relevant market. Likewise, the attributes or at least their implicit marginal prices should be independent. Furthermore, the market must operate in perfect competition and in equilibrium, at least in the long run. This implies the existence of perfect and symmetric information between consumers and producers, something that, as Miller et al. (2007) point out, does not occur in many markets, including the wine market, although it can be partially controlled in the specification of the hedonic function and, in some cases, nonfulfillment of this information requirement does not necessarily invalidate the obtained results.

Moreover, Rosen's (1974) model does not provide a final specification of the hedonic function to be estimated (neither in the choice of the functional form nor in terms of the selection of relevant attributes). To these issues Unwin (1999) adds others of econometric nature, such as the problems of multicollinearity between attributes, endogeneity and that related to the representativeness and quality of the information used.

Despite the above, hedonic price functions have been extensively applied for the analysis of many markets², with a significant increase in recent years. The most widely analysed one corresponds to the real estate market, incorporating characteristics of the properties and their corresponding environment (Chin and Chau, 2003 and Jayantha and Oladinrin, 2020).

However, its first uses focused on the valuation of food products (Costanigro and McCluskey, 2011). In addition to wine, it has also been used for other alcoholic and non-alcoholic beverages such as cider (Le Fur and Otreville, 2021), beer (Lukasz and Czupryna, 2021), whisky (Moroz and Pecchioli, 2021) or bottled water (He et al., 2008).

Therefore, this model is very versatile due to its ability to adapt to many markets, and provides a good and robust empirical basis. From its wide use many variants have been derived that help to overcome some of its weaknesses.

3. SAMPLE OF ANALISED RESEARCH

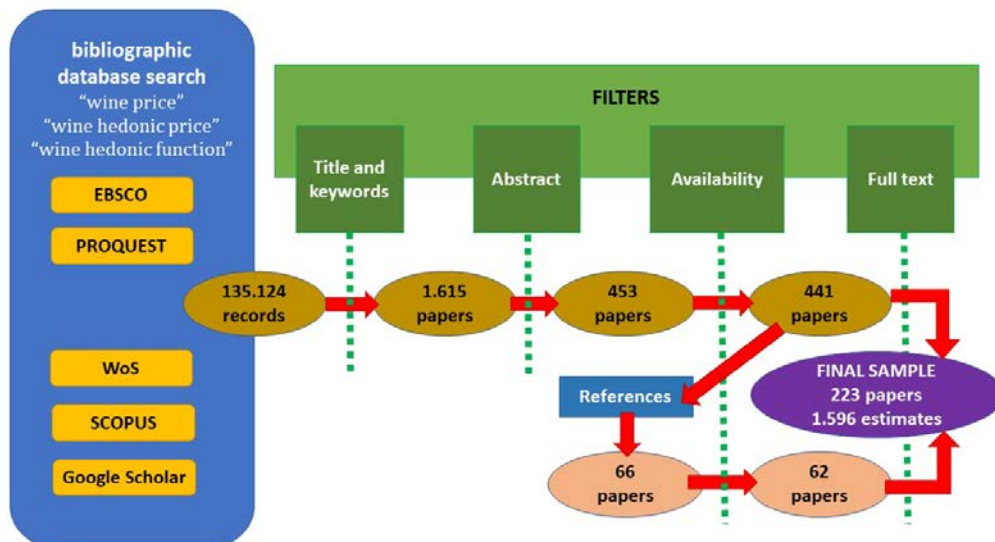
The review begins with a literature search aimed at obtaining the whole population of papers that incorporate the estimation of at least one hedonic price function in the wine market. We used the ESBCO platform (Academic Search Complete, Business Source Complete, eBook collection, Food Science & Technology Abstracts and Econlit), ProQuest (ABI/INFORM, Agricultural Science Database, Social Science Database, among others), Web of Science, Scopus and Google Scholar, although in this latter case we did not follow such a strict process as in the remaining ones. In all of them, searches were carried out for the words: "wine price", "wine hedonic price" and "wine hedonic function". The

² See Núñez (2022) for a complete list of the analysed markets and their respective references.

last search was completed on 30 May 2021.

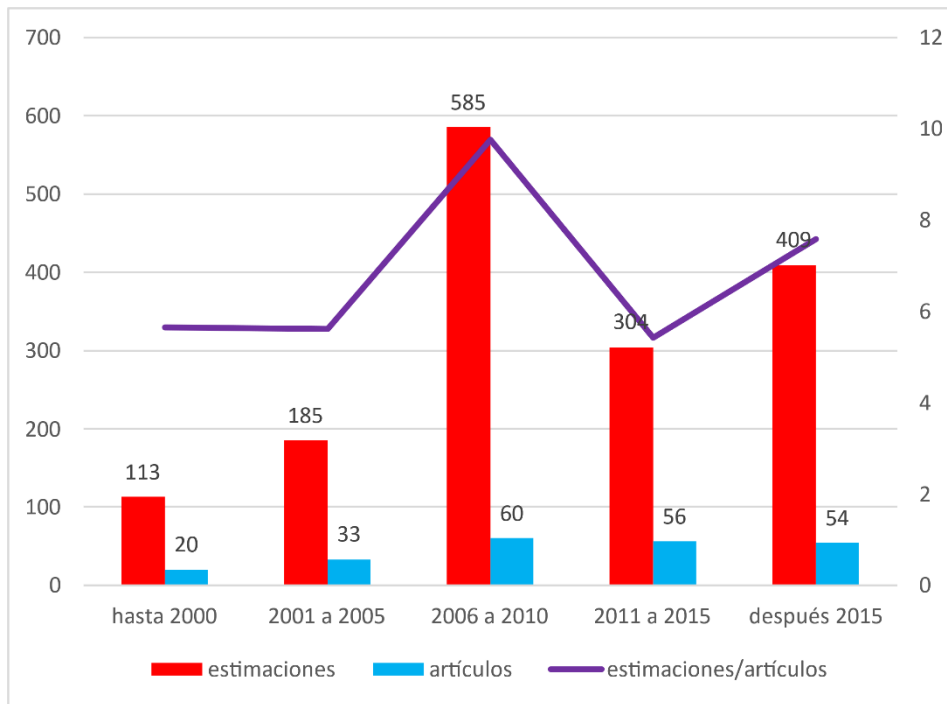
This process yields 135,124 records including duplicates. This set of information is subsequently filtered from the title, the keywords and the abstract reading, obtaining 453 papers. After being read, analysed, and their citations evaluated for the inclusion of hedonic price functions, we obtain a final sample of 223 different articles containing 1,596 estimations of hedonic price functions referring to the wine market. These analysed papers can be considered to constitute the population of papers on the subject (refer to Figure 1 for the summary of the search process and sample formation and Table A.1 in the Appendix for the list of papers and some of their characteristics).

Figure 1. Search process and sample creation of analysed articles



When the number of papers and estimations is organised in time periods, a growth in the number of this type of studies is observed (*cf.* Figure 2). The maximum level is attained in the five-year period from 2006 to 2010. From that point onwards, a more stable pattern is observed at around 11 publications per year.

Figure 2. Number of papers and estimations of hedonic price functions in the wine market by five-year publication periods



Estimations, papers, estimations/papers

An important issue with respect to this type of analysis is the concentration of papers by authors³. In this regard, it can be seen that the nine authors who have participated in at least five papers account for only 62 of them (28% of the total). The concentration is greater in the case of specific estimations, as the nine authors with the highest number of estimations account for 53% of the total. In addition, there are 285 different authors. It is therefore a very diverse literature, both from the perspective of the authorship of research and the markets analysed. The authors who stand out quantitatively are Schamel, with 13 papers, and Oczkowski, one of the precursors, with 11. At some distance there are three authors with six papers, four with five, 10 with four, 27 with three, 62 with two and 177 authors participating with a single paper.

4. ESTIMATION OF HEDONIC PRICE FUNCTIONS IN THE WINE MARKET

This section reviews the available literature estimating hedonic price functions in the wine market, carefully analysing the methodological choices, the data

³ Refer to Table A.2 in the Annex for the list of main authors.

characteristics and the problems encountered in the estimations as well as the provided solutions and the implications where appropriate.

4.1. RELEVANT MARKETS

The assumptions of homogeneity in attribute markets and perfect competition, central to the theory of hedonic prices, require the correct identification and definition of markets in their two most conventional perspectives: geographical (origin of wines and sales markets) and product.

Geographical definition

The consideration of the origin or place of production of the wine is mainly related to the homogeneity in the attributes considered to define the varieties of the good, as geographically close producers use similar grape varieties and production techniques. Wines from the same region are more substitutable for each other. The relevant attributes may even differ between different regions, as in the case of wines from the Old and the New World: the former are usually distinguished by their origin, while the latter are differentiated by the grape varieties used in their production. However, the intensification of globalisation has generated a certain convergence in the patterns and considered valuable attributes from both origins.

On the other hand, the delimitation of the wine sales market is directly related to competition aspects. Thus, there are physical, legal and administrative barriers that hinder the creation of transactional markets (such as a European market): transport costs, different public health regulations, taxation, the existence of stable monopolies for the distribution of alcohol (Sweden and Norway), as well as different cultural and religious habits that determine specific tastes and preferences. A separate case is that of wines sold at auctions, whose market is financially focused and its scope largely depends on the scope of the auction house, which is usually oriented towards the global market (Masset et al., 2016).

In any case, the literature has adopted two potential solutions to consider the geographical aspect of markets. The first has been to segment markets either according to origin, destination (i.e. market of sale), or both. The second has been

to introduce indicator variables that identify any or both of these geographical aspects, most often the origin of the wines.

Table 1.1 shows that hedonic price estimation papers using countries (43% of papers and 46% of estimations) and specific regions (39% and 36%, papers and estimations, respectively) as the geographical dimension to identify the market origin are predominant. Fewer papers incorporate wines from several countries (17% and 13%) or regions (8% and 5%). In addition, there is a high proportion of papers using national markets (74% of articles and 56% of estimations) and only a minority considering geographical units within a country (15% and 11%), mainly regions. Few papers analyse several countries in the same price function (5% and 2%) and, finally, 23 papers (10% and 31%) focus on price formation in auctions⁴.

In this context, in many of the early studies there was a coincidence between the origin of the wine and the market where it was sold, as in Oczkowski's (1994) paper on Australian wines. This trend has been widely repeated in the literature. However, in other papers there is a dissociation between both geographic areas. For example, Galati et al. (2017) studied the sale of Italian wines in Russia, while Griffin (2009) focused on Champagne wines in the American market. Some other authors have analysed wines from multiple origins in a unique market, such as Panzone's (2011) examination of wines from various Eastern European countries in the British market or Schamel's (2006) analysis of New World wines in the US market. Research that investigates wines from a single origin in multiple markets is less common. This is the case of Defrancesco et al. (2012), they consider Argentine wines in four different Western markets.

⁴ Table A.3 in the Annex lists most widely used origins and markets.

Table 1. Market definitions in hedonic price functions in the wine market. Number of estimations, the number of articles in parentheses

1.1. Geographical markets

| | | Markets for wine sales | | | | | |
|----------------|-------------------|------------------------|-------------------|------------------|-----------------|----------|-------------|
| | | Export | Several countries | A unique country | A unique region | Auction | Total |
| Origin of wine | World | - | - | 24 (4) | - | - | 24 (4) |
| | Several countries | 6 (1) | - | 169 (31) | 16 (3) | - | 191 (34) |
| | A unique country | 6 (1) | 3 (3) | 406 (83) | 24 (9) | 288 (3) | 727 (95) |
| | Several regions | - | 7 (1) | 72 (16) | - | - | 79 (17) |
| | A unique region | 4 (3) | 10 (3) | 219 (43) | 128 (23) | 214 (20) | 575 (87) |
| | Total | 16 (4) | 20 (7) | 890 (166) | 168 (34) | 502 (23) | 1.596 (223) |

1.2. Products

| | |
|------------------------------|----------|
| By grape variety | 152 (25) |
| By type of wine | 324 (76) |
| Red | 221 (62) |
| White | 78 (32) |
| Sparkling | 25 (12) |
| By price classes | 141 (22) |
| By reputation classes | 198 (7) |
| Organic and ecological wines | 15 (4) |
| Other classes | 29 (10) |

Product spectrum definition

Delimitation from the product perspective is more complex. Seemingly different products (such as red and sparkling wines) can, in practice, achieve a high degree of substitutability through prevailing pairing or consumption practices.

