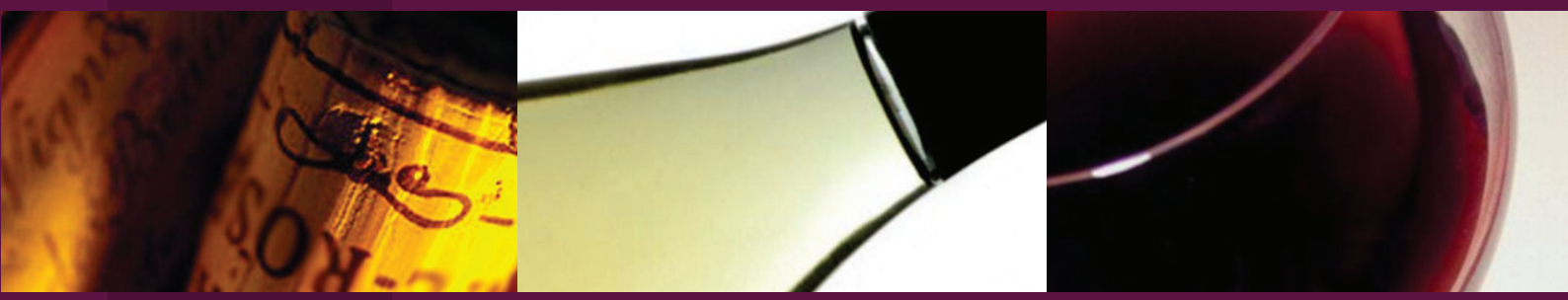
WEP

Wine Economics and Policy



Production and hosting by
FIRENZE UNIVERSITY PRESS

Volume 14 Issue 1 june 2025 ISSN 2213-3968

Wine Economics and Policy

Volume 14, Issue 1 – 2025

Firenze University Press

Wine Economics and Policy is an international, peer reviewed and open access journal published by UniCeSV – Centre for the Strategic Development of the Wine Sector, University of Florence.
The mission of the journal is to provide an environment for academic researchers and business professionals around the world to work together in the fields of wine economics and policy in order to deal with the current and future issues of the wine sector.

Contacts:
Scientific Manager:
Veronica Alampi Sottini
email: wepjournal@fup.unifi.it
Department of Agriculture, Food, Environment and Forestry (DAGRI) – University of Florence
P.le delle Cascine, 18 – 50144 Florence (I)

Editor in-Chief
Nicola Marinelli,
email: nicola.marinelli@unifi.it
Department of Agriculture, Food, Environment and Forestry (DAGRI) – University of Florence
P.le delle Cascine, 18 – 50144 Florence (I)

Published by Firenze University Press

Firenze University Press
Università degli Studi di Firenze
via Cittadella, 7, 50144 Firenze, Italy
www.fupress.com

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Zanchini, R., Blanc, S., Theodorakis, S., Di Vita, G., Merlino, V. M., Brun, F. & Massaglia, S. (2025). How European consumers value wine credence attributes: a cross-country comparison of France, Greece and Italy. *Wine Economics and Policy* 14(1): 3-15. doi: 10.36253/wep-15235

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

How European consumers value wine credence attributes: a cross-country comparison of France, Greece and Italy

Raffaele Zanchini[1], Simone Blanc[1]*, Stefanos Theodorakis[1], Giuseppe Di Vita[2], Valentina Maria Merlino[1], Filippo Brun[1], Stefano Massaglia[1]

[1] *Department of Agricultural, Forest and Food Science (DISAFA), University of Turin, Grugliasco, Italy*
[2] *Department of Agriculture Food and Environment (Di3A), University of Catania, Italy*
*Corresponding author. Email: simone.blanc@unito.it

Abstract. Several attributes can be used to differentiate wine products to meet consumer interest and thus increase producer visibility, attractiveness and revenues. Perception of the same attribute may depend on various factors that characterise the subjects, such as individual, behavioural and situational characteristics, like their country of origin. This study aims to identify which credence attributes and related levels motivate consumers the most to buying wine, by comparing the results obtained in three different European countries: France, Greece and Italy. A conjoint experiment based on linear assumption was administered using price, production method, Geographical Indications (GIs) and wine origin as product attributes. The conjoint data were analysed in three steps: performing a model with the whole sample; performing three models using national data to compare results between the countries; and performing a cluster analysis using the Ward method to associate consumer characteristics with product attributes. Results show that wine origin is the most valued attribute for choosing wine, followed by the production method. Cross-country evaluation reveals several significant differences among the attributes of the production method, geographical indication and origin. The cluster analysis identified three groups named: Higher-priced and nation-specific wine seekers; Certification seekers and Price-sensitive consumers. This paper provides several implications for both academicians and enterprises. Indeed, it is the first evaluation comparing the role given by consumers to biodynamic certification in a cross-country evaluation. Several indications are also provided for producers who can help differentiate better wine production by earning a higher income.

Keywords: wine consumption, organic, geographical indications, biodynamic, conjoint analysis.

1. INTRODUCTION

Producers adopt several strategies to differentiate wine production with the aim of reaching new market segments and gaining consumer attention. Among the strategies, communicating valuable credence characteristics of

products can help producers mitigate asymmetric information by increasing consumer awareness and consequently obtain proper income from product sales [1,2]. Following this line, wineries have adopted various certification schemes, either related to product sustainability, such as organic certification, or to geographical indications (GIs), such as protected designation of origin (PDO) or protected geographical indication (PGI) [3].

Focusing on geographical indications, which are regulated by Regulation (EU) No 1308/2013 of the European Parliament and of the Council, Europe has seen a greater spread of PDO wines compared to PGI ones [4]. In the literature, different aspects of GI wine consumption have been assessed, as well as the importance attached by consumers to these certifications [5]. In fact, a recent paper indicates that PDO certification provides positive utility to consumers and can be considered as a driving attribute of consumer decision-making [6]. PGI wines are preferred to ones without GIs, however these products are considered to be at an intermediate level compared to PDO products and consumption determinations may change, particularly those related to consumer habits, such as the purchasing channel [7].

The study of the importance of GI for consumer choice was also conducted in a cross-country analysis that showed the high relevance of this attribute for wine choice in the total sample, showing, however, heterogeneous perception when comparing selected markets (Italy, USA, UK) [8].

[9] conducted a study among Colombian wine consumers highlighting how appellation of origin, nutritional information, and health warnings are key aspects in conveying a positive perception of product quality. Although criteria related to the production system seem to be less important for consumer choice [10], organic certification plays a discriminating role in wine consumer decision-making [11].

Organic certification was first regulated by Council Regulation (EC) No 834/2007, later amended by Implementing Regulation (EU) No 203. Certification can be considered an effective differentiation tool; indeed, consumers show a positive attitude towards organic wine and are more willing to pay for it [12]. In addition, when the attribute is compared with other characteristics, it gains high importance and can be considered a discriminating driver of wine consumption [13]. A recent study showed that consumers have a heterogeneous attitude towards organic certification; although there is an important market niche willing to buy organic wine [14]. Sillani et al. [15] also showed that information on organic production methods, together with the grape variety, were two of the most important attributes, followed by price, for the heterogeneous sample of buyers considered. Among the certifications related to sustainability aspects, a recent study analysed consumer preferences for wine certified for sustainability, comparing the behaviour of US and Italian consumers and highlighting divergent attitudes between consumers in the two countries [16]. Demeter certification can be used in wine to indicate a product developed using biodynamic practices [17]. Biodynamic agriculture is based on the theory of anthroposophy and was founded by R. Steiner in 1924, who identified this method as a possible response to the increase in chemical inputs in agriculture [18]. Biodynamic agriculture also refers to philosophical concepts, a holistic approach to agriculture and agronomic practices that have not been scientifically verified; therefore, this method is considered more of a belief or spiritual approach than a cultivation technique [19]. In this paper, we do not wish to delve into the claims and cultivation practices prescribed by the Biodynamic method of cultivation. However, given the objective possibility of applying Demeter certification to wines to differentiate products, it is necessary to assess whether there is a niche of interested consumers and what characteristics they have. To do this, a recent study [20] evaluated consumer willingness to pay (WTP) by comparing conventional, organic, and biodynamic certifications. The authors observed that consumers expressed a positive WTP for biodynamic wine, which was higher than for conventional and lower than for organic wine.