Similarly, wines that involve different production techniques (e.g. red and white wines) become similar with the emergence of new product variations (e.g. aging in white wines). Therefore, different authors have approached this issue in two distinct ways. The first is to assume that all wines constitute a single market, considering the type of wine as an additional attribute due to a certain degree of substitutability among them. On the other hand, other authors propose running separate estimations as these are products with very low degrees of substitutability.

In this way, three types of market segmentation are found: by type of wine (red, white, sparkling, etc.); by grape variety (e.g. Cabernet Sauvignon, Pinot Noir, Merlot, etc.); and by reputation elements (price, critics' ratings, premium wines). These market segmentations, especially the first two, generate different preferences among consumers based on their organoleptic characteristics and affects their willingness to pay for the rest of the attributes (Carew and Florkowski, 2010 and Carew et al., 2017). Segmentation by reputation responds to the low substitutability that occurs between wines of different price and quality segments, obtaining different price premia for the different attributes (Gibbs et al., 2009; Costanigro et al., 2007, 2009 and 2010).

As shown in Table 1.2, the most commonly used product segmentation has been by type of wine (34% of articles and 20% of estimations), followed by grape variety (11% and 10%). Of all of them, red wine has been the most analysed wine as it is the most consumed.

4.2. HEDONIC PRICE FUNCTION ESPECIFICATION

Attributes

The selection of attributes to be incorporated into the hedonic price function has been one of the most empirically complex issues (Unwin, 1999). The only “guidance” that Rosen (1974) provides is that those attributes to be included in the function should be relevant to both consumers' utility function and producers' cost function.

Mathis et al. (2003) differentiate between intrinsic and extrinsic attributes (cf. Table 2). The intrinsic attributes are those that are part of the wine itself and can be directly observable or not, although they are usually identified on labels or fact sheets. The extrinsic attributes affect the consumer or producer but do not belong to the product itself and could also be classified as observable or measurable on one hand, and opinion (subjective or perceived attributes) or non-observable on the other. Intrinsic characteristics sometimes require specific knowledge that many consumers lack (Unwin, 1999) and "delegate" this evaluation to other extrinsic characteristics related to reputation and quality evaluations.

In parallel, attributes can be classified according to the function they have in hedonic price models of wine, which can be differentiated into three main categories: objective, quality and reputation, belonging to the productive, the consumption, and the economic environment (Table 2).

Objective elements are those that define wine as a good or commodity based on basic objective attributes. Among them, perfectly observable ones include the colour (red, white, and rosé) and the type of wine (still, sparkling, and fortified), which sometimes blend together to form wine categories (e.g., reds, whites, rosés, sparkling, and fortified or dessert wines).

Table 2. Classification of wine attributes based on their nature, observability, and functionality

| | | NATURE AND OBSERVABILITY | | | | |
|--|----------------------------------|--------------------------|----------------------------------|--|---|------------------------------------|
| | | INTRINSIC | | EXTRINSIC | | |
| | | DIRECTLY OBSERVABLE | NON-OBSERVABLE OR BELIEF (LABEL) | OBSERVABLE OR MEASURABLE | OPINION OR NON-OBSERVABLE | |
| FUNCTIONALITY | OBJECTIVE CHARACTERISTICS | | Wine colour and type | Vintage, age, aging, grape variety, alcohol, organic or ecological (1) | | |
| | QUALITY AND REPUTATION | SUBJECTIVE | Quality of wine | | Brand, quantity of wine, exclusivity | Critics' ratings, Prizes or awards |
| | | | Reputation of the winery | | Winery, age of the winery, years of experience of the winemaker | Winery ratings |
| | | | Collective reputation | | Production region, appellation of origin, business association | |
| | | OBJECTIVE | Sensory characteristics (2) | Chemical characteristics | Climatic or weather conditions, soil characteristics (3) | |
| PRODUCTIVE, CONSUMPTION, AND ECONOMIC ENVIRONMENT | | | Productive process (4) | Winery size, marketing, bottling and labeling, consumption conditions, distribution and marketing channels, training (5) | Business environment, motivation, training | |

(1) An experienced consumer may directly perceive some of these characteristics.

(2) Some of these characteristics are observed by all consumers, while others require some level of experience and knowledge.

(3) Since these characteristics could modify the organoleptic properties of the wine, they could be considered intrinsic to the wine.

(4) Some of these characteristics could be considered extrinsic to the wine, while others are involved in the perception of the wine.

(5) Some of these characteristics may not be directly observable or measurable.

Table 3. Attributes used in hedonic price functions in the wine market

| Objective characteristics | Quality and reputation |
|--|---|
| <ul style="list-style-type: none"> • Intrinsic <ul style="list-style-type: none"> ○ Observable 248 (23) <ul style="list-style-type: none"> - Wine colour and type 248 (63) ○ Non-observable (label) 1.306 (196) <ul style="list-style-type: none"> - Vintage and age 1.054 (146) - Aging 172 (42) - Grape varieties 871 (132) - Alcohol content 181 (41) - Organic, ecological 110 (22) | <ul style="list-style-type: none"> • Subjective <ul style="list-style-type: none"> ○ Wine quality (extrinsic) <ul style="list-style-type: none"> ▪ Observable (label) 442 (80) <ul style="list-style-type: none"> - Brand 105 (24) - Wine quantity 317 (55) - Exclusivity 70 (17) ▪ Opinion (non-observable) 1.065 (157) <ul style="list-style-type: none"> - Critics ratings 901 (142) - Evaluation (yes/no) 33 (11) - Vintage rating 56 (11) - Prizes 140 (15) ○ Winery reputation (extrinsic) <ul style="list-style-type: none"> ▪ Observable/measurable 195 (48) <ul style="list-style-type: none"> - Winery 159 (34) - Winery age 36 (11) ▪ Opinion (non-observable) 257 (52) <ul style="list-style-type: none"> - Winery rating 257 (52) ○ Collective reputation 808 (172) <ul style="list-style-type: none"> - Region or appellation 795 (70) - Business association 44 (11) • Objective <ul style="list-style-type: none"> ○ Intrinsic <ul style="list-style-type: none"> ▪ Observable 61 (23) <ul style="list-style-type: none"> - Sensory 61 (23) ▪ Non-observable 104 (23) <ul style="list-style-type: none"> - Chemical 104 (23) ○ Extrinsic <ul style="list-style-type: none"> ▪ Observable/measurable 123 (18) <ul style="list-style-type: none"> - Climate, weather 120 (16) - Soils 5 (3) |
| Productive, consumption and economic environment | |
| <ul style="list-style-type: none"> • Intrinsic, non-observable <ul style="list-style-type: none"> - Productive process 52 (15) • Extrinsic <ul style="list-style-type: none"> ○ Observable or measurable 996 (143) <ul style="list-style-type: none"> - Winery size 104 (28) - Packaging 208 (39) - Consumption environment 105 (2) - Consumption moment 563 (45) - Commercialisation 274 (67) - Consumption loyalty 59 (16) - Training 13 (4) ○ Non-observable 142 (25) <ul style="list-style-type: none"> - Motivation 8 (3) - Micro environment 85 (18) - Macro environment 58 (7) | |

The unobservable objective characteristics usually refer to those that are stated on the label (either front or back) or on the sheets distributed by the wineries, which can be found on their websites, in wine guides, and on online purchasing platforms. Among these is the vintage (year in which the grapes were harvested), which has a great impact on the price (Couto and Lima, 2007; Wood and Anderson, 2006 and Dimson et al., 2015)⁵. Another characteristic that is often confused with the vintage, although it may be related, is the aging of the wines, referring to the time the wine matures in the barrel (and bottle) once the alcoholic fermentation is completed (number of months or official categories of aging in the case of Spain). The grape varieties used in the wine production have been one of the main differentiating elements in the case of wines from the “New World”

⁵ Troncoso and Aguirre (2006) question this effect since not all wines age in the same way and not all consumers enjoy the characteristics that aging brings.

(Troncoso and Aguirre, 2006 and Ling and Lockshin, 2003) with much less relevance, although increasing, in the “Old World” (Steiner, 2004). It is also common to include the alcohol content, usually expressed as a percentage of alcohol, which generally has a negative influence on the price.

In recent years, other attributes related to the respect for the environment and lifestyle have gained relevance. Organic or biodynamic wines, environmentally friendly wines, vegan wines, or even wines without sulfites have emerged as a result. However, there is a wide debate about whether they are overpriced (Abraben et al., 2017; Ascuito et al., 2012; Corsi and Strom, 2013; Delmas and Grant, 2014 and Grogan, 2015).

Within the objective characteristics (Table 8), the one that has been included the most is related to the vintage or age of the wine (66% of articles and 65% of estimations), and the grape varieties used (55% and 60%, articles and estimations, respectively). The colour and type of wine⁶ are relatively less frequent, appearing at a considerable gap from the top two attributes (16% and 28%).

A second group of attributes consists of quality and reputation. The inclusion of quality indicators in the price function is essential due to their influence on the price of wine, as they serve to mitigate the information asymmetry between consumers and producers.

The predominant approach to consider wine quality in hedonic price functions is by including evaluations made by experts or prizes obtained in wine competitions. Additionally, elements such as the brand, exclusivity (e.g., “Family Reserve”, etc.), and even the quantity of bottles produced for each reference have been incorporated (Zhao, 2009) as complementary factors.

The effect of quality ratings on price has been a topic of wide controversy. Two meta-analyses have analysed this issue, concluding with a positive effect on price (Oczkowski and Doucouliagos, 2015 and Núñez, 2022). In different studies, this effect is nuanced, as it is found to be more relevant in red wines (Schamel et al.,

⁶ The lower presence of this type of attribute is related to the existence of segmented estimations by type of wine.

1998), wines sold as *primeur* (Dubois and Nauges, 2010), and when ratings from different experts coincide (Lecocq and Visser, 2006). Statistically non-significant effects of these ratings on prices are also found (e.g. Panzone, 2011 and Fogarty, 2003).

Some studies have questioned the informative content behind these quality ratings, trying to replace them with more objective measures (climatic, soil, chemical, and sensory characteristics). Ashenfelter et al. (1995) were the first to introduce more objective measures based on climatic characteristics (precipitation in the winter prior to harvest and temperature and precipitation during ripening), and they found positive results on price. These results were reproduced in Wood and Anderson (2006), Haeger and Storchmann (2006), Di Vittorio and Ginsburgh (1996), and Ashenfelter and Jones (2013), although for Oczkowski (2016b), the effect varies substantially between regions and grape varieties.

On the contrary, there is no consensus on the contribution of sensory characteristics or chemical components, as a proxy for quality. This is because Lecocq and Visser (2006), Benfratello et al. (2009), and Combris et al. (1997 and 2000) find little or no contribution to price. These results are nonetheless opposite to those of Cardebat and Figuet (2004), Roma et al. (2013), Brentari et al. (2011), and Gàl (2017).

On the other hand, reputation arises as the accumulation over time of elements of current quality from a region, winery, or wine, playing an even more powerful role than quality. This variable has also been identified with the age of the winery. A particular case occurs in some regions such as Bordeaux where historical classifications of the Chateaux are used, many of them unchanged since the mid-19th century.

Undoubtedly, the most relevant elements of reputation are those of a collective nature. That is, objective aspects defined geographically, climatically, geologically, thematically, or from the entrepreneurship perspective (appellations of origin, regions, associations, quality seals). Appellations of origin have been of special interest in the Old World. The results generally indicate, a positive

influence on prices for these appellations of origin (Landon and Smith, 1998; Panzone and Simoes, 2009; Sellers-Rubio et al., 2017, Cacchiarelli et al., 2016). However, some studies do not find this relationship, attributing this result to the emergence of high-quality New World wines in markets where both compete (Steiner, 2004) or to problems of information in distant markets (Galati et al., 2017). The importance of geographical indications is also relevant in the case of New World wines (Defrancesco et al., 2012 and Berrios and Saens, 2012 and 2015).

Landon and Smith (1997) point out that the non-inclusion of winery reputation in the price function overestimates the true effect of quality. Moreover, Oczkowski (2001), Fogarty (2008), and Hadj Ali and Nauges (2007) highlight this interaction, concluding that reputation is preferred to quality. Conversely, Roma et al. (2013) find a statistically significant effect of both critic ratings and winery reputation on wine prices. Benfratello et al. (2009) and Carew and Florkowski (2008) conclude with the relevance of reputation over sensory characteristics.

This interaction is also present with collective reputation, establishing different types of relationships between them: substitutive (Cacchiarelli et al., 2014; Cardebat and Figuet, 2009; Schamel, 2003 and Ling and Lockshin, 2003), complementary or non-rival (Cardebat and Figuet, 2004 and Schamel, 2000), or with collective reputation being more relevant for wines of lower quality and individual reputation being more relevant for wines of higher quality (Caracciolo et al., 2016; Costanigro et al., 2010 and Rabkin and Beatly, 2007). Additionally, major brands are capable of compensating for the effect of collective reputation (Frick and Simmons, 2013; Schamel, 2006 and 2009).

Among the quality and reputation indicators (Table 3), the most commonly used ones are critics' ratings (present in 64% of the studies and in 56% of the estimations), and references to geographic regions or appellations of origin (76% and 50%). The reputation of the winery, measured either through ratings (23% and 16%) or through individual effects (15% and 10%), is somewhat less frequent. The introduction of exclusivity (amount of wine produced or amount available in markets) is also relevant (25% and 20%). Objective assessments of quality have only been incorporated in one-fifth of the studies.

In recent years, elements related to the production, consumption, and economic environment have been incorporated into price functions. Features related to the production process include production techniques that influence the cost or sensory characteristics of the wine (Wood and Anderson, 2006; Haeger and Storchmann, 2006). These techniques often aim to replicate traditional handcrafted production processes. Other elements directly related to the production environment influence production costs (e.g., training), and are often associated (directly or indirectly) with quality or exclusivity factors (e.g., family-owned or small wineries).

On the other hand, drinking wine constitutes a social habit or practise and is usually associated with a leisure “experience”. This implies the influence on the willingness to pay of the consumption environment and the way in which the wine is presented: names of wines (Cacchiarelli et al., 2016), type of bottle (Gonzalez and Melo, 2008), packaging (Mueller and Szolnoki, 2012), colour, shape, design, and text on the label (Boatto et al., 2011; García Arancibia et al., 2015, and Galati et al., 2018), bottle closure —natural cork, synthetic, screw cap, etc.—, variety names (Oczkowski, 2018), wine descriptions (Mora and Livat, 2013 and Ramirez, 2010), loyalty and marketing strategies, and the moment or purpose for which the wine is consumed.

Furthermore, there is evidence regarding the importance of the distribution channel (Brentari and Levaggi, 2011 and Rebelo et al., 2019) and tradition and commercial penetration (Hoang et al., 2014).

Along with these elements, the macro or microeconomic environment can determine wine prices through costs (costs of raw materials, exchange rates, inflation) or consumption (falls in households’ disposable income), or even in the company's own survival based on the competition conditions in the sector (Michis and Markidou, 2013; Gonzalez and Melo, 2008). Finally, there is also evidence of the effect of winemakers’ personal motivations on quality improvements and price (Scott Morton and Podolny, 2002).

The attributes related to the productive, consumption, and economic environment have been present in this literature from the beginning, but not in an intensive

way. Among them, the variables that analyse the moment of consumption (35% and 20%), marketing strategies or channels (17% and 30%), and those that consider different aspects of packaging and labelling (13% and 17%) stand out.

Functional form

One of the decisions that must be made when estimating hedonic price functions is the functional form that is adopted. Considering transformations in both the dependent and independent variables, five groups of functional forms are distinguished: a) linear, without any type of transformation; b) logarithmic, where only the dependent variable and independent variables are logarithmically transformed, except for dummies (forming mixed models); c) log-linear, where only the dependent variable is logarithmically transformed; d) Box-Cox, where some Box-Cox transformation is applied to the dependent variable, with the reciprocal of the square root being a common choice; and finally e) other *ad hoc* transformations.

The choice of the functional form has been addressed in two ways. Firstly, it has been chosen in a completely *ad hoc* manner, relying on some authority argument or based on the greater interpretability of the estimated coefficients. Secondly, applying some type of functional form specification test, such as the one proposed by Ramsey (1969) or Box and Cox (1964), or some of their variants. Oczkowski (2016a) points out that the distribution of prices is typically positively skewed, and this motivates the dominance of log-linear forms in hedonic price specifications (Orrego et al., 2012, Oczkowski and Doucouliagos, 2015).

The choice of the functional form has direct implications on the interpretation of the coefficients obtained. In fact, in the logarithmic form, the coefficients are interpreted as elasticities, while in the semi-logarithmic form they are semi-elasticities, and in linear functions, they represent absolute changes. The interpretation of Box-Cox transformations is more complex. The results obtained from the first three mentioned specifications are usually quite similar if the appropriate equivalence is applied (see Annex B).

Indeed, due to its straightforward interpretability, and as shown in Table 4, the majority of authors use the semi-logarithmic functional form (76% of studies and 75% of estimations). The logarithmic form is the second most commonly used, either in its pure form (7% and 5%) or mixed with dummies (7% and 8%). Finally, the linear form is the third most used (7% and 13%). Other functional forms are less frequently used.

Table 4. Functional forms used in the estimation of hedonic price functions in wine markets

| | | Transformation of the independent variables | | | | Total |
|---|-------------|---|-------------|-------------------|----------|----------------|
| | | Linear | Logarithmic | Mixed logarithmic | Other | |
| Transformation of the dependent variable | Linear | 111 (28) | 1 (1) | - | - | 112 (28) |
| | Logarithmic | 1.201 (169) | 111 (12) | 112 (17) | 3 (2) | 1.427 (192) |
| | Box-Cox | 8 (5) | - | - | 3 (2) | 11 (7) |
| | Other | 46 (13) | - | - | - | 46 (13) |
| | Total | 1.366 (201) | 112 (13) | 112 (17) | 6 (3) | 1.596 (223) |
| Implementation of a selection procedure for the functional form | | | | | | 18,8% |

4.3. DATA SOURCES, SAMPLES, AND TYPES OF PRICES USED

Primary sources of information

The estimation of hedonic price functions relies heavily on the representativeness, quantity, and quality of the information used. For this reason, databases representative of the markets under study have been used, containing information on the main attributes of wine, and specifically identifying the quality indicator and the type of price used in the hedonic price function.

While there are numerous databases available, there are eight potential sources or origins for the information, which include: a) critics, wine guides, and specialised periodicals in wine markets (magazines); b) stock scanning and purchases; c) websites for online wine sales or search engines; d) auction houses or websites that collect this information; e) information on wine sales in *primeur*, some through auctions; f) catalogues, price lists, or databases from suppliers or monopolies in alcohol distribution; g) direct surveys or data collection carried out by the authors themselves or third parties; h) other databases not directly related to the wine market (climate, soil, etc.).

All of these sources usually contain information on objective characteristics. Guides, websites, and surveys may incorporate sensory attributes. Each one contains a type of price (see next section). Only guides and websites usually offer quality ratings. In turn, auction and *primeur* databases tend to be biased towards the ultra-premium segment, while guides and websites tend to be broader, and they usually do not incorporate table wines. Supplier catalogues and direct surveys may be biased due to the choices made by distributors or the authors of the research. The volume of information is high and very representative in the case of scanning, websites, and auction databases.

As shown in Table 5, 106 different sources of information have been used in this literature, with an average of 1.45 sources per article. However, in the majority of them (72% of the studies and 74% of the estimations), only a single source is used. Wine guides, critics, and specialised magazines dominate as the type of source used (59% and 52%), followed by own surveys (17% and 10%), product scanning databases (12% and 8%), and auction information (10% and 30%). In recent years, information from online wine sales websites has increased (10% and 10%).

Table 5. Used information sources used and type of prices in the estimation of hedonic price functions in wine markets

4.1. Type of sources

| | |
|---------------------------------|-----------|
| Wine guides, critics, magazines | 836 (132) |
| scanning | 121 (27) |
| Online sales | 159 (22) |

| | |
|------------------------------|-------------|
| Auctions | 481 (23) |
| <i>En primeur</i> | 83 (8) |
| Suppliers | 93 (20) |
| Own surveys | 159 (39) |
| Other | 126 (17) |
| Average number of sources | 1,45 (1,41) |
| Just one source | 1.177 (160) |
| Total number of used sources | 106 |

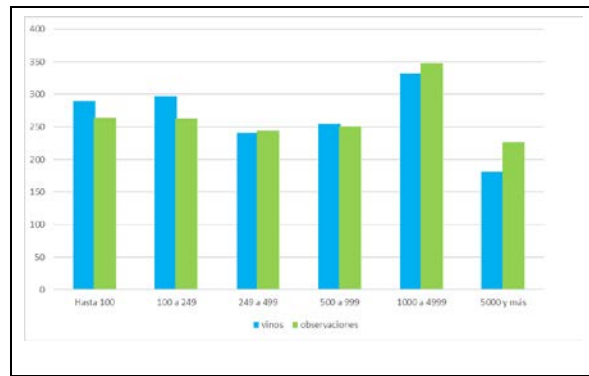
4.2. Type of prices

| | |
|-----------------------------|-----------|
| Indicative/approximate | 651 (115) |
| Retail sales | 194 (52) |
| Online sales | 155 (22) |
| Wholesale | 80 (17) |
| Exports | 11 (3) |
| Auction | 406 (12) |
| <i>En primeur</i> | 38 (2) |
| Auction + <i>en primeur</i> | 61 (9) |

The most widely used database due to its straightforward accessibility is WineSpectator (26% and 19%). Robert Parker's (7% and 10%) is the next one and has been used in less than half the number of studies as WineSpectator (refer to Table A.4 in the Appendix for a precise list of used databases).

Figure 3 shows that the mode in the size of used data samples is in the range between 1,000 and 4,999 observations, although more than 250 estimations use less than 100 observations. The number of observations is usually related to the precision of the estimated coefficients in the different expressions.

Figure 3. Number of wines and size of data samples used in estimations



Wines, Observations

Types of prices

The type of available prices for estimating price functions depends on the source of information used. Critic databases and guides typically offer suggested retail prices, while information obtained from scanning and direct surveys usually provides market retail prices. Sales websites provide retail prices exclusive to their channels, and suppliers' catalogues typically contain wholesale prices. The prices obtained from surveys depend on the surveyed agent.

Finally, auction prices and/or *primeur* prices have been used in some studies. Auction prices, and sometimes *primeur* prices too, often respond more to financial aspects and are subject to the volatility of these markets. *Primeur* prices are only observed in regions or wineries that sell wine in barrels, before bottling (Hadj Ali and Nauges, 2007).

Some authors discourage the use of recommended prices (Combris et al., 1997) because they may not accurately reflect the reality of the market. However, if the prices used are a monotonic transformation of the hypothetically real prices, the estimation results of price functions will not be systematically biased. This is supported by studies comparing recommended and market prices (Oczkowski, 2016a), as well as research comparing *primeur*, retail, and wholesale prices (Ashenfelter and Storckmann, 2010). Ortuzar and Alfranca (2010) suggest eliminating abnormally high or low prices to approximate the regular or current price.

As shown in Table 4.2, the use of indicative or recommended prices dominates (52% of the studies and 41% of the estimations), corresponding to the use of

guides or critic databases as a source of information. Next in importance is the use of retail market prices (23% and 12%) and online retail prices (10% and 10%). An interesting case is auction prices, which, although few articles use them (5%), have a wide representativeness in terms of estimations (25%) due to the large number of estimations that the financial literature tends to present.

4.4. ECONOMETRIC METHODS

The estimation of hedonic price functions has not been characterised by a high degree of econometric sophistication. As shown in Table 6, the dominant estimation procedure is Ordinary Least Squares (93% of the studies and 85% of the estimations), usually providing robust to heteroscedasticity and autocorrelation standard errors (51% and 38%, respectively).

Some studies have questioned the exogeneity of the different attributes and highlighted the problems of measurement errors, especially regarding quality and reputation variables (Unwin, 1999). This has led to the use of two-stage estimation procedures (9% and 10%), using quality ratings made by others as instruments (Ling and Lockshin, 2003), or chemical characteristics (Golan and Shalit, 1993), or climatic variables (Cardebat et al., 2014 and Oczkowski, 2019).