The origin of the product was also found to be able to guide consumer choices. In a conjoint analysis study, different wine origins provided different levels of utility; in particular, wine produced in countries known as typical producers was rated higher [21]. In Spanish regions, origin was considered an important attribute; however, by segmenting the original sample of consumers, a portion of individuals preferred inexpensive wine to locally produced wine, while consumers in Madrid rated locally produced wine higher [22]. In Italy, consumers were clustered, allowing researchers to identify different groups interested in specific wine characteristics, including local origin [23]. The origin of wine can be extremely important, since export may represent a significant share of producers' revenues [24].

Another important aspect of wine consumption is that consumer preferences towards product attributes can change depending on their origin. For example, in a cross-country analysis, [25] found that Italian consumers were the most interested in price, while US respondents were the least. Further indications of the importance of consumers origin were suggested by [26], who found that Nova Scotia respondents valued price and region of

origin more than Canadians. These results are significant as they indicate that a considerable amount of the variability in consumers' choices arises from their origin. In another cross-country analysis conducted by Perrouty et al. [27] considering France, Austria, Germany and the United Kingdom, the region of origin emerged as the most important attribute for wine selection, both for expert and regular consumers in all the considered countries. Therefore, cross-country comparisons are needed to get a clearer picture of the role of wine attributes. Conversely, in the same study, comparing expert and regular consumers, the price perception changed between the two groups. In fact, moving on to price, this attribute can also be considered an important factor in consumer choices, as those concerned about price were less willing to pay for organic wine [28]. Regarding the quantification of the utility derived from price attribute levels, unlike other food products where price is predominant [29], in the case of wine it may also be a secondary attribute [30].

1.1 Objectives and research questions

Considering the importance of product valorisation and the need to market better products based on communicating the quality characteristics of wine, the general aim of this study is to identify which credence attributes and attribute levels are most valued by consumers in three different countries of the European Union and to compare the results across these countries. The wine attributes price, production method, geographical indication and product origin were chosen to be compared using a conjoint experiment.

The general aim was analysed in depth through the following research questions:

1) Which wine attributes and attribute levels are most valued by European consumers?
2) Are there differences in the perception of wine characteristics by consumers in different EU countries?
3) Is it possible to segment European consumers according to different wine attributes and attribute levels?

This study enables a better understanding of the factors that drive consumers towards wine consumption. In particular, by developing a cross-country evaluation, it will be possible to understand how preferences differ in various European countries and thus gain deeper insights regarding the role of the selected credence attributes in wine differentiation. Furthermore, to the best of our knowledge, this article is the first attempt to compare consumer interest in biodynamic certification as a production method in a cross-country evaluation. As for the other attributes, this is the first time they are combined, analysed and compared in a study involving France, Greece and Italy.

Following the introductory section, the article is organised into four parts: Methodology, in which data collection, conjoint experiment and inferential statistics are addressed; Results, in which the results are explained; Discussion, which aims to compare the results with the current literature; Conclusion, in which the main findings, implications, limitations and future perspectives of the research are summarised.

2. METHODOLOGY

2.1 Data collection

To collect data on European consumer interests in different aspects of wine consumption, a multi-section survey was developed using Google Forms. The questionnaire consisted of four sections as follows: (1) Conjoint experiment; (2) General wine consumption habits and characteristics; (3) Consumer beliefs regarding intrinsic and extrinsic characteristics of wine; (4) Socio-demographic features of the respondents. Data collection took place in early 2020 by sharing a link generated by Google Forms on several social networks and specialised wine consumption forums found in Greece, France, and Italy. The choice of specialised forums was made to boost the likelihood of collecting data from current wine consumers and thus improve the reliability of the responses. The study focuses on the data of the conjoint experiment and the socio-demographic characteristics that are required to meet the research questions. Regarding the conjoint experiment, a detailed explanation will be provided in a specific methodology sub-section; while in the other sections, questions were asked using binary questions (yes/no) and on a 5-points Likert scale. A total of 506 questionnaires were collected and used for statistical processing after a consistency check of the answers. Indeed, as a preliminary step to data analysis, a data cleaning process was performed in which variables were coded and missing values and inconsistent values, defined as out-of- Likert scale values, were searched for. In fact, responses presenting inconsistent values were dropped because they were considered unreliable due to the possible low cognitive effort used by the respondent. Missing values were also discarded. A total of 592 records were present in the first database from which 86 responses were removed, representing approximately 14.5%. The socio-demographic characteristics of the respondents located in the cleaned database are shown in Table 1. Details on the composition of the sample are

Table 1. Characteristics of the sample (n = 506).

Variables	Items	Frequency	Percent
Gender	Male	279	55.14
	Female	227	44.86
Age	18-35	293	57.91
	36-50	122	24.11
	over 50	91	17.98
Family members	1-2	208	41.11
	3-4	241	47.63
	>4	57	11.26
Education	Middle school	14	2.77
	High school	95	18.77
	University degree	212	41.90
	Postgraduate	185	36.56
Income	Up to 1000€/month	54	10.67
	1001-2000	131	25.89
	2001-3000	108	21.34
	3001-4000	69	13.64
	>4000	62	12.25
	No answers	82	16.21
Countries	Italy	178	35.18
	France	184	36.36
	Greece	144	28.46

described in the Annex 1, which shows an equal distribution across countries, gender and age; also reporting a comparison with the 2020 Census of the population of the three countries, which highlights the limitations of socio-demographic representativeness of the sample, considering the difficulty of interviewing consumers in a pandemic period.

2.2 Conjoint analysis

A conjoint experiment based on the linear hypothesis was chosen to assess the value given by consumers to different wine attribute rankings. The study included four wine credence attributes with different levels indicated in table 2. Concerning the selection of price levels, this attribute was selected by direct market analysis conducted in large retail chains and specialized stores in the countries under study: the average price observed during the data collection period was chosen as the central value, while the range was determined with a percentage deviation of 20% [25]. No substantial differences were found between the three considered markets, so it was chosen to use the same price in the survey in the three countries. Another aspect to contemplate concerning the choice of attributes is the introduction of Geographical indication as a general presence of PDO and PGI certifications. This approach aims to derive an average level of utility not specific for these certifications. This choice was developed based on two closely related considerations. The first is a methodological constraint. As noted by [31] , to maximize the reliability of estimates and obtain dependable responses, the number of cards in conjoint ranking experiments should be limited to facilitate the classification task for consumers. In fact, the orthogonal design has proven to be a useful tool for minimizing the number of cards, thereby preserving the reliability of responses and, consequently, the estimates [32]. However, if the GI attribute had been considered with three levels, the minimum number of cards would have increased, thus making the classification task more challenging for consumers. The second consideration is related to the novelty of the product. Given the model constrictions in terms of number of cards and considering the novelty derived from the introduction of the biodynamic certification, GIs were treated as an attribute with two levels, while the production method had three, facilitating comparison among conventional, organic, and biodynamic.

The model yields a variety of valuable insights into consumer preferences, including the mean relative importance for food attributes as a weight of attribute values [33,34] and part-worth utilities for attribute levels [30]. Moreover, when the linear model is adopted, the part-worth utilities that can be considered as regression coefficients, can be interpreted as marginal probabilities [35]. In this context, the econometric model enabling the estimation of part-worths can be formalised as indicated in Equation 1.

$$y_k = \sum_{j=1}^{J} \beta_j x_{jk} \quad (1)$$

where y_k is the utility perceived by consumers for k-th stimulus represented by the number of cards (k = 1,..., k). β_j the coefficients of the regression that in the ranking conjoint are also considered as utility levels. Finally, x_{jk} represent the variables adopted in the model or the attributes levels as a matrix of dummy variables [36]. Similarly, to other studies [31,37] goodness of fit of the model was evaluated using Person's R and Kendall's Tau which are indicators of the correlation between observed and estimated preferences. Considering the high values obtained, the models were deemed robust for analysing the results.