Table 6. Econometric methods used in the estimation of hedonic price functions in wine markets.

| | |
|--|-------------|
| Ordinary Least Squares | 1.361 (208) |
| Instrumental Variables | 144 (22) |
| First Differences | 94 (6) |
| Panel Data | 81 (11) |
| | |
| Heteroscedasticity and autocorrelation | 808 (85) |
| | |
| "Preferred" estimations | 1.104 |

One way to improve goodness of fit of estimated functions is by using non-parametric or semi-parametric estimation procedures, which does not require

specifying any functional form a priori. Perhaps the most widespread criticism of this option is that the improvement comes at the expense of the loss of interpretation of coefficients. Kwong et al. (2011), Kwong et al. (2017) and Niklas and Rinkie (2020) compare parametric, semi-parametric and non-parametric estimation results, demonstrating the advantages of the latter two methods compared to the former.

However, it is worth noting that statistical and econometric techniques have been applied with a certain degree of sophistication to segment samples into their relevant markets. Thus, some quantile estimations are encountered in an attempt to identify differentiated behaviours, such as Rebelo et al. (2019) for Portuguese wines or Di Vita et al. (2015) for Italian wines. A more sophisticated procedure based on mixture is used by Caudill and Mixon (2016) to split the sample into different classes.

4.5. PUBLICATIONS

This section analyses the type of publication where the different studies are published. It is usually assumed that peer-reviewed publications have greater guarantees that the results are derived following scientific procedures. However, the intervention of reviewers can potentially interfere with the results towards the dominant paradigm. This is known as publication bias in the context of meta-analysis. In addition, the publication channel also influences the dissemination of research, with articles in higher prestige journals having greater diffusion and mimeos having less.

As shown in Table 7, articles in journals dominate this literature (73% of the articles and 65% of the estimations). The remaining publication types are distributed across various forms of publication. The results obtained from university documents are particularly relevant, as some of them contain a significant number of estimations. It is worth mentioning that there is no great concentration of studies in any specific publication (see Table A.5. in the Annex). Regarding journals with impact factors, they are distributed in the four quartiles of the Journal Citation Reports (JCR) and SCImago Journal Rank (SJR) (*cf.* Figure 5). In JCR, the mode is in the third quartile, while in SJR, it is in the second

quartile. Finally, it is significant to note that a small group of articles concentrate the majority of the citations, whether measured through the Web of Science (WoS), Scopus or Google Scholar. Specifically, the 25 most cited articles, typically conducted at the outset of the literature, concentrate around 75% of the citations received (*cf.* Figure 6).

Table 7. Types of publication and journals where the different studies estimating hedonic price functions in wine markets have been published

| Type of publication | Articles | Estimations |
|----------------------|----------|-------------|
| Articles | 162 | 1.018 |
| Chapters/Books | 5 | 16 |
| Working documents | 15 | 97 |
| University documents | 15 | 341 |
| Presentations | 22 | 89 |
| Mimeos | 4 | 35 |

Figure 5. JCR and SJR quartiles of journals that include studies estimating hedonic price functions in wine markets

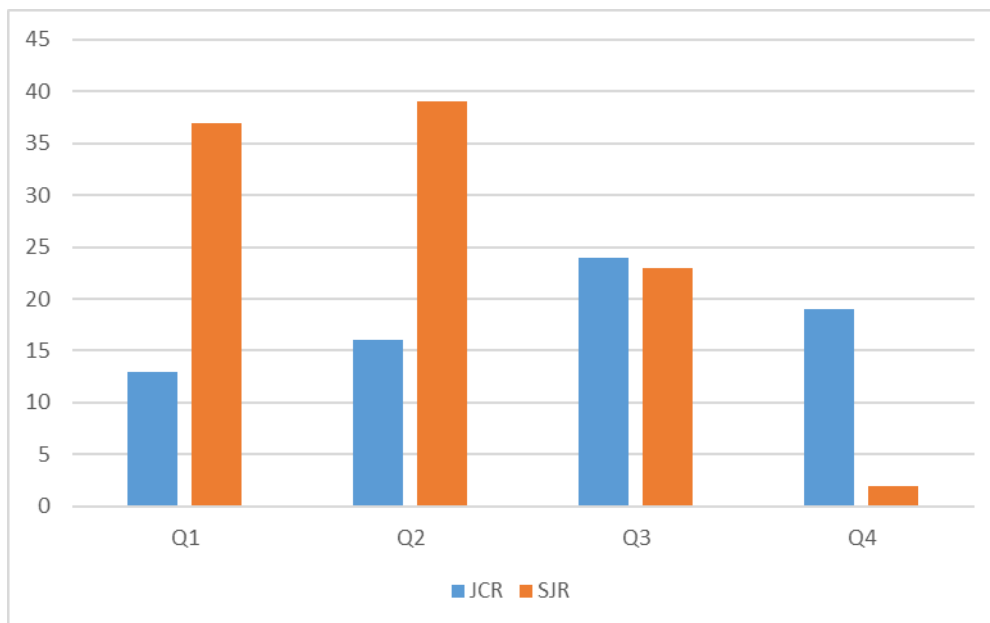
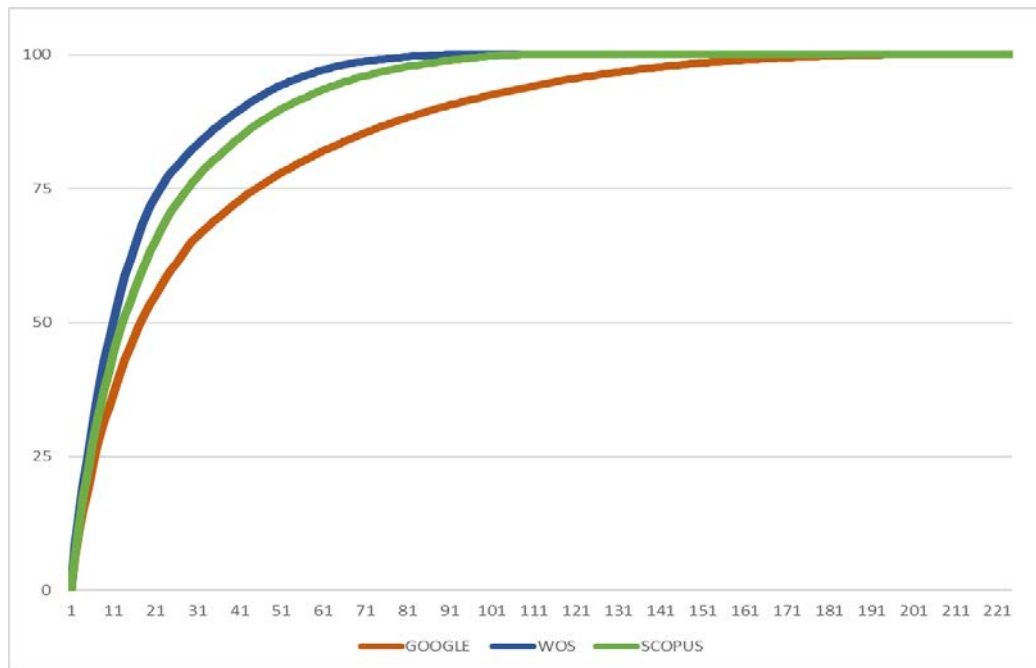


Figure 6. Distribution function of citations received by studies that include hedonic price functions in wine markets



5. CONCLUSIONS

This paper aims to conduct a comprehensive review of the literature on the estimation of hedonic price functions in wine markets for the entire population of available studies. From this literature review, some relevant conclusions are drawn, which are summarised in the following points:

- In the literature on the estimation of hedonic price functions in the wine market, data-driven methodology dominates, as the available databases condition some of the methodological choices made in each study. Of those decisions left to the author, most are determined from specific statistical tests that seek better goodness of fit.
- Due to the aforementioned reasons, the methodological options used are very diverse. Although some of them tend to dominate, it is true that the dispersion is so great that except for some exceptions, almost none of these options usually reaches 50% of the analysed studies. This diversity is possibly the result of the large number of authors who have participated in this literature.
- However, it should be pointed out that despite this dispersion, there are some options that do show certain dominance: studies done with wines

from a single country or region, sold in a single market (country or region), generally referring to the set of premium wines and not to submarkets, where objective and non-observable opinion attributes prevail—with the quality or the quality rating being one of the most relevant attributes—, using wine guides or critic valuation databases as the basic source, and consequently, having indicative prices. Log-linear is the dominant functional form. In general terms, there is no excess of econometric sophistication, although it has been recently increasing.

Once the main conclusions have been drawn, it is now suitable to outline the main lines of research and areas for improvement that the authors believe should be pursued in this particular field of study.

From a theoretical point of view, the vast majority of the reviewed applications are addressed from the demand perspective. **The only study to adopt a supply-side approach aimed at accurately identifying the coefficients is the recent work by Oczkowski (2022).** This is perhaps the fundamental challenge to conducting hedonic price analysis, to correctly identify the various factors that contribute to the product's value and price. This requires careful consideration of both supply and demand factors in the relevant market.

From an empirical point of view, it would be desirable, in the first instance, to have greater access to databases. In this regard, some websites, super-search engines, and international peer review pages (e.g., WineSearcher, Vivino, etc.) combine different types of information: prices, objective characteristics of wines, quality evaluations—both from critics and consumers, as well as tasting notes—. However, these webpages often do not share this information with researchers, and only through web scraping is this information beginning to be available, albeit partially. This still generates incomplete analyses of the complex price formation mechanisms.

Precisely, the literature is pointing to four lines of research that only some recent studies have treated. The first, concerning the correct identification of markets, is that the different existing studies have not strictly analysed the degree of substitutability between different types of wine, grape varieties, or between

different levels of reputation. The existing literature only performs analyses based on statistical tests that capture structural breaks in the relationship between prices and attributes.

The second line is that the valuation of the impact on prices of different intangibles sometimes shows the existence of significant measurement problems. To achieve this, it is necessary to use more reliable indicators of quality that distinguish between objective and subjective factors, as well as to assess the influence of various distribution channels, non-objective label elements (design, colour, graphics, text, etc.), and consumption modes. Despite existing literature on the topic, generalising these findings can be challenging at times due to the specific nature of the measures employed.

The third aspect is to analyse how the internationalisation process of the wine market is generating structural changes that must be taken into consideration by producers and scholars of the subject. Thus, the analysis of price formation should be carried out not only in the country of origin of the wines or in some of the major markets, but in all relevant ones.

In addition, it seems that the accumulation of evidence in the estimation of hedonic price functions is important enough to obtain robust conclusions through the use of meta-analysis. The study by Oczkowski and Doucouliagos (2015) marked the beginning of this line of research by exploring the impact of quality on prices, a study that, due to the relevance of the topic, is reviewed and extended in Nuñez (2023). However, certain significant questions such as the influence of reputation or aging on prices remain unanswered.

The review conducted reveals a notable dearth in the adoption of modern econometric techniques. Although some recent studies have implemented methodologies that enhance goodness of fit, such studies are relatively infrequent. Many studies would benefit from using the most suitable methodologies available for their respective datasets.

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Table A.1 Studies included in the literature review

| Autor(año) | Tipo de publicación | Origen de los vinos | Mercado de venta | Uvas específicas | Sólo vino tinto | Sólo vino blanco | Sólo vino espumoso | Periodo de la muestra | Número de observaciones | Número de estimaciones | Atributos objetivos directamente observables | Atributos objetivos no observables | Calidad del vino observable | Calidad del vino no observable | Reputación de la bodega observable | Reputación de la bodega no observable | Reputación colectiva observable | Calidad objetiva intrínseca observable | Calidad objetiva intrínseca no observable | Calidad objetiva extrínseca | Entorno intrínseco | Entorno extrínseco observable | Entorno extrínseco no observable | Interacciones | Total variables |
|--|---------------------|---|--------------------|------------------|-----------------|------------------|--------------------|-----------------------|-------------------------|------------------------|--|------------------------------------|-----------------------------|--------------------------------|------------------------------------|---------------------------------------|---------------------------------|--|---|-----------------------------|--------------------|-------------------------------|----------------------------------|---------------|-----------------|
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| ABRABEN(2014) | 4 | ITA | USA | | 1 | 0 | 0 | 2012 | 444 | 22 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| ABRABEN, GROGAN & GAO(2017) | 1 | ITA | ITA | | 1 | 0 | 0 | 2012 | 393 | 12 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 34 |
| ALLEN & GERMOV(2010) | 1 | AUS | AUS | SHIRAZ | 0 | 0 | 0 | 2007 | 1215 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | |
| AMARO & FERRO(2016) | 4 | MUNDO | USA | | 0 | 0 | 0 | 1988-2015 | 1300 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 107 | |
| AMEDEE-MANESME, FAYE & LE FUR(2020) | 1 | FRA | MUNDO | | 0 | 0 | 0 | 2003-2017 | 50426 | 12 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 47 | |
| AMRUSCH & WIRL(2013) | 1 | AUT | AUT | | 0 | 0 | 0 | 2012 | 298 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | |
| ANDRANGO & CANALES(2017) | 1 | ARG | USA | | 0 | 0 | 0 | 1989-2010 | 1807 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 23 | |
| ANGULO, GIL, GRACIA, SANCHEZ(2000) | 1 | ESP | ESP | | 1 | 0 | 0 | 1998 | 66 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | |
| ARETA(2015) | 1 | ESP | USA | | 0 | 0 | 0 | 2012 | 9260 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 68 | |
| ARETA & BARDAJI(2009) | 4 | ESP | USA | | 0 | 0 | 0 | 1987-2006 | 444 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 21 | |
| ARETA, BARDAJI & IRAIZOZ(2017) | 1 | ESP | USA | | 0 | 0 | 0 | 2012 | 653 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 68 | |
| ARIAS-BOLZMANN, LODISH, BAEZ & DE SOUSA(2002) | 1 | AUS, USA, CHL, FRA, ITA, NZL, ZAF | USA | | 0 | 0 | 0 | 2000 | 420 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | |
| ARIAS-BOLZMANN, SAK, MUSALEM, LODISH, BAEZ & DE SOUSA(2003) | 1 | AUS, USA, CHL, FRA, ITA, NZL, ZAF | USA | | 0 | 0 | 0 | 2000 | 420 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | |
| ASCIUTO, DACOUJISTO, GESARO & GALATI(2012) | 3 | ITA | ITA | | 0 | 0 | 0 | 2012 | 382 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 11 | |
| ASSARI & REEDY(2016) | 3 | USA | USA | | 0 | 0 | 0 | 2004-2014 | 4693 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| ASHENFELTER & JONES(2013) | 1 | FRA | MUNDO | | 1 | 0 | 0 | 1991 | 27 | 5 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | |
| ASHENFELTER & STORCHMANN(2010) | 1 | DEU | DEU | | 0 | 0 | 0 | 1994-2008 | 6355 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 14 | |
| ASHENFELTER, ASHMORE & LALONDE(1995) | 1 | FRA | MUNDO | | 1 | 0 | 0 | 1992 | 26 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| ASHTON(2016) | 1 | FRA | MUNDO | | 0 | 0 | 0 | 2004-2012 | 922 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 14 | |
| BEKKERMAN & BRESTER(2019) | 1 | MUNDO | USA | | 0 | 0 | 0 | 2009-2012 | 1050996 | 17 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 917 | |
| BENFRATELLO, PIACENZA & SACCHETTO(2009) | 1 | ITA | ITA | NEBBIOLO | 0 | 0 | 0 | 2002 | 603 | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 12 | |
| BENTZEN & SMITH(2006) | 1 | DEU | DEU, SWE, DNK, NOR | | 0 | 1 | 0 | 2004 | 213 | 5 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 17 | |
| BENTZEN & SMITH(2008) | 1 | FRA | NOR, SWE, DNK | | 0 | 0 | 1 | 2006 | 179 | 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | |
| BERNI, BEGALLI, CAPITELLO & DALLA BERNARDINA(2005) | 3 | ITA | ITA | | 0 | 0 | 1 | 2003 | 274 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | |
| BERRIOS & SAENS(2012) | 1 | ARG, AUS, USA, CHL, FRA, ZAF | USA | | 0 | 0 | 0 | 1997 | 1842 | 10 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | |
| BERRIOS & SAENS(2015) | 1 | ARG, AUS, FRA, CHL, USA, NZL, ZAF | USA | | 0 | 0 | 0 | 1997 | 2513 | 18 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | |
| BICKNELL & MACDONALD(2009) | 3 | NZL | NZL | CHARDONNAY | 0 | 0 | 0 | 2007 | 1500 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 12 | |
| BICKNELL & MACDONALD(2012) | 1 | NZL | NZL | PINOT NOIR | 0 | 0 | 0 | 1994 | 42 | 9 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | |
| BICKNELL, FRIESEN & MACDONALD(2005) | 3 | NZL | NZL | | 0 | 0 | 0 | 1994 | 696 | 10 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | |
| BLAIR & BURLEY(1998) | 1 | AUS | AUS | | 1 | 0 | 0 | 1997 | 392 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | |
| BOATTO, DEFRANCESCO & TRESTINI(2011) | 1 | ITA | ITA | | 0 | 1 | 0 | 2006 | 1028 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 26 | |
| BRENTARI & LEVAGGI(2011) | 4 | ITA | ITA | | 1 | 0 | 0 | 2006-2008 | 367 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 27 | |
| BRENTARI, LEVAGGI & ZUCCOLOTTO(2011) | 1 | ITA | ITA | | 1 | 0 | 0 | 2007 | 359 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 19 | |
| BRENTARI, LEVAGGI & ZUCCOLOTTO(2015) | 1 | ITA | ITA | | 1 | 0 | 0 | 2005-2011 | 973 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 25 | |
| BROOKS(2003) | 4 | ARG, AUS, AUT, CHL, FRA, DEU, ITA, ESP, USA | USA | | 0 | 0 | 0 | 1992-1998 | 20421 | 20 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 29 | |
| BURGER & KUNCIC(2010) | 3 | MUNDO | SVN | | 0 | 0 | 0 | 2010 | 925 | 13 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | |
| BUZETA(2005) | 4 | CHL | CHL | | 0 | 0 | 0 | 2003 | 576 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 31 | |
| BYRON & ASHENFELTER(1995) | 1 | AUS | MUNDO | | 0 | 0 | 0 | 1991 | 26 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| CACCHIARELLI, CARBONE, ESTI, LAURETI & SORRENTINO(2016) | 1 | ITA | ITA | | 0 | 0 | 0 | 2010 | 2439 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 32 | |
| CACCHIARELLI, CARBONE, LAURETI & SORRENTINO(2014) | 1 | ITA | ITA | | 1 | 0 | 0 | 2010 | 221 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | |
| CACCHIARELLI, CARBONE, LAURETI & SORRENTINO(2016) | 1 | ITA | ITA | | 0 | 0 | 0 | 2010 | 2439 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 26 | |
| CADIMA & FREITAS(2003) | 1 | PRT | PRT | | 0 | 0 | 0 | 1999 | 709 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | |
| CADIMA & FREITAS(2007) | 3 | PRT | PRT | | 0 | 0 | 0 | 1999 | 711 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | |
| CARACCILO, CEMBALO & POMARICI(2013) | 1 | ITA | ITA | AGLIANICO | 0 | 0 | 0 | 2010 | 1053 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 15 | |
| CARACCILO, DAMICO, DI VITA, POMARICI, DAL BIANCO & CEMBALO(2016) | 1 | ITA | ITA | | 0 | 0 | 0 | 2011 | 80000 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | |
| CARDEBAT & FIGUET(2004) | 1 | FRA | FRA | | 0 | 0 | 0 | 2001 | 254 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | |
| CARDEBAT & FIGUET(2009) | 1 | FRA | FRA | | 0 | 0 | 0 | 2005 | 140 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | |
| CARDEBAT, FAYE, LE FUR & STORCHMANN(2017) | 1 | FRA | MUNDO | | 0 | 0 | 0 | 2000-2012 | 38941 | 11 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 29 | |
| CARDEBAT, FIGUET & PAROISSIEN(2014) | 1 | FRA | FRA | | 0 | 0 | 0 | 2011 | 2172 | 14 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 204 | |
| CAREW & FLORKOWSKI(2008) | 1 | AUS | CAN | | 1 | 0 | 0 | 2002-2004 | 6175 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 52 | |
| CAREW & FLORKOWSKI(2010) | 1 | FRA | CAN | | 0 | 1 | 0 | 2002-2004 | 4024 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 51 | |
| CAREW, FLORKOWSKI & MENG(2017) | 1 | USA | CAN | | 1 | 0 | 0 | 2009-2011 | 3707 | 7 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | |
| CASTILLO-VALERO, VILLANUEVA & GARCIA-CORTIJO(2018) | 1 | ESP | ESP | | 1 | 0 | 0 | 2010 | 115 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | |
| CAUDILL & MIXON(2016) | 1 | USA | USA | | 0 | 0 | 0 | 1991-2000 | 2381 | 8 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | |
| COMBRIS, LECOCCQ & VISSER(1997) | 1 | FRA | FRA | | 0 | 0 | 0 | 1992 | 193 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 9 | |
| COMBRIS, LECOCCQ & VISSER(2000) | 1 | FRA | FRA | | 0 | 0 | 0 | 1993 | 613 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 7 | |

Table A.1. (continued)