To determine the best conjoint model to administer, two important issues must be addressed: maximising both the efficiency of the model and the consumer responses [32]. When ranking conjoint analysis based on ordinary least squares (OLS) is used, as in this study, these issues are solved using an orthogonal design [32]. The orthogonal design can be considered the principal

experimental design for maximising the information obtained from product profiles, while avoiding cognitive overload for consumers [31]. An orthogonal design can be derived from a full factorial design, which cannot be used in data collection since the number of profiles represents all possible combinations of attribute levels, generating a defined number of cards that are difficult for consumers to manage [38]. This strategy allows the experiment to be administered to consumers, reducing the cognitive effort required for the task assigned to them, i.e., to rank the cards or products profiles compared to a full factorial design [31,37]. Moreover, generating an orthogonal design produce uncorrelated product profiles, avoiding overlap among attributes levels, preserving model efficiency and solving multicollinearity issues [29]. Based on these considerations, an orthogonal design was applied in the study to the attributes and attribute levels, resulting in nine conjoint cards shown in Table 3. To improve readability, a visual representation of the conjoint cards is presented in Annex 2.

We chose not to describe the attributes used in the experimental design to minimize biases like social desirability and cognitive bias [39]. By avoiding detailed explanations, respondents are more likely to provide genuine evaluations based on their impressions and experiences. This approach is especially relevant for credence attributes, such as the "local" attribute, which underscores the wine's connection to its origin—encompassing terroir, climate, soil, and winemaking traditions. The interpretation of "local" can vary widely, from wines produced within a small village to those from a broader wine region, depending on the individual's knowledge and experience [40]. Local wines are often appreciated for their authenticity and reflection of regional heritage.

Table 2. Attributes and levels adopted in the conjoint analysis.

Attributes	Attribute levels
Price	Low (4.00€/bottle); middle (6.00€/bottle); high (8.00€/bottle)
Production method	Conventional, organic, biodynamic
PDO/PGI	None; yes
Origin	Local, national, imported

Table 3. Card profile used in the conjoint experiment.

Card	Price	Production method	PDO/PGI	Origin
1	High	Organic	None	Local
2	High	Biodynamic	None	National
3	Mid	Conventional	None	National
4	Mid	Biodynamic	Yes	Local
5	Mid	Organic	None	Imported
6	Low	Biodynamic	None	Imported
7	Low	Conventional	None	Local
8	High	Conventional	Yes	Imported
9	Low	Organic	Yes	National

The conjoint analysis was performed twice: the first on the entire sample, to answer the first research question, and the second by dividing the responses according to country of origin, to answer the second research question. The second analysis produced results for each country in which data was collected. To determine whether there were significant differences between the part-worth utilities of the attribute levels, according to the origin of the consumers, the ANOVA model was applied [29].

2.3 Cluster analysis

To answer the third research question, the Conjoint analysis was further explored by applying a cluster analysis based on the Ward method, which enables the development of groups with high within-group homogeneity [41] using squared Euclidean distances between observations [42]. Indeed, the first analysis provides a personal utility pattern for each consumer that can be considered as an individual preference towards the level of attributes employed in the design [30]. These utility patterns can be clustered, obtaining homogeneous groups of consumers [31,34,43]. When cluster analysis is applied, one question should be addressed: which cluster solution should be used? Different strategies can be adopted, but in this study the best cluster solution was evaluated using the Dunn index, which assesses separations among cluster and internal compactness [44]. The highest index value was found for the three-clusters solution. Once the clusters were obtained, the ANOVA model was applied to evaluate significant differences among the utility patterns [30,43]. In addition, the chi-square test was chosen to assess differences in the frequencies of socio-demographic characteristics among clusters [45].

All analyses were performed using IBM SPSS 27, except the best cluster solution, which was performed using the R package NbClust [46].

3. RESULTS

3.1 Conjoint analysis outcomes

Table 4 shows the results obtained from the Conjoint Analysis performed on the whole sample of con-

Table 4. Conjoint results based on whole sample (n=506).

Attributes	Attribute levels	Utility estimate	Mean relative importance
Price	Low price	-0.232	22.48
	Middle price	-0.047	
	High price	0.279	
Production method	Conventional	-0.630	27.40
	Organic	0.617	
	Biodynamic	0.013	
PDO/PGI	None	-0.713	20.66
	DOP/IGP	0.713	
Origin	Local	0.634	29.47
	National	0.283	
	Imported	-0.916	
Constant		5.238	
Goodness of fit of the conjoint analysis	Pearson's R	0.998	
	Kendall's Tau	0.944	

sumers. In terms of the mean relative importance calculated for each attribute among European consumers, wine origin was the most valued, followed by the production method. Price was considered as the third most important attribute, while certification of origin was the last attribute. To gain insights into the role of the attribute level, the evaluation of utility estimation coefficients is required. Starting with price, the results suggest that European consumers prefer higher prices. As for the production method, conventional production results in negative utility, while organic production is preferred by the surveyed sample. Compared to the biodynamic method, the coefficient is close to 0, indicating that this certification is irrelevant. The presence of PDO/PGI certifications is considered an important factor for consumers, as the coefficient is quite high and positive. Finally, imported wine provides negative utility, while national and locally sourced products are appreciated by consumers, especially local wine.

Moving on to the second conjoint analysis, which concerns differences between countries, the results are shown in Table 5. Several significant differences were observed, indicating that various credence wine attributes may be valued differently, depending on the origin of the consumers. Regarding price, the results indicate that Italian consumers are the most interested in this attribute in terms of mean relative importance. However, no significant differences in utility estimates were observed.

Focusing on the production method, consumers from France valued this attribute the most. Significant differences were observed between conventional and organic production. In fact, French consumers are the least interested in conventional production while being the most interested in organic production. Biodynamic production was not significant, but slight differences can be observed where Italian consumers perceived a negative utility from this certification and French consumers perceived the most positive utility.

The presence of a geographical indication is the most valued by Greek consumers, both in terms of mean relative importance and utility estimate. Finally, several significant differences were observed for each level of origin attribute. Local production was preferred by consumers in France, who obtained the highest utility coefficient. Interestingly, Greek consumers are the only group indifferent to local production, obtaining the highest util-

Table 5. Conjoint results based on country preferences.

Attributes	Attribute levels	Utility Italy	Mean	Utility France	Mean	Utility Greece	Mean
Price	Low price	-0.129	24.76	-0.226	21.71	-0.366	20.63
	Middle price	-0.120		-0.031		0.023	
	High price	0.249		0.257		0.343	
Production method	Conventional***	-0.328	26.38	-0.870	29.43	-0.697	26.06
	Organic**	0.468		0.755		0.623	
	Biodynamic	-0.140		0.114		0.074	
PDO/PGI	None *	-0.583	20.93	-0.747	19.90	-0.832	21.28
	DOP/IGP*	0.583		0.747		0.832	
Origin	Local ***	0.781	27.93	1.051	28.96	-0.081	32.03
	National ***	-0.088		0.034		1.058	
	Imported ***	-0.693		-1.085		-0.977	
Constant *		5.194		5.249		5.277	
Goodness of fit of the conjoint analysis	Pearson's R	0.996		1.000		0.997	
	Kendall's Tau	0.944		1.000		0.944	

*,**,*** significant results according to one-way ANOVA. P-value <0.01;0.05;0.001, respectively.

ity from national wine. With regard to imported wine, French consumers considered this attribute as a negative indicator of wine quality more than respondents in other countries, based on the negative utility obtained.

3.2 Cluster analysis outcomes

Cluster analysis was performed on the consumer part-worth utility pattern to achieve a deeper understanding of European consumers based on similarity in attribute preferences and socio-demographic characteristics. ANOVA and chi-square tests, performed on the utility patterns and socio-demographic frequencies respectively, revealed several significant differences. Table 6 shows the results of the cluster analysis in terms of mean relative importance and utility estimates, while Table 7 shows the distribution of socio-demographic data among the clusters.

Table 6. Conjoint results based on cluster analysis.

Attributes	Attribute levels	Utility Cl 1 (n = 80)	Mean	Utility Cl 2 (n = 301)	Mean	Utility Cl 3 (n = 125)	Mean
Price	Low price ***	-1.321	30.82	-0.348	18.78	0.744	26.05
	Middle price ***	0.642		-0.259		0.024	
	High price ***	0.679		0.607		-0.768	
Production method	Conventional***	-0.271	17.26	-1.220	27.81	0.563	32.91
	Organic***	0.208		0.849		0.317	
	Biodynamic ***	0.063		0.371		-0.880	
PDO/PGI	None ***	0.047	14.31	-1.065	22.61	-0.354	20.01
	DOP/IGP ***	-0.047		1.065		0.354	
Origin	Local ***	-0.392	37.61	1.060	30.81	0.264	21.04
	National ***	1.313		0.162		-0.085	
	Imported ***	-0.921		-1.221		-0.179	
Constant ***		4.984		5.355		5.118	
Goodness of fit of conjoint analysis	R di Pearson	0.995		1.000		0.997	
	Tau di Kendall	0.944		1.000		0.944	

*** significant results according to one-way ANOVA. P-value <0.001.

Table 7. Frequency analysis on cluster results.

Variables	Items	Cluster 1	Cluster 2	Cluster 3	p-value
Gender	Male	0.63	0.53	0.55	0.328
	Female	0.38	0.47	0.45	
Age	18-35	0.45	0.59	0.62	0.067*
	36-50	0.28	0.23	0.24	
	over 50	0.28	0.17	0.14	
Family members	1-2	0.41	0.44	0.35	0.507
	3-4	0.48	0.46	0.50	
	>4	0.11	0.10	0.15	
Education	Middle school	0.04	0.03	0.02	0.020**
	High school	0.32	0.17	0.14	
	University degree	0.30	0.45	0.42	
	Postgraduate	0.34	0.35	0.42	
Income	Up to €1000/month	0.11	0.12	0.15	0.055*
	1001-2000	0.25	0.35	0.26	
	2001-3000	0.30	0.20	0.37	
	3001-4000	0.15	0.18	0.12	
	>4000	0.18	0.15	0.11	

*,** significant results according to the chi-square test. P-value < 0.1;0.05 respectively.

Starting with cluster 1, the results indicate that these consumers are most interested in the price and origin attributes, when considering the indicator of mean relative importance. They perceive the highest utility for medium- and high-priced wine, indicating that the attribute could be considered as a quality indicator for this group. In addition, this cluster places the highest importance to nationally produced wine. Finally, consumers in this group do not consider the geographical indication certification and perceive a slight utility for organic production. Based on these considerations, this cluster can be named **"High price and nation-specific"**. In terms of socio-demographic characteristics, this group includes middle and older age consumers with a high school diploma and an income of over €4000 per month.

The second group obtained the highest mean relative importance for the PDO/PGI certification attribute and the second highest for the production method and origin. Considering utility terms, these consumers are very attentive to PDO/PGI certifications: in fact, the coefficient is the highest among the clusters. In terms of production method, the cluster perceived the greatest utility from organic certification. Interestingly, biodynamic certification is also considered in this cluster, and respondents who appreciate local production and high-priced wines can also be found. Given these characteristics, the cluster can be called **"Certification seekers"**. Focusing on socio-demographic characteristics, the group contains mainly young consumers with a university degree and with an income of €1000-2000 and 3000-4000 per month.

The last group has the highest mean relative importance for the production method. Remarkably, this is the only group that appreciates conventional wine. Regarding the price attribute, these consumers are interested in low-priced wine, while a low positive utility is obtained by organic and local products in the other attributes. On the basis of these characteristics, this group can be called **"Price-sensitive consumers"**. Analysing the socio-demographic characteristics, this cluster grouped mainly young consumers with a high level of education and a low-intermediate level of income in the range of €1000-2000 per month.

4. DISCUSSION

The results obtained from the adopted models allow the research questions to be addressed, suggesting that different credence attributes and attribute levels influence the behaviour of wine consumers differently, also considering the different countries of origin of the individuals.

Starting with the first research question, it emerges that wine attributes are valued differently by consumers. Among the evaluated attributes, the origin of the product is considered the most important for European wine consumers. This result is partially in line with current literature suggesting the importance of wine origin [47]. In fact, various studies suggest that the origin of wine is a critical information for consumers [48].

Moreover, our study confirms the negative utility derived from imported wine [49,50], highlighting the strong impact of the cultural and national identity on wine choice [51]. The results are also consistent with the study of [26], who found price and origin as the most important attributes for wine selection.

Production methods represent the second most important attribute, confirming the current trend among wine consumers who consider this characteristic extremely important for product choices [49]. The attribute levels provide different utility scores; in fact, an organic label is preferred over biodynamic certification, which seems to be indifferent for consumers. This result confirms current literature indicating that biodynamic certification may only interest to a limited portion of consumers. In fact, consumers are less willing to pay for biodynamic wine than for organic wine [20].

The study highlights that price is an important driver of wine consumer choices [24,26]; in particular, a higher price provides greater utility, suggesting that consumers consider price as a sign of quality, as observed in Barcelona [22] or in Germany [52]. This result is also supported by consumer literature, since the importance of price as a sign of quality is typical of consumer science and can also be found in other products [34,53,54]. Moreover, when compared with other wine characteristics, price can also represent a secondary driver of consumer preferences [5]. However, in many cases, a high price doesn't guarantee high quality. Factors such as branding and scarcity can inflate the price of a wine without necessarily reflecting its intrinsic quality, and in the presence of limited knowledge, wine prices act as information tool to evaluate the quality [7,55]. Furthermore, the relationship between price and quality can vary depending on the wine market, region, and grape variety [55,56]. In some cases, lesser-known wineries may produce high-quality wines at relatively affordable prices, while well-established brands may command higher prices based on reputation rather than quality alone [57].

It is interesting that the geographical indications, such as PDO and PGI, obtained the least mean relative importance score. This result indicates that when certification of origin is compared with other attributes, it might have secondary importance in consumer choices.

However, the results do not contradict the literature when adopting the multi-attribute evaluation method as an estimation tool [14,58]. The utility estimate for certification is very high, indicating that consumers positively value such characteristic [5].

Proceeding to address the second research question, this study reveals regional differences among wine consumers, affirmatively answering the question. These findings constitute a significant novel aspect of this paper. Notably, to the best of our knowledge, no study has compared Italian consumers with Greek or Greek with French wine consumers. Conversely, only a couple of studies have conducted cross-country analyses between Italian and French consumers [59,60]. Starting with the price attribute, no significant differences were found between countries, suggesting that this attribute is perceived similarly by consumers. This outcome can be explained by the high importance given by wine consumers to price, as indicated in studies conducted in different European countries [52,61,62]. The conventional production method provided the least utility to French consumers. This outcome, coupled with the highest perceived utility of organic and PDO certification, suggests that French consumers are particularly attentive to wine quality certification. These results partially confirm existing literature on cross-country analyses, where French consumers are attentive to wine quality [47] and interested in organic production [60]. An important outcome is related to the utility perceived by biodynamic certification, which provides a slightly positive utility only to Greek consumers, suggesting that market opportunities are mainly in this country. Regarding local production, these products are mainly appreciated by French consumers, followed by Italian consumers, confirming the interest in this attribute [60,63]. French and Italian consumers have a strong cultural emphasis on traditional foods and beverages, including wine. They are often more familiar with local wine varieties, grape cultivars, and winemaking techniques than with wines from other regions or countries. This familiarity breeds a sense of comfort and trust in local products, making them a preferred choice [64,65].

Moreover, a remarkable result emerged: Greek consumers exhibit a greater interest in national wine rather than in products from specific territories. An indirect explanation may lie in the Greek wine market's export-oriented nature, thereby reducing the importance of local production [66].

European consumers were effectively clustered, facilitating an answer to the third research question. The first identified group, called "Higher-priced and nation-specific seekers" displayed a connection between high price and higher income, consistent with existing literature. High-income consumers may perceive expensive wines as being of higher quality or prestige due to their higher price points. They may be willing to pay a premium for wines that are perceived as luxurious or exclusive, regardless of their actual intrinsic quality [67]. Furthermore, the link between older consumers and high price is reaffirmed, as these respondents are more willing to pay for wine [28]. The connection between national wine and income could be attributed to variety-seeking behaviour [57]. In fact, opting for national wines over local ones may broaden choices, given the availability of numerous products.

The "Certification seekers" cluster was identified, in which the connection between younger consumers and different certifications was highlighted. This result is in line with current literature, in which younger people show a higher attitude towards certified wine [48] and confirms the results obtained by Capitello and Sirieix (2019) [60], who found that the organic attribute needs a high level of education to be properly appreciated by consumers. In addition, this paper confirms the importance given by younger generations to the Geographical Indications of wine [6].

Finally, our results suggest that consumers with high incomes are also interested in wine quality certification [65]. However, it is also possible that individuals with average incomes are interested in organic and PDO wine.

The last cluster was called "Price-sensitive consumers" and groups younger generations with low-intermediate incomes. The results are in line with current literature, since younger generations may have lower incomes, making them primarily price-driven, and thus price-sensitive consumers [6,65]. Low-income individuals often have limited disposable income, making affordability a primary concern when choosing wines. Price-sensitive consumers are more likely to opt for lower-priced wines that fit within their budget constraints [68]. This peculiar attitude was also found in other agri-food products, suggesting the importance of this cluster in consumer science [69,70].

5. CONCLUSION

5.1 Main findings

This study sheds light on some important information from the conjoint ranking experiment, which enables the role of different wine credence attributes among consumers in Greece, France and Italy to be estimated. Based on the conjoint model performed on the overall

sample, origin appears to be the most important factor in terms of mean relative importance and the local origin of the wine provided greater utility than the national or imported product. Among the production method levels, organic wine was the most valued by consumers, while biodynamic was considered indifferent as the coefficient was close to zero. Concerning price, consumers were mainly interested in high-priced products. Finally, the geographical indication was the least important attribute in terms of mean relative importance. However, the high estimated utility coefficient for the presence of GIs suggests that this attribute is highly valued by consumers.

Differences between countries were observed, particularly in terms of the utility derived from the organic method, which was higher for French consumers, as well as the importance attached to GIs. Regarding the origin of the product, French and Italian consumers were mainly attracted by the local product, while Greek consumers by national wine.

Three distinct groups were identified and named: High price and national wine seekers; Certification seekers and Price-sensitive. Inferential tests suggest that age, income and education can be used to characterise wine consumers.

5.2 Implications

This work provides several implications for both academics and business. It represents the first evaluation comparing consumers perceptions of biodynamic certification across multiple countries. On the producer side, several indications emerge that can aid in differentiating wine production and achieving higher income. The role of certifications such as GI and organic is reaffirmed confirmed as effective tools for enhancing wine marketing. Indeed, in France and Italy, consumers are more interested in local production that can be enhanced by organic, PDO or PGI indications. Finally, biodynamic was found to play a marginal role in each country, suggesting its limited effectiveness.

5.3 Limitations and further research

The study has a number of limitations that are worthy to be discussed to help readers to interpret the results. The first limitation is related to the sample; in fact, since the sampling was carried out online, a limited selection of consumers in terms of gender, age group and income was possible, which is more easily done in the case of face-to-face interviews. Therefore, the sample could be unbalanced for certain socio-demographic aspects, limiting the possibility of inferring the entire population. These limitations in data collection are mainly due to the need to collect data online for the limits imposed in the pandemic period by COVID-19 in 2020.

The second limitation is attributable to the methodology itself. While conjoint analysis is a valuable tool in marketing analysis, the number of attributes that can be included is limited, potentially influencing the importance derived from the combination of attributes used in the analysis. Additionally, the use of Geographical indications (PDO, PGI) in the orthogonal design with two levels (presence or absence) may have resulted in an average utility level, rather than a specific one for these certifications.

Future steps in the analysis may include evaluating the willingness to pay for different attributes, including biodynamic, in a cross-country evaluation, covering the same countries evaluated in this paper or others. In addition, the effectiveness of other combinations of attributes as wine differentiators can be tested.

REFERENCES

[1] H. Kendall, B. Clark, C. Rhymer, S. Kuznesof, J. Hajslova, M. Tomaniova, P. Brereton, L. Frewer, A systematic review of consumer perceptions of food fraud and authenticity: A European perspective, Trends in Food Science & Technology 94 (2019) 79–90.

[2] M. Rui, A. Sparacino, V.M. Merlino, F. Brun, S. Massaglia, S. Blanc, Exploring consumer sentiments and opinions in wine E-commerce: A cross-country comparative study, Journal of Retailing and Consumer Services 82 (2025). https://doi.org/10.1016/j.jretconser.2024.104097.

[3] D. Vergamini, F. Bartolini, P. Prosperi, G. Brunori, Explaining regional dynamics of marketing strategies: The experience of the Tuscan wine producers, Journal of Rural Studies 72 (2019) 136–152.

[4] C. Dias, L. Mendes, Protected designation of origin (PDO), protected geographical indication (PGI) and traditional speciality guaranteed (TSG): A bibiliometric analysis, Food Research International 103 (2018) 492–508.

[5] L.M.-C. Martínez, M.B. Mollá-Bauzá, F.J.D.C. Gomis, Á.M. Poveda, Influence of purchase place and consumption frequency over quality wine preferences, Food Quality and Preference 17 (2006) 315–327.

[6] R. Capitello, L. Agnoli, S. Charters, D. Begalli, Labelling environmental and terroir attributes: Young Italian consumers' wine preferences, Journal of Cleaner Production 304 (2021) 126991.
[7] G. Di Vita, F. Caracciolo, F. Brun, M. D'Amico, Picking out a wine: Consumer motivation behind different quality wines choice, Wine Economics and Policy 8 (2019) 16–27.
[8] N. Casolani, A. Ciccarelli, M.A. Perito, E. Chiodo, The Importance of Region of Origin in Sparkling Wines: An International Analysis of Consumers' Perception, Sustainability 16 (2024) 390. https://doi.org/10.3390/su16010390.
[9] D. Escandon-Barbosa, J. Rialp-Criado, The impact of the content of the label on the buying intention of a wine consumer, Frontiers in Psychology 9 (2019) 426438.
[10] A. Chamorro, J.M. García-Gallego, H. da C. Trindade-Carlos, Study on the importance of wine bottle design on consumer choices, British Food Journal 123 (2021) 577–593.
[11] M. Lanfranchi, A. Zirilli, A. Alibrandi, C. Giannetto, The behaviour of wine consumers towards organic wine: a statistical analysis through the non-parametric combination test, International Journal of Wine Business Research 33 (2021) 275–287.
[12] P. Tait, C. Saunders, P. Dalziel, P. Rutherford, T. Driver, M. Guenther, Estimating wine consumer preferences for sustainability attributes: A discrete choice experiment of Californian Sauvignon blanc purchasers, Journal of Cleaner Production 233 (2019) 412–420. https://doi.org/10.1016/j.jclepro.2019.06.076.
[13] S. Sillani, Consumer perceptions and motivations in choice of minimally processed vegetables, British Food Journal 117 (2015) 970–986.
[14] F. Boncinelli, A. Dominici, F. Gerini, E. Marone, Insights into organic wine consumption: behaviour, segmentation and attribute non-attendance, Agricultural and Food Economics 9 (2021) 1–16.
[15] S. Sillani, A. Miccoli, F. Nassivera, Different preferences for wine communication, Wine Economics and Policy 6 (2017) 28–39.
[16] M. Rui, F. Rosa, A. Viberti, F. Brun, S. Massaglia, S. Blanc, Understanding Factors Associated with Interest in Sustainability-Certified Wine among American and Italian Consumers, Foods 13 (2024) 1468.
[17] Demeter international, (2021). https://demeter.net/biodynamics/biodiversity/ (accessed February 8, 2022).
[18] A. Castellini, C. Mauracher, S. Troiano, An overview of the biodynamic wine sector, International Journal of Wine Research 9 (2017) 1–11.
[19] K. Lewis, S. Cassells, The spiritual dimension of biodynamics: an alternative source of capital in the rural context, in: Exploring Rural Enterprise: New Perspectives on Research, Policy & Practice, Emerald Group Publishing Limited, 2014.
[20] G. Scozzafava, F. Gerini, F. Boncinelli, C. Contini, L. Casini, How much is a bottle of conventional, organic or biodynamic wine worth? Results of an experimental auction, Food Quality and Preference 93 (2021) 104259.
[21] R. Veale, P. Quester, Consumer sensory evaluations of wine quality: The respective influence of price and country of origin, Journal of Wine Economics 3 (2008) 10–29.
[22] R. Bernabéu, M. Díaz, F. Oliveira, Consumer preferences for red wine in the Spanish market, Ciência e Técnica Vitivinícola 31 (2016) 88–97.
[23] G. Gallenti, S. Troiano, F. Marangon, P. Bogoni, B. Campisi, M. Cosmina, Environmentally sustainable versus aesthetic values motivating millennials' preferences for wine purchasing: evidence from an experimental analysis in Italy, Agricultural and Food Economics 7 (2019) 1–16.
[24] A. Dal Vecchio, S. Massaglia, V.M. Merlino, D. Borra, M. Hao, Italian wines in China's e-commerce market: focus on Piedmont region products, Italian Journal of Food Science 30 (2018).
[25] A. Annunziata, E. Pomarici, R. Vecchio, A. Mariani, Do consumers want more nutritional and health information on wine labels? Insights from the EU and USA, Nutrients 8 (2016) 416.
[26] H.A. Jantzi, M.B. McSweeney, An overview of wine consumers in Nova Scotia, Canada: A conjoint analysis study, Journal of Wine Research 30 (2019) 48–61.
[27] J.P. Perrouty, F. d'Hauteville, L. Lockshin, The influence of wine attributes on region of origin equity: An analysis of the moderating effect of consumer's perceived expertise, Agribusiness 22 (2006) 323–341. https://doi.org/10.1002/agr.20089.
[28] C. Mauracher, I. Procidano, M. Valentini, How product attributes and consumer characteristics influence the WTP, resulting in a higher price premium for organic wine, Sustainability 11 (2019) 1428.
[29] G. Di Vita, R. Zanchini, G. Falcone, M. D'Amico, F. Brun, G. Gulisano, Local, organic or protected? Detecting the role of different quality signals among Italian olive oil consumers through a hier-

archical cluster analysis, Journal of Cleaner Production 290 (2021) 125795.
[30] A. Annunziata, E. Pomarici, R. Vecchio, A. Mariani, Nutritional information and health warnings on wine labels: Exploring consumer interest and preferences, Appetite 106 (2016) 58–69.
[31] A. Annunziata, R. Vecchio, Consumer perception of functional foods: A conjoint analysis with probiotics, Food Quality and Preference 28 (2013) 348–355.
[32] J.F. Bridges, A.B. Hauber, D. Marshall, A. Lloyd, L.A. Prosser, D.A. Regier, F.R. Johnson, J. Mauskopf, Conjoint analysis applications in health—a checklist: a report of the ISPOR Good Research Practices for Conjoint Analysis Task Force, Value in Health 14 (2011) 403–413.
[33] G. Di Vita, R. Zanchini, D. Spina, G. Pappalardo, E. Schimmenti, M. D'Amico, The Hierarchical Utility of Credence Attributes of Orange Marmalade: What do ConsumerS Look for in a Multi-Claim Food Product?, Journal of Marketing Communications (2023) 1–30. https://doi.org/10.1080/13527266.2023.2273539.
[34] G. Di Vita, R. Vecchio, M. Borrello, R. Zanchini, G. Maesano, G. Gulisano, F. Brun, M. D'Amico, Oh my darling clementine: heterogeneous preferences for sustainable citrus fruits, Renewable Agriculture and Food Systems 36 (2021) 557–568.
[35] A.B. Hauber, J.M. González, C.G. Groothuis-Oudshoorn, T. Prior, D.A. Marshall, C. Cunningham, M.J. IJzerman, J.F. Bridges, Statistical methods for the analysis of discrete choice experiments: a report of the ISPOR conjoint analysis good research practices task force, Value in Health 19 (2016) 300–315.
[36] E. Pelzer, The Potential of Conjoint Analysis for Communication Research, Communication Research Reports 36 (2019) 136–147. https://doi.org/10.1080/08824096.2018.1559138.
[37] T. Mancuso, R. De Cianni, G.A. Di Vita, E. Spada, F. Brun, D.C. Spadaro, R. Zanchini, Understanding Italian consumers' perceptions of tomato agricultural innovation: Exploring the nexus between sustainability, health and consumer beliefs, Journal of Cleaner Production 435 (2024) 140528. https://doi.org/10.1016/j.jclepro.2023.140528.
[38] D. McCullough, A User's Guide to Conjoint Analysis, Marketing Research 14 (2002) 18–23.
[39] K.E. Stanovich, R.F. West, On the relative independence of thinking biases and cognitive ability., Journal of Personality and Social Psychology 94 (2008) 672.
[40] E. Mazaheri, M.-O. Richard, M. Laroche, The role of emotions in online consumer behavior: a comparison of search, experience, and credence services, Journal of Services Marketing 26 (2012) 535–550.
[41] L.C. Shan, A. De Brún, M. Henchion, C. Li, C. Murrin, P.G. Wall, F.J. Monahan, Consumer evaluations of processed meat products reformulated to be healthier–A conjoint analysis study, Meat Science 131 (2017) 82–89.
[42] T. Strauss, M.J. von Maltitz, Generalising Ward's method for use with Manhattan distances, PloS One 12 (2017) e0168288.
[43] G. Hailu, A. Boecker, S. Henson, J. Cranfield, Consumer valuation of functional foods and nutraceuticals in Canada. A conjoint study using probiotics, Appetite 52 (2009) 257–265.
[44] S. Wajrock, N. Antille, A. Rytz, N. Pineau, C. Hager, Partitioning methods outperform hierarchical methods for clustering consumers in preference mapping, Food Quality and Preference 19 (2008) 662–669. https://doi.org/10.1016/j.foodqual.2008.06.002.
[45] M. Miraballes, A. Gámbaro, Influence of Images on the Evaluation of Jams Using Conjoint Analysis Combined with Check-All-That-Apply (CATA) Questions, Journal of Food Science 83 (2018) 167–174.
[46] M. Charrad, N. Ghazzali, V. Boiteau, A. Niknafs, NbClust: an R package for determining the relevant number of clusters in a data set, Journal of Statistical Software 61 (2014) 1–36.
[47] M.-P. Sáenz-Navajas, J. Ballester, D. Peyron, D. Valentin, Extrinsic attributes responsible for red wine quality perception: A cross-cultural study between France and Spain, Food Quality and Preference 35 (2014) 70–85.
[48] G. Maesano, G. Di Vita, G. Chinnici, P. Gioacchino, M. D'Amico, What's in organic wine consumer mind? A review on purchasing drivers of organic wines, Wine Economics and Policy 10 (2021) 3–21.
[49] A. Galati, G. Schifani, M. Crescimanno, G. Migliore, "Natural wine" consumers and interest in label information: An analysis of willingness to pay in a new Italian wine market segment, Journal of Cleaner Production 227 (2019) 405–413.
[50] R. Mehta, N. Bhanja, Consumer preferences for wine attributes in an emerging market, International Journal of Retail & Distribution Management (2017).
[51] N.-H. Le, H.-M.T. Nguyen, T. Van Nguyen, National identity and the perceived values of foreign

products with local brands: The case of local wine in Vietnam, Asia Pacific Journal of Marketing and Logistics (2013).
[52] M. Janssen, I. Schäufele, K. Zander, Target groups for organic wine: The importance of segmentation analysis, Food Quality and Preference 79 (2020) 103785.
[53] V.M. Merlino, S. Massaglia, D. Borra, A. Mimosi, P. Cornale, Which Factors Drive Consumer Decisions during Milk Purchase? New Individuals' Profiles Considering Fresh Pasteurized and UHT Treated Milk, Foods 11 (2021) 77.
[54] J. Mota-Gutierrez, A. Sparacino, V.M. Merlino, S. Blanc, F. Brun, F. Massimelli, E. Vassallo, D. Borra, S. Massaglia, Socio-demographic and cross-country differences in attention to sustainable certifications and changes in food consumption, Npj Science of Food 8 (2024) 31.
[55] F. Caracciolo, M. D'Amico, G. Di Vita, E. Pomarici, A. Dal Bianco, L. Cembalo, Private vs. collective wine reputation, International Food and Agribusiness Management Review 19 (2016) 191–210.
[56] B.-H. Ling, L. Lockshin, Components of wine prices for Australian wine: How winery reputation, wine quality, region, vintage, and winery size contribute to the price of varietal wines, Australasian Marketing Journal (AMJ) 11 (2003) 19–32.
[57] F. Caracciolo, M. Furno, M. D'Amico, G. Califano, G. Di Vita, Variety seeking behavior in the wine domain: A consumers segmentation using big data, Food Quality and Preference 97 (2022) 104481.
[58] V.M. Merlino, D. Borra, V. Girgenti, A. Dal Vecchio, S. Massaglia, Beef meat preferences of consumers from Northwest Italy: Analysis of choice attributes, Meat Science 143 (2018) 119–128.
[59] A. Annunziata, L. Agnoli, R. Vecchio, S. Charters, A. Mariani, Health warnings on wine labels: A discrete choice analysis of Italian and French Generation Y consumers, Wine Economics and Policy 8 (2019) 81–90.
[60] R. Capitello, L. Sirieix, Consumers' perceptions of sustainable wine: An exploratory study in France and Italy, Economies 7 (2019) 33.
[61] A. Krystallis, P. Chrysochou, An exploration of loyalty determinants in Greek wine varieties, EuroMed Journal of Business (2010).
[62] M. Stanco, M. Lerro, G. Marotta, Consumers' preferences for wine attributes: A best-worst scaling analysis, Sustainability 12 (2020) 2819.
[63] N. Palmieri, M.A. Perito, Consumers'willingness to consume sustainable and local wine in Italy, Italian Journal of Food Science 32 (2020).
[64] A. Hertzberg, G. Malorgio, Wine demand in Italy: an analysis of consumer preferences, New Medit 7 (2008) 40–46.
[65] I. Schäufele, U. Hamm, Organic wine purchase behaviour in Germany: Exploring the attitude-behaviour-gap with data from a household panel, Food Quality and Preference 63 (2018) 1–11.
[66] V.A. Vlachos, A macroeconomic estimation of wine production in Greece, Wine Economics and Policy 6 (2017) 3–13.
[67] G. Migliore, A. Thrassou, M. Crescimanno, G. Schifani, A. Galati, Factors affecting consumer preferences for "natural wine": An exploratory study in the Italian market, British Food Journal (2020).
[68] C. Aqueveque, Consumers' preferences for low-priced wines' packaging alternatives: the influence of consumption occasion, gender, and age, British Food Journal 125 (2022) 781–793. https://doi.org/10.1108/BFJ-09-2021-1040.
[69] G. Di Vita, G. Maesano, R. Zanchini, C. Barbieri, D. Spina, F. Caracciolo, M. D'Amico, The thin line between tradition and well-being: Consumer responds to health and typicality attributes for dry-cured ham, Journal of Cleaner Production 364 (2022) 132680.
[70] S. Massaglia, D. Borra, C. Peano, F. Sottile, V.M. Merlino, Consumer Preference Heterogeneity Evaluation in Fruit and Vegetable Purchasing Decisions Using the Best–Worst Approach, Foods 8 (2019) 266

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Fantechi, T., Contini, C., Marinelli, N., Moriondo, M. & Costafreda-Aumedes, S. (2025). Sustainable wine – for whom? Consumer preferences for different environmental labels. *Wine Economics and Policy* 14(1): 17-29. doi: 10.36253/wep-17712

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Sustainable wine – for whom? Consumer preferences for different environmental labels

Tommaso Fantechi[1], Caterina Contini[1], Nicola Marinelli[1], Marco Moriondo[2], Sergi Costafreda-Aumedes[2]

[1] *Department of Agriculture, Food, Environment and Forestry – DAGRI – University of Florence, P.le delle Cascine 18, 50144 Florence, Italy*
[2] *National Research Council, Institute of BioEconomy (CNR-IBE), Sesto Fiorentino (FI), Italy*
*Corresponding author. Email: tommaso.fantechi@unifi.it

Abstract. As sustainability concerns increasingly influence agri-food systems, environmental labels have become an important tool for signalling producers' ecological responsibility to consumers. However, the effectiveness of such labels depends on how they are perceived and valued in specific product contexts. This study investigates consumer preferences for four environmental labels in the wine sector: organic certification, carbon neutral, reduced water footprint, and reduced pesticide use. A discrete choice experiment conducted with 300 Italian wine consumers, combined with latent class analysis, revealed four distinct segments with heterogeneous responses to environmental labels. While one group rejected environmental labels altogether, others displayed selective interest based on the perceived relevance of the label to specific concerns such as health or resource conservation. These findings highlight the need for tailored communication strategies that take into account both consumers' cultural associations with wine – such as tradition, authenticity, and artisanal value – and their individual priorities, including differing levels of engagement with various aspects of environmental sustainability. In a category as culturally embedded as wine, where tradition, identity, and quality perceptions play a central role, tailored messaging becomes especially crucial to ensure that environmental-labels are understood, trusted, and valued.

Keywords: sustainable wine, consumer preferences, environmental label, discrete choice experiment.

1. INTRODUCTION

Growing environmental concerns have placed increasing attention on the role of agriculture in climate change and the depletion of natural resources [1,2]. Viticulture exemplifies this link, as it generates multiple environmental pressures through various channels, including greenhouse gas emissions, pesticide use, and water consumption. The majority of greenhouse gas emissions in vineyard operations stem from energy use (mainly electricity and fuel) required for irrigation and field work [3–7]. Additionally, in water-limit-

ed viticultural areas, irrigation can significantly increase pressure on local water supplies and contribute to the overall environmental footprint [8]. Moreover, due to the susceptibility of grapevines to fungal diseases, viticulture ranks among the sectors with the highest pesticide use per hectare in Europe [9,10]. This dependency raises concerns related to biodiversity, soil health, and the contamination of water bodies, thus prompting interest in more sustainable practices, such as low-input strategies and integrated pest management [11,12]. Given these combined pressures, viticulture provides a compelling case for examining sustainability transitions both for its environmental challenges and its strong connections to local economies, cultural heritage, and rural identity [8,12]. In many wine-producing regions, vineyards are more than a source of agricultural output, they shape landscapes, support tourism, and contribute to the symbolic and economic value of entire territories. These ties are further reinforced by the fact that wineries are often small, locally embedded enterprises, deeply integrated into the social and economic fabric of rural areas. This territorial relevance makes viticulture especially visible and politically salient in sustainability debates [4,6].

Sustainability in viticulture is influenced by a range of conflicting factors. Producers must balance the need to maintain grape quality and economic viability, while consumers demand environmentally responsible products without compromising on taste or price. Meanwhile, public policies promote stricter environmental standards and regulations. At the European level, the Common Agricultural Policy and the Farm to Fork Strategy encourage the adoption of environmentally sustainable farming practices. At the national level, initiatives such as France's Haute Valeur Environnementale certification and Italy's National Quality System for Integrated Production (Sistema di Qualità Nazionale Produzione Integrata) encourage producers to meet specific ecological benchmarks and reduce chemical inputs. These initiatives not only drive sustainable practices at the production level but also support transparency through signals of environmental sustainability. In this context, environmental labels have become a key tool for communicating the sustainability attributes of a product whether by indicating reduced impacts, such as lower water consumption or pesticide use, or by highlighting contributions to ecosystem services, such as carbon sequestration [13,14].

As consumers become more environmentally conscious, they are increasingly drawn to products that carry environmental labels. However, despite this growing interest, consumer responses to sustainability claims are not uniform. Delmas and Gergaud [15] highlight that reactions to environmental labels can vary considerably. This may be due to the proliferation of labelled products in the marketplace, which can lead to information overload [16,17], or to concerns about potential trade-offs between environmentally friendly practices and product quality [18,19]. Indeed, some studies show that environmentally certified wines may be perceived as lower in sensory quality, or that consumers struggle to distinguish between different types of labels [20].

The coexistence of various types of environmental labels, ranging from broad sustainability claims to indicators focused on single issues, further complicates consumer interpretation. While some labels, such as organic certification, are often associated with a holistic approach to sustainability, they may not explicitly address all environmental dimensions (e.g., greenhouse gas emissions or water use). Conversely, labels like "carbon neutral" focus on specific impacts but do not account for other aspects such as pesticide use or biodiversity. This divergence can lead consumers to perceive fundamentally different sustainability efforts as interchangeable [21,22]. In this context, the credibility, familiarity, and clarity of environmental labels become decisive for consumer acceptance. Yet, as Schäufele and Hamm [23] point out, such qualities are often lacking in the wine sector, where label meanings and standards are not always well understood [24].

In Italy, while labels highlighting specific positive impacts on natural resources are not yet widespread or standardised, they are beginning to emerge, particularly through private initiatives and pilot projects, reflecting a growing interest in communicating differentiated environmental performances to consumers [25]. Understanding how these labels are perceived can help producers tailor their sustainability strategies and allow policymakers to design clearer and more targeted communication tools. It also sheds light on the specific environmental concerns that matter most to consumers, offering practical insights into the drivers of their purchasing decisions and helping to align supply-side initiatives with real demand.

Building on this premise, the present study explores how consumers perceive different types of environmental labels and how these perceptions influence their preferences in the wine sector. Four labels were selected to reflect distinct dimensions of sustainability: organic certification, carbon neutrality, reduced water footprint, and reduced pesticide use. Extending previous research such as Tait et al. [26], who examined preferences for sustainable wine attributes in Californian Sauvignon blanc and emphasised the relevance of specific environmental outcomes, our study applies a discrete choice

experiment to the Italian context. While organic certification is well established in Italy, labels referring to more targeted environmental impacts such as carbon emissions, water use, or pesticide application remain relatively less familiar to consumers and less embedded in their purchasing routines. This context, where wine production is deeply rooted in cultural practices and heritage values, provides a novel perspective for examining how consumers interpret differentiated sustainability claims in a product category shaped by tradition and identity.

In this setting, we adopt a latent class approach to understand how different environmental labels are perceived, uncovering the diversity of consumer reactions to sustainability claims and offering insights into how environmental messaging can be effectively tailored. This paper is structured as follows: the following section presents the methodology employed and the econometric analysis. The subsequent sections report the results, followed by a discussion and concluding remarks, presented in two distinct parts.

2. METHODOLOGY AND ECONOMETRIC ANALYSIS

2.1 Survey design

The data were collected through an online questionnaire administered via Google Forms, structured into five consecutive sections covering respondent eligibility, wine consumption behaviours, motivations underlying preferences, and both psychographic and socio-demographic profiling.

More specifically, the section included three filter questions. The first filter excluded individuals who were not responsible or co-responsible for food purchases within their family, ensuring that participants were involved in purchasing decisions. The second filter focused on the frequency of wine consumption, to ensure that only individuals who consumed wine regularly (at least once a month) were included. Those who never consumed wine or drank it less than once a month were excluded. The third filter concerned the price range at which individuals usually purchase wine for domestic consumption. We excluded those who typically spent more than 14.99 € per bottle, as the study aimed to focus on wines purchased for routine consumption, within a price range of 4 € to 14 €. While wine prices can vary significantly, with some wines exceeding 14 €, this decision aligned with the average monthly wine expenditure per family, which is 11.43 € [27], and the average price of a bottle with a designation of origin, which is 5.40 € [28]. As a result, the respondents who participated in the study were those involved in food purchasing decisions, consumed wine regularly, and spent an amount consistent with the average for routine wine consumption.

The second section presented consumers with a discrete choice experiment (DCE), which will be described in detail in Section 2.2.

In the third section of the questionnaire, consumers were asked to choose their preferred label from the four options and to explain the reasons behind their choice.

The fourth section aimed to assess the psychographic characteristics of the sample in order to explore potential correlations with their preferences. Existing literature highlights the role of sustainability awareness in shaping sustainable food choices [29,30]. To measure this dimension, we employed the Involvement in Sustainable Eating (ISE) scale developed by Pieniak et al. [31] and adapted by Van Loo et al. [32]. Linked to this aspect, we evaluated how consumers perceive the impact of their choices on the future, using the scale on the Consideration of Future Consequences (CFC), developed by Joireman et al. [33]. Finally, assessed the extent to which individuals attribute responsibility to themselves when making sustainability-related choices, utilising the Ascription of Responsibility (AOR) scale [34,35]. All three constructs were measured using five-point Likert scales ranging from 1 (completely disagree) to 5 (completely agree). This range was chosen to ensure consistency, as both the CFC and ISE are originally measured on a 1-to-5 scale, and the AOR scale was consequently adapted. Table 1 presents the items included in each scale, along with key descriptive statistics and Cronbach's α, which exceeds the minimum threshold of 0.70, indicating satisfactory internal consistency and reliability.

The fifth and final section of the questionnaire aimed to gather the primary sociodemographic characteristics of the sample.

2.2 Experimental design

The DCE allows comparing a discrete number of alternatives differentiated by the levels characterising the different attributes of the product. Widely acknowledged in the literature as an effective and intuitive tool, the DCE is capable of readily capturing consumer preferences [36]. Specifically, we asked respondents to imagine themselves at the place where they usually buy wine, with the intention of purchasing a Bordeaux-style bottle of red wine for a regular meal at home. We then asked them to choose between two products or to opt for the no-choice option if neither satisfied their preferences. The base wine selected for our scenarios was a Sangiovese IGT, produced and bottled in Italy (San Casciano, Tuscany, in the Chianti Region) with an

Table 1. Items from the three psychographic scales in the questionnaire along with their respective descriptive statistics (analysis performed using STATA/SE 18.0).

Scale (Alpha)	Item	Mean	Standard deviation	Source
Consideration of future consequences (0.83)	My behaviour is generally influenced by future consequences	3.26	1.26	Joireman et al, 2012
	When I decide to consume food products, I think about the future consequences of my decision	3.40	1.32	
	I prefer foods that make me feel better in the future to foods that satisfy me here and now	3.34	1.25	
	I often think about negative outcomes of the food I consume even if the negative outcome will not occur for many years	3.43	1.36	
Involvement in sustainable eating (0.94)	Sustainable eating is very important to me	3.61	1.14	Pienak et al., 2010; Van Loo et al., 2017
	I care a lot about sustainable eating	3.35	1.12	
	Sustainable eating means a lot to me	3.43	1.16	
	I am very concerned about the consequences of what I eat in terms of sustainability	3.43	1.16	
Ascription of responsibility (0.90)	I feel personally responsible for the problems resulting from my non-ecofriendly product purchases	3.16	1.29	Abrahamse et al., 2011
	My non-ecofriendly purchases contribute to environmental problems	3.46	1.27	
	I take joint responsibility for environmental problems	3.43	1.23	

alcohol content of 13%. We know from the literature that the grape variety and the origin are fundamental characteristics in the choice of the wine [37-39]. Therefore, we opted for Sangiovese due to its widespread cultivation throughout Italy, making it one of the nation's most significant and emblematic grape varieties. Furthermore, we chose San Casciano because it is a locality renowned for its strong association with winemaking [40,41]. We centred the analysis on two attributes: price and environmental label (Table 2). As outlined in the introduction, our analysis focused on three key sustainability aspects that environmental labels can signal – water use, pesticide use, and carbon footprint [8–12] – comparing them with the most widespread environmental label on the market, organic certification, and with the absence of any label. While labels addressing specific environmental dimensions (e.g. "carbon neutral" or "reduced water footprint") have begun to emerge in various markets [25], none of them is yet consolidated or widely recognised by consumers in the Italian context. The environmental labels tested were kept general by design, in order to reflect their current state of development and limited standardisation in the Italian market. The price levels were selected based on market research: the minimum level was set just below the average price of a bottle with a designation of origin, while the maximum level corresponded to the cut-off point used in our sample selection criteria for everyday wine consumption [27, 28]. Figure 1 displays the 4 labels used for the different levels.

Table 2. Attributes and their corresponding levels in the DCE.

Attribute	Level
Price	4 €
	6 €
	10 €
	14 €
Environmental label	None
	Organic
	Reduced water footprint
	Reduced pesticides
	Carbon neutral

Figure 1. The 4 environmental labels employed in the choice experiment.

Once attributes and levels were chosen