| Autor(año) | Tipo de publicación | Origen de los vinos | Mercado de venta | Uvas específicas | Sólo vino tinto | Sólo vino blanco | Sólo vino espumoso | Periodo de la muestra | Número de observaciones | Número de estimaciones | Atributos objetivos directamente observables | Atributos objetivos no observables | Calidad del vino observable | Calidad del vino no observable | Reputación de la bodega observable | Reputación de la bodega no observable | Reputación colectiva observable | Calidad objetiva intrínseca observable | Calidad objetiva intrínseca no observable | Calidad objetiva extrínseca | Entorno intrínseco | Entorno extrínseco observable | Entorno extrínseco no observable | Interacciones | Total variables |
|--|---------------------|---------------------|------------------|--------------------|-----------------|------------------|--------------------|-----------------------|-------------------------|------------------------|--|------------------------------------|-----------------------------|--------------------------------|------------------------------------|---------------------------------------|---------------------------------|--|---|-----------------------------|--------------------|-------------------------------|----------------------------------|---------------|-----------------|
| COPPOLA, SODAN & VERNEAU(2005) | 3 ITA | | ITA | | 0 | 0 | 0 | 1999 | 437 | 1 | 0 | | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 6 |
| COPPOLA, SODANO & VERNEAU(2000) | 1 ITA | | USA | | 0 | 0 | 0 | 1998 | 460 | 3 | 0 | | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 7 |
| CORREIA, REBELO & CALDAS(2015) | 1 PRT | | MUNDO | | 0 | 0 | 0 | 2010-2012 | 162 | 4 | 1 | | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 |
| CORSI & STROM(2008) | 3 ITA | | ITA | | 0 | 0 | 0 | 2006 | 388 | 5 | 0 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 19 |
| CORSI & STROM(2009) | 4 ITA | | ITA | | 0 | 0 | 0 | 2006 | 389 | 3 | 0 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 20 |
| CORSI & STROM(2013) | 1 ITA | | ITA | | 0 | 0 | 0 | 2006 | 389 | 3 | 0 | | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 18 |
| COSTANGRO, MITTELHAMMER & MCCLUSKEY(2009) | 1 USA | | USA | | 1 | 0 | 0 | 1991 - 2000 | 9600 | 5 | 0 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 28 |
| COSTANIGRO & MCCLUSKEY(2011) | 2 USA | | USA | | 1 | 0 | 0 | 1991 - 2000 | 13024 | 1 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 30 |
| COSTANIGRO, MCCLUSKEY & GOEMANS(2010) | 1 USA | | USA | | 1 | 0 | 0 | 1992 - 2003 | 9261 | 1 | 0 | | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| COSTANIGRO, MCCLUSKEY & MITTELHAMMER(2007) | 1 USA | | USA | | 1 | 0 | 0 | 1991 - 2000 | 13024 | 5 | 0 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 30 |
| COUSIDO(2017) | 4 ESP | | MUNDO | | 0 | 0 | 0 | 2017 | 135 | 12 | 1 | | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 24 |
| COUTO & LIMA(2007) | 1 PRT | | PRT, MUNDO | | 0 | 0 | 0 | 2002 | 14122 | 5 | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 44 |
| CUELLAR & CLAPS(2013) | 1 USA | | | CABERNET, ZINFADAL | 1 | 0 | 0 | 2004 - 2009 | 40320 | 3 | 0 | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| DAHL(2019) | 4 MUNDO | | SWE | | 0 | 0 | 0 | 2002 | 526 | 4 | 1 | | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 35 |
| DAVIS & AHMADI-ESFAHANI(2005) | 1 AUS | | USA | | 0 | 0 | 0 | 2004 | 920 | 1 | 0 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 36 |
| DEFRANCESCO, ESTRELLA ORREGO & GENNARI(2012) | 1 ARG | | USA | | 0 | 0 | 0 | 2009 | 1250 | 2 | 0 | | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 21 |
| DELMAS & GRANT(2014) | 1 USA | | USA | | 0 | 0 | 0 | 1998 - 2005 | 13426 | 22 | 0 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1688 |
| DI VITTORIO & GINSBURGH(1996) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 1980 - 1992 | 29911 | 19 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 122 |
| DIMSON, ROUSSEAU & SPAENJERS(2015) | 1 FRA | | MUNDO, GBR | | 0 | 0 | 0 | 1899-2012 | 9492 | 6 | 0 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 117 |
| DUBOIS & NAUGES(2010) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 1994 - 1998 | 392 | 3 | 0 | | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 21 |
| ESTRELLA ORREGO(2014) | 4 ARG | | USA | | 0 | 0 | 0 | 2011 | 1563 | 2 | 1 | | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 19 |
| FEDOSEEVA(2020) | 1 MUNDO | | RUS | | 0 | 0 | 0 | 2017-2018 | 7701 | 1 | 1 | | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 19 |
| FERRO & AMARO(2018) | 1 MUNDO | | USA | | 0 | 0 | 0 | 2003-2016 | 1222 | 1 | 1 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 398 |
| FLORKOWSKI, CAREW & HE(2008) | 3 ITA | | CAN | | 0 | 0 | 0 | 2002 - 2004 | 1500 | 5 | 0 | | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| FOGARTY(2003) | 1 AUS | | AUS | | 0 | 0 | 0 | 2001 | 262 | 4 | 0 | | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 |
| FOGARTY(2008A) | 4 AUS | | AUS | | 0 | 0 | 0 | 2000 | 262 | 4 | 0 | | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 31 |
| FOGARTY(2008A) | 4 AUS | | MUNDO | | 0 | 0 | 0 | 1989-1990 | 301 | 88 | 0 | | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 32 |
| FOGARTY(2008B) | 4 AUS | | MUNDO | | 0 | 0 | 0 | 1989-1990 | 79 | 176 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 24 |
| FREITAS & CADIMA(2005) | 3 PRT | | DEU | | 0 | 0 | 0 | 2001 | 709 | 1 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 12 |
| FRICK & SIMMONS(2013) | 1 DEU | | DEU | | 0 | 0 | 0 | 1994 - 1997 | 1303 | 4 | 0 | | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 86 |
| GABBERT, SCHAMEL & VON WITZKE(1998) | 2 USA, CHL, AUS | | USA | | 0 | 0 | 0 | 1995-1997 | 543 | 6 | 1 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| GAL(2017) | 3 HUN | | HUN | | 0 | 0 | 0 | 2015 | 2453 | 6 | 0 | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 |
| GALATI, CRESCIMANNO & TINERVA(2017) | 1 ITA | | JPN | | 1 | 0 | 0 | 2014 | 829 | 1 | 0 | | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| GALATI, CRESCIMANNO, ABBRUZZO, CHIRONI & TINERVA(2017) | 1 ITA | | RUS | | 1 | 0 | 0 | 2013 | 2286 | 1 | 0 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| GALATI, TINERVA, TULONE, CRESCIMANNO & RIZZO(2018) | 1 ITA | | CHN | | 1 | 0 | 0 | 2017 | 434 | 1 | 0 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 20 |
| GARCIA ARANCIBIA, DEPETRIS GUIGUET & ROSSINI(2016) | 2 ARG | | ARG | | 1 | 0 | 0 | 2015 | 2911 | 3 | 0 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 11 |
| GARCIA ARANCIBIA, ROSSINI & DEPETRIS GUIGUET(2015) | 1 ARG | | ARG | | 0 | 0 | 0 | 2011 | 1015 | 6 | 1 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 18 |
| GERGAUD(1998) | 1 FRA | | FRA | | 0 | 0 | 1 | 1986 - 1994 | 286 | 1 | 0 | | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 18 |
| GERGAUD(2000) | 4 FRA | | FRA | | 0 | 0 | 1 | 1998 | 891 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 58 |
| GIBBS, TAPIA & WARZYNSKI(2009) | 1 USA, FRA, ESP | | USA | | 0 | 0 | 0 | 1992 - 2006 | 9408 | 12 | 0 | | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 26 |
| GINSBURGH, MONZAK & MONZAK(2013) | 1 FRA | | FRA | | 1 | 0 | 0 | 1991 | 808 | 2 | 1 | | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 54 |
| GOLAN & SHALIT(1993) | 1 USA | | USA | | 1 | 0 | 0 | 1992 | 18 | 2 | 0 | | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| GONCALVES, REBELO, LOURENCO-GOMES & CALDAS(2021) | 1 MUNDO | | AUS | | 0 | 0 | 0 | 2019 | 2063 | 48 | 1 | | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 12 |
| GONZALEZ & MELO(2008) | 1 CHL | | CHL | | 0 | 0 | 0 | 2004 | 214 | 6 | 0 | | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 14 |
| GRIFFIN(2009) | 4 MUNDO | | USA | | 0 | 0 | 1 | 1984 - 2008 | 5974 | 3 | 0 | | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 950 |
| GROGAN(2015) | 1 FRA | | FRA | | 0 | 0 | 0 | 2012 | 542 | 9 | 1 | | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 64 |
| GUSTAFSON, LYBBERT & SUMNER(2011) | 4 USA | | USA | | 0 | 0 | 0 | 2009 | 1474 | 1 | 0 | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| GUSTAFSON, LYBBERT & SUMNER(2016) | 1 USA | | USA | | 0 | 0 | 0 | 2009 | 877 | 1 | 0 | | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| HADJ ALI & NAUGES(2007) | 1 FRA | | MUNDO | | 1 | 0 | 0 | 1983 - 1998 | 1153 | 2 | 0 | | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| HAEGER & STORCHMANN(2006) | 1 USA | | USA | | 0 | 0 | 0 | 1998 - 2003 | 451 | 9 | 0 | | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 95 |
| HAY(2010) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2005 | 51 | 11 | 0 | | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| HAY(2010) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2005 | 50 | 7 | 0 | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| HEKIMOGLU & KAZAZ(2020) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2001-2017 | 626 | 32 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| HOANG, IIDIA, MATSUMOTO, WATANABE & WILSON(2014) | 4 MUNDO | | JPN | | 1 | 0 | 0 | 2012 | 1682 | 6 | 0 | | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 32 |
| HOANG, IIDIA, MATSUMOTO, WATANABE & WILSON(2016) | 1 MUNDO | | JPN | | 1 | 0 | 0 | 2012 | 1682 | 2 | 0 | | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 32 |
| JAEGER & STORCHMANN(2011) | 1 MUNDO | | USA | | 1 | 0 | 0 | 2006-2008 | 82698 | 6 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 55 |
| JIAO(2017) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 1996-2015 | 231 | 28 | 0 | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |

Table A.1. (continued)

| Autor(año) | Tipo de publicación | Origen de los vinos | Mercado de venta | Uvas específicas | Sólo vino tinto | Sólo vino blanco | Sólo vino espumoso | Periodo de la muestra | Número de observaciones | Número de estimaciones | Atributos objetivos directamente observables | Atributos objetivos no observables | Calidad del vino observable | Calidad del vino no observable | Reputación de la bodega observable | Reputación de la bodega no observable | Reputación colectiva observable | Calidad objetiva intrínseca observable | Calidad objetiva intrínseca no observable | Calidad objetiva extrínseca | Entorno intrínseco | Entorno extrínseco observable | Entorno extrínseco no observable | Interacciones | Total variables |
|--|---------------------------|---------------------|------------------|--------------------|-----------------|------------------|--------------------|-----------------------|-------------------------|------------------------|--|------------------------------------|-----------------------------|--------------------------------|------------------------------------|---------------------------------------|---------------------------------|--|---|-----------------------------|--------------------|-------------------------------|----------------------------------|---------------|-----------------|
| JONES & STORCHMANN(2001) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 1997 | 15 | 21 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| KEATING(2020) | 1 USA | | USA | | 0 | 0 | 0 | 2004-2013 | 5017 | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| KUGLER & KUGLER(2010) | 4 FRA | | CHE | | 0 | 0 | 0 | 2010 | 26 | 24 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| KWON, LEE, SUMNER(2008) | 4 USA | | USA | | 1 | 0 | 0 | 1995-2001 | 8806 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| KWONG, CYR, KUSHNER & OGWANG(2011) | 1 CAN | | CAN | | 1 | 0 | 0 | 1998-2007 | 337 | 10 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 21 |
| KWONG, OGWANG & SUN(2017) | 1 CAN | | CAN | | 1 | 0 | 0 | 1998 - 2007 | 337 | 4 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 23 |
| LONDON & SMITH(1997) | 1 FRA | | USA | | 1 | 0 | 0 | 1987 - 1991 | 559 | 12 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 29 |
| LONDON & SMITH(1998) | 1 FRA | | USA | | 0 | 0 | 0 | 1989 - 1990 | 302 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 19 |
| LECOCQ & VISSER(2001) | 3 FRA | | FRA | | 0 | 0 | 0 | 2000 | 255 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | |
| LECOCQ & VISSER(2006) | 1 FRA | | FRA | | 0 | 0 | 0 | 1992 | 519 | 3 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | |
| LECOCQ & VISSER(2006B) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 1994 - 2003 | 1615 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 7 | |
| LEE & SUMNER(2013) | 2 USA | | USA | | 0 | 0 | 1 | 1981 - 2006 | 1352 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 10 | |
| LEVAGGI & BRENTARI(2014) | 1 ITA | | ITA | | 1 | 0 | 0 | 2005 - 2009 | 696 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 31 |
| LI, GOMEZ, ROSS & CHADDAD(2019) | 1 USA | | USA | | 0 | 0 | 0 | 2012 | 233 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 32 |
| LIANG(2018) | 3 USA | | USA | | 0 | 0 | 0 | 2016 | 542 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 18 |
| LIMA(1999) | 3 USA | | USA | | 0 | 0 | 0 | 1995 | 807 | 27 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| LIMA(2006) | 1 USA | | USA | | 0 | 0 | 0 | 1995 | 1884 | 7 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| LING & LOCKSHIN(2003) | 1 AUS | | AUS | | 0 | 0 | 0 | 1999 | 1880 | 5 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 22 |
| LUTZEYER(2008) | 4 ZAF | | ZAF | | 1 | 0 | 0 | 2005-2007 | 260 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 34 |
| MARONGIU(2011) | 1 ITA | | ITA | | 0 | 0 | 0 | 2007 | 294 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 15 |
| MASSET, WEISSKOPF & COSSUTTA(2015) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2003 - 2012 | 674 | 25 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | |
| MASSET, WEISSKOPF, FAYE & LE FUR(2016) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2007 - 2014 | 92538 | 3 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 87 |
| MELO, BUZETA & MARSHALL(2005) | 1 CHL | | CHL | | 0 | 0 | 0 | 2003 | 576 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 117 |
| MENIVAL & CHARTERS(2008) | 3 FRA | | MUNDO | | 0 | 0 | 1 | 2007 | 118 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 12 |
| MENIVAL & CHARTERS(2014) | 1 FRA | | FRA | | 0 | 0 | 1 | 2009 | 410 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| MICHIS & MARKIDOU(2012) | 1 CYP | | CYP | | 0 | 0 | 0 | 2004 - 2008 | 5586 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 130 |
| MILLER, GENC & DRISCOLL(2007) | 1 USA | | USA | CABERNET SAUVIGNON | 1 | 0 | 0 | 2001 | 163 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| MILLER, STONE & STUEN(2015) | 1 USA | | USA | CABERNET SAUVIGNON | 0 | 0 | 0 | 1996-2005 | 2450 | 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 16 |
| MIU(2001) | 1 MUNDO | | USA | | 0 | 0 | 0 | 1995 - 2000 | 5356 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 144 |
| MORA & LIVAT(2013) | 1 FRA | | MUNDO | | 0 | 0 | 0 | 2009 | 127 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 23 |
| MORILLA & MARTINEZ(2002) | 1 ESP | | ESP | | 0 | 0 | 0 | 1999 - 2000 | 1616 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 125 |
| MUELLER & SZOLNOKI(2010) | 3 MUNDO | | USA | | 1 | 0 | 0 | 2007 - 2008 | 1166 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 36 |
| MUELLER & SZOLNOKI(2012) | 1 MUNDO | | USA | | 1 | 0 | 0 | 2007 - 2008 | 1168 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 64 |
| NERLOVE(1995) | 1 MUNDO | | SWE | | 0 | 0 | 0 | 1989 - 1991 | 235 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 20 |
| NIKLAS & RINKE(2020) | 1 DEU | | DEU | RIESLING | 0 | 0 | 0 | 2015 | 8335 | 23 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 11 |
| NOEV(2005) | 1 BGR | | BGR | | 0 | 0 | 0 | 2000 | 233 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| NUNEZ(2014) | 4 ESP | | ESP | | 0 | 0 | 0 | 2014 | 3967 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| OCZKOWSKI(1994) | 1 AUS | | AUS | | 0 | 0 | 0 | 1991 - 1992 | 1604 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 105 |
| OCZKOWSKI(2001) | 1 AUS | | AUS | | 0 | 0 | 0 | 1999-2000 | 276 | 14 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| OCZKOWSKI(2010) | 1 AUS | | AUS | | 0 | 0 | 0 | 2007 | 6497 | 4 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 230 |
| OCZKOWSKI(2016) | 1 AUS | | AUS | | 0 | 0 | 0 | 2014 | 3929 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 11 |
| OCZKOWSKI(2016A) | 1 AUS | | AUS | | 0 | 0 | 0 | 2014 | 2496 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| OCZKOWSKI(2016B) | 1 AUS | | AUS | | 0 | 0 | 0 | 2013 | 786 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 41 |
| OCZKOWSKI(2016D) | 1 AUS | | AUS | CABERNET SAUVIGNON | 0 | 0 | 0 | 2014 | 690 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 |
| OCZKOWSKI(2018) | 1 AUS | | AUS | | 0 | 0 | 0 | 2015-2016 | 1268 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 |
| OCZKOWSKI(2018) | 1 AUS | | AUS | SAUNIGNON BLANC | 0 | 0 | 0 | 2011 | 396 | 21 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 20 |
| OCZKOWSKI(2019) | 1 AUS | | AUS | | 0 | 0 | 0 | 2016 | 1907 | 31 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| OCZKOWSKI & PAWSEY(2019) | 1 AUS | | AUS | | 0 | 0 | 0 | 2017 | 771 | 15 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 49 |
| ORTUZAR & ALFRANCA(2010) | 1 CHL | | CHL | | 0 | 0 | 0 | 2004 - 2006 | 154943 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 28 |
| PANZONE(2011) | 1 RUS, MKD, BGR, ROU, HUN | | GBR | | 0 | 0 | 0 | 2006 | 134 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 26 |
| PANZONE & SIMOES(2009) | 1 PRT | | PRT | | 0 | 0 | 0 | 2007 | 302 | 5 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 24 |
| PAROISSIEN & VISSER(2020) | 1 FRA | | FRA | | 0 | 0 | 0 | 2006-2016 | 16399 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| PAVESE & ZANOLA(2008) | 4 ITA | | ITA | | 0 | 0 | 0 | 2007 | 3660 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 23 |
| PENNERSTORFER, WEISS & HUBER(2017) | 3 AUT | | AUT | | 0 | 0 | 0 | 2004-2007 | 7403 | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 397 |
| PENNERSTORFER, WEISS & HUBER(2019) | 4 AUT | | AUT | | 0 | 0 | 0 | 2004-2007 | 7355 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 390 |
| PERZA(2010) | 4 ESP | | ESP | | 0 | 0 | 0 | 2009 | 1006 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 62 |
| PIQUERAS(2014) | 4 ESP | | ESP | | 0 | 0 | 0 | 2011 | 494 | 11 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |

Table A.1. (continued)

| Autor(año) | Tipo de publicación | Origen de los vinos | Mercado de venta | Uvas específicas | Sólo vino tinto | Sólo vino blanco | Sólo vino espumoso | Periodo de la muestra | Número de observaciones | Número de estimaciones | Atributos objetivos directamente observables | Atributos objetivos no observables | Calidad del vino observable | Calidad del vino no observable | Reputación de la bodega observable | Reputación de la bodega no observable | Reputación colectiva observable | Calidad objetiva intrínseca observable | Calidad objetiva intrínseca no observable | Calidad objetiva extrínseca | Entorno intrínseco | Entorno extrínseco observable | Entorno extrínseco no observable | Interacciones | Total variables |
|--|-------------------------------------|---------------------|------------------|------------------------------------|-----------------|------------------|--------------------|-----------------------|-------------------------|------------------------|--|------------------------------------|-----------------------------|--------------------------------|------------------------------------|---------------------------------------|---------------------------------|--|---|-----------------------------|--------------------|-------------------------------|----------------------------------|---------------|-----------------|
| PRILAIID & VAN RENSBURG(2006) | 1 ZAF | ZAF | ZAF | | 1 | 0 | 0 | 2004 | 537 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| PRILAIID & VAN RENSBURG(2012) | 1 ZAF | ZAF | ZAF | | 1 | 0 | 0 | 2007 | 896 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| PRILAIID & VAN RENSBURG(2012B) | 1 ZAF | ZAF | ZAF | | 1 | 0 | 0 | 2007 | 896 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| RABKIN & BEATTY(2007) | 1 CAN | CAN | CAN | | 0 | 1 | 0 | 2002-2004 | 5433 | 8 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 37 |
| RAMIREZ(2008) | 1 USA | USA | USA | CABERNET SAUVIGNON | 0 | 0 | 0 | 1970-2004 | 5714 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 8 |
| RAMIREZ(2010) | 1 USA | USA | USA | CABERNET SAUVIGNON | 0 | 0 | 0 | 2000-2006 | 2623 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 7 |
| REBELO, LOURENCO-GOMES, GONCALVES & CALDAS(2019) | 1 PRT | PRT | PRT | | 0 | 0 | 0 | 2017 | 1722 | 8 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| RITCHIE(2011) | 4 USA, CAN, AUT, FRA, DEU, NZL | USA | USA | RIESLING | 0 | 0 | 0 | 1997-2009 | 2809 | 3 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 22 |
| ROBERTO, LOPES & BELFIORE(2009) | 1 BRA, ARG, CHL | BRA | BRA | | 0 | 0 | 0 | 2008 | 229 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| ROBERTS & REAGANS(2007) | 1 AUS, NZL, ARG, CHL, ZAF, CAN, ISR | USA | USA | | 0 | 0 | 0 | 1987-2001 | 8892 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 11 |
| RODRIGUEZ AVENDAÑO & CASTILLO VALERO(2009) | 1 ESP | ESP | ESP | | 1 | 0 | 0 | 2007 | 147 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 40 |
| ROMA, DI MARTINO & PERRONE(2013) | 1 ITA | ITA | ITA | | 0 | 0 | 0 | 2010 | 558 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 58 |
| ROSSEL & BECKERT(2013) | 1 DEU | DEU | DEU | | 0 | 0 | 0 | 2007 | 1890 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 8 |
| ROSSETTO & GALLETTO(2019) | 1 ITA | ITA | ITA | | 0 | 1 | 0 | 2013 | 420 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 31 |
| ROWLAND(2013) | 1 NZL | USA | USA | | 0 | 0 | 0 | 1995-2012 | 492 | 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SAN MARTIN, TRONCOSO & BRUMMER(2008) | 1 ARG | USA | USA | | 0 | 0 | 0 | 1977-2005 | 1102 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 40 |
| SCHAMEL(2000) | 4 USA, AUS, CHL, ZAF | USA | USA | | 0 | 0 | 0 | 1998 | 578 | 6 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 13 |
| SCHAMEL(2002) | 3 USA | USA | USA | | 0 | 0 | 0 | 2001 | 19583 | 15 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| SCHAMEL(2003B) | 3 AUS, NZL, ARG, CHL, ZAF, USA | USA | USA | | 0 | 0 | 0 | 1990-2001 | 3055 | 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 27 |
| SCHAMEL(2003C) | 1 DEU | DEU | DEU | | 0 | 0 | 0 | 2001 | 4141 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 27 |
| SCHAMEL(2004) | 3 FRA | DEU | DEU | | 1 | 0 | 0 | 2003 | 2133 | 3 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| SCHAMEL(2006) | 1 MUNDO | USA | USA | | 0 | 0 | 0 | 2003 | 5420 | 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 40 |
| SCHAMEL(2009) | 1 MUNDO | USA | USA | | 0 | 0 | 0 | 1999-2002 | 39041 | 9 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 48 |
| SCHAMEL(2011) | 3 MUNDO | USA | USA | | 0 | 0 | 0 | 1995-2010 | 43446 | 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 48 |
| SCHAMEL(2018) | 3 ITA | ITA | ITA | | 0 | 0 | 0 | 2016 | 1265 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 19 |
| SCHAMEL & ANDERSON(2001) | 4 AUS | AUS | AUS | | 0 | 0 | 0 | 1992-1998 | 4584 | 15 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| SCHAMEL & ANDERSON(2003) | 1 AUS | AUS | AUS | | 0 | 0 | 0 | 2000 | 429 | 31 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| SCHAMEL, GABBERT & VON WITZKE(1998) | 2 USA, FRA, AUS, CHL | USA | USA | | 0 | 0 | 0 | 1994 | 305 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| SCHAUFEL, HERRMANN & SZOLNOKI(2016) | 1 DEU | DEU | DEU | | 0 | 0 | 0 | 2013 | 3995 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 33 |
| SCHROETER, RITCHIE & RICKARD(2011) | 1 USA, CAN, AUT, FRA, DEU, NZL | USA | USA | RIESLING | 0 | 0 | 0 | 1997-2009 | 2809 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 36 |
| SCOTT MORTON & PODOLNY(2002) | 1 USA | USA | USA | | 0 | 0 | 0 | 1980-1990 | 8223 | 5 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 49 |
| SECCIA, CARLUCCI, MAGGI & NARDONE(2014) | 3 ITA | ITA | ITA | | 0 | 0 | 0 | 2012-2013 | 589 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| SECCIA, CARLUCCI, SANTERAMO, SARNARI & NARDONE(2017) | 3 ITA | ITA | ITA | | 0 | 0 | 0 | 2008-2013 | 2280 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| SELLERS-RUBIO, MAS-RUIZ & SANCHO-ESPER(2017) | 1 ESP | ESP | ESP | | 0 | 0 | 0 | 1999-2013 | 6956 | 4 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 10 |
| SHANE, MURAD, FREEMAN(2018) | 1 AUS | GBR | GBR | | 1 | 0 | 0 | 2017 | 713 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| STEINER(2001) | 1 AUS | GBR | GBR | | 0 | 0 | 0 | 1994 | 14440 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 59 |
| STEINER(2002) | 3 MUNDO | GBR | GBR | | 0 | 0 | 0 | 1994 | 14440 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 59 |
| STEINER(2004A) | 1 AUS | GBR | GBR | | 0 | 0 | 0 | 1994 | 1495 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 40 |
| STEINER(2004B) | 1 FRA | GBR | GBR | | 0 | 0 | 0 | 1994 | 7062 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 36 |
| STEINER(2009) | 4 ESP | GBR | GBR | | 0 | 0 | 0 | 1994 | 1067 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 25 |
| STORCHMANN, MITTERLING & LEE(2012) | 4 USA | USA | USA | | 0 | 0 | 0 | 1984-2008 | 44808 | 7 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| THRANE(2004) | 1 FRA | NOR | NOR | | 1 | 0 | 0 | 2004 | 161 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| THRANE(2009) | 1 DEU, FRA | NOR | NOR | | 0 | 1 | 0 | 2007 | 212 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 13 |
| TRONCOSO & AGUIRRE(2006) | 1 CHL | USA | USA | | 0 | 0 | 0 | 1989-1990 | 140 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| VAN RENSBURG & PRILAIID(2004) | 1 ZAF | ZAF | ZAF | CABERNET SAUVIGNON, MERLOT, SHIRAZ | 0 | 0 | 0 | 1993-2001 | 1501 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| VITA, CARACCILOLO, CEMBALO, POMARICI & DAMICO(2015) | 1 ITA | ITA | ITA | | 0 | 0 | 0 | 2011 | 5192 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 8 |
| WADE(1999) | 1 AUS | AUS | AUS | | 0 | 0 | 0 | 1997 | 875 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 26 |
| WALDROP, MCCLUSKEY & MITTELHAMMER(2017) | 1 USA | USA | USA | | 0 | 0 | 0 | 1984-1993 | 5387 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| WOOD & ANDERSON(2006) | 1 AUS | AUS | AUS | | 0 | 0 | 0 | 1992 | 27 | 24 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 6 |
| YANG, MCCLUSKEY & BRADY(2012) | 1 USA | USA | USA | | 1 | 0 | 0 | 1995-2005 | 79 | 4 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| YOO, FLORKOWSKI & CAREW(2011) | 1 ARG, BGR, CHL, HRV, HUN | CAN | CAN | | 1 | 0 | 0 | 2002-2004 | 19439 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 82 |
| ZHAO(2008) | 1 USA | USA | USA | | 0 | 0 | 0 | 1984-2002 | 4856 | 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 36 |
| ZHAO(2009) | 1 USA | USA | USA | | 0 | 0 | 0 | 2004 | 5652 | 6 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 |

Table A.2 Main authors of articles with estimations of hedonic price functions in wine markets (*)

| Autor | Estimations | Articles |
|-----------------------|--------------------|-----------------|
| Abraben | 34 | 2 |
| Anderson | 70 | 3 |
| Ashenfelter | 27 | 4 |
| Berrios | 28 | 2 |
| Brentari | 11 | 4 |
| Caldas | 60 | 3 |
| Cardebat | 38 | 4 |
| Carew | 17 | 5 |
| Cossuta | 25 | 1 |
| Faye | 26 | 3 |
| Figuet | 27 | 3 |
| Florkowski | 17 | 5 |
| Fogarty | 272 | 4 |
| Galati | 4 | 4 |
| Gonçalves | 56 | 2 |
| Hekimoglu | 32 | 1 |
| Jiao | 28 | 1 |
| Jones | 26 | 2 |
| Kazaz | 32 | 1 |
| Kugler | 48 | 1 |
| Le Fur | 26 | 3 |
| Lecoq | 14 | 5 |
| Levaggi | 11 | 4 |
| Lima | 39 | 3 |
| Lourenço-Gomes | 56 | 2 |
| Masset | 28 | 2 |
| McCluskey | 19 | 6 |
| Oczkowski | 110 | 11 |
| Priilaid | 15 | 4 |
| Ramirez | 30 | 2 |
| Rebelo | 60 | 3 |
| Saens | 28 | 2 |
| Schamel | 100 | 13 |
| Smith | 25 | 4 |
| Steiner | 6 | 5 |
| Storchmann | 60 | 6 |
| Sumner | 6 | 4 |
| Van Rensburg | 15 | 4 |
| Visser | 20 | 6 |
| Weisskopf | 28 | 2 |

Authors with more than 25 estimations or more than 4 articles

Table A.3 Main origins and sales markets used in the estimation of hedonic price functions for wine

A.3.1 Wine origins

| Wine origins | Estimations | Articles |
|--|--------------------|-----------------|
| Australia | 540 | 38 |
| France | 398 | 53 |
| USA | 270 | 46 |
| Italy | 139 | 36 |
| World | 127 | 19 |
| Chile | 93 | 17 |
| Spain | 82 | 15 |
| New Zealand | 77 | 13 |
| Argentina | 70 | 13 |
| Germany | 68 | 12 |
| South Africa | 59 | 12 |
| Canada | 30 | 7 |
| Portugal | 26 | 7 |
| Austria | 23 | 6 |
| Bulgaria | 10 | 3 |
| Hungary | 10 | 3 |
| Other countries analysed: Brazil, Cyprus, Croatia, Denmark, Israel, Macedonia, Romania, Russia, and Slovenia | | |

At least 10 estimations and more than 2 articles

A.3.2. Wine sales markets

| Markets | Estimations | Articles |
|--|--------------------|-----------------|
| World | 499 | 25 |
| USA | 398 | 70 |
| Australia | 194 | 21 |
| Italy | 96 | 28 |
| France | 72 | 15 |
| Germany | 60 | 11 |
| New Zealand | 41 | 5 |
| Canada | 38 | 8 |
| Spain | 37 | 8 |
| Switzerland | 24 | 1 |
| Portugal | 22 | 6 |
| UK | 22 | 10 |
| Norway | 17 | 4 |
| South Africa | 17 | 5 |
| Sweden | 15 | 4 |
| Slovenia | 13 | 1 |
| Chile | 12 | 4 |
| Other countries: Austria, Japan, Argentina, Bulgaria, Brazil, China, Cyprus, Denmark, Hungary, the Netherlands, Russia | | |

At least 10 estimations and more than 2 articles

Table A.4 Main sources of information used in the estimation of hedonic price functions in wine markets

- Used in at least 5 studies

| Source | Country | Type | Estimations | Articles |
|--|---|--|-------------|----------|
| WineSpectator | USA (final market) | Critics' ratings | 307 | 57 |
| Own sources (*) | Several | Several | 279 | 55 |
| Robert Parker | USA (final market) | Critics' ratings | 154 | 16 |
| Australian Wine Companion - Halliday | Australia (origin and final market) | Critics' ratings | 139 | 15 |
| Nielsen | Several (final market) | Scanning | 48 | 9 |
| WineSearcher | Several (final market) | Super search engine, online retail sales | 30 | 8 |
| British Columbia Liquor Distribution Branch | British Columbia, Canada (final market) | Public monopoly on alcohol distribution | 25 | 6 |
| Penguin Good Australian Wine Guide (Shield & Meyer, Hooke & Shield, Hooke, etc.) | Australia (origin and final market) | Critics' ratings | 20 | 6 |
| Il vini di Veronelli | Italy (origin and final market) | Critics' ratings | 11 | 6 |
| Duemila Vini (Associazione Italiana Sommelier) | Italy (origin and final market) | Critics' ratings | 16 | 5 |
| Vini d'Italia (Gambero Rosso) | Italy (origin and final market) | Critics' ratings | 16 | 5 |
| Gault Millau | Germany (origin and final market) | Critics' ratings | 39 | 5 |
| Institut National de la Consommation | France (origin and final market) | Critics' ratings | 13 | 5 |
| Platter's Southafrican Wine Guide (John Platter) | South Africa (origin and final market) | Critics' ratings | 15 | 5 |
| Wine Magazine | South Africa (origin and final market) | Critics' ratings | 15 | 5 |

(*) This refers to the use of authors' own surveys to obtain information about wines (prices and attributes) and/or other additional features such as meteorological, soil, sensory characteristics, etc.

Table A.4 (continued)

- **Used in at least 25 estimations (in addition to the previous ones)**

| Source | Country | Type | Estimations | Articles |
|--|---|--------------------------------------|-------------|----------|
| Langton's | Australia (origin) | Auctions | 301 | 4 |
| Liv-Ex | France (origin) | Auctions | 60 | 2 |
| MeteoFrance | France (origin) | Meteorological data | 56 | 3 |
| California Wine Winners | California, USA (origin and final market) | Critics' ratings. Prizes | 39 | 3 |
| Vinopedia.com | USA (final market) | Price comparison tools, retail sales | 34 | 2 |
| WineTip | USA (final market) | Online retail sales | 34 | 2 |
| Australian Bureau of Meteorology | Australia (origin) | Meteorological data | 32 | 2 |
| International Wine Cellar (Stephen Tanzer) | USA (final market) | Critics' ratings | 29 | 3 |
| Christie's | Several | Auctions | 28 | 3 |
| Cellar Tracker (Eric Levine) | USA (final market) | Critics' ratings | 26 | 2 |
| Wine Enthusiasts | USA (final market) | Online retail sales | 26 | 2 |

Table A.5 Academic journals where different studies estimating hedonic price functions in wine markets have been published

| Publications | Articles | Estimations |
|---|-----------------|--------------------|
| Journal of Wine Economics | 24 | 220 |
| Journal of Wine Research | 8 | 41 |
| International Journal of Wine Business | 6 | 66 |
| Agribusiness | 6 | 16 |
| Applied Economics | 5 | 30 |
| British Food Journal | 5 | 10 |
| Wine Economics and Policy | 4 | 59 |
| Applied Economics Letters | 4 | 20 |
| German Journal of Agricultural Economics | 4 | 14 |
| Economic Record | 3 | 58 |
| Australian Journal of Agricultural and Resource Economics | 3 | 36 |
| Agricultural Economics | 3 | 31 |
| American Journal of Agricultural Economics | 3 | 9 |
| International Journal of Wine Marketing | 3 | 8 |
| Journal of Agricultural Economics | 3 | 8 |
| Wine Industrial Journal | 3 | 8 |
| Canadian Journal of Agricultural Economics | 2 | 12 |
| Agricultural Economics Review | 2 | 10 |
| Food Quality and Preference | 2 | 9 |
| Economía Agraria | 2 | 7 |
| Spanish Journal of Agricultural Research | 2 | 5 |
| Revista Española de Estudios Agrosociales y Pesqueros | 2 | 3 |

ANNEX B

Table B.1 presents the results of hedonic price function estimations using different functional forms, where only quality is used as an attribute. The table shows the estimated expressions and the underlying price equation for each of them, as well as the corresponding price elasticity and semi-elasticity expressions for a generic attribute. The wine sample was obtained from the *Guía Gourmets de Vinos de España* (GGVE) for the year 2016⁷, containing evaluations of quality on a 100-point scale. The originally estimated coefficients in these expressions show significant differences. However, after computing the indicators that hold a

⁷ In particular, this is a sample of 1,183 wines included in the GGVE with quality ratings on a 100-point scale. The average price is €17.73 (standard deviation of €15.26) and the average quality is 88.83 (4.36).

genuine economic interpretation and measure the magnitude of the effect calculated on the average (namely, elasticity or semi-elasticity), the resulting figures exhibit no significant statistical differences.

Table B.1 Relationship between the different functional forms used in the estimation of hedonic price functions

| Functional form | Log-Log | Log-Lin | Lin-Lin | Box-Cox-Lin $\lambda = -0.5$ |
|--|------------------------------------|--------------------------------|----------------------------|--|
| Estimated expression | $\ln p = \alpha_1 + \beta_1 \ln x$ | $\ln p = \alpha_2 + \beta_2 x$ | $p = \alpha_3 + \beta_3 x$ | $\frac{p^\lambda - 1}{\lambda} = \alpha_4 + \beta_4 x$ |
| Price equation | $p = e^{\alpha_1} x^{\beta_1}$ | $p = e^{\alpha_2} x^{\beta_2}$ | $p = \alpha_3 + \beta_3 x$ | $p = [\lambda(\alpha_4 + \beta_4 x) + 1]^{1/\lambda}$ |
| Price elasticity of x | β_1 | $\beta_2 x$ | $\beta_3 \frac{x}{p}$ | $\beta_4 \frac{x}{p^\lambda}$ |
| Price semi-elasticity of x | $\frac{\beta_1}{x}$ | β_2 | $\beta_3 \frac{1}{p}$ | $\frac{\beta_4}{p^\lambda}$ |
| | Example | | | |
| $\hat{\beta}$ | 8.99*** (0.3502) | 0.1012*** (0.0039) | 1.9144*** (0.0852) | 0.0274*** (0.0011) |
| Elasticity of x (calculated on the average) | 8.9987*** | 8.9894*** | 9.5909*** | 10.2485*** |
| Semi-elasticity of x (calculated on the average) | 0.1013*** | 0.1012*** | 0.1080*** | 0.1154*** |

*** Statistically significant at the 99% significance level.

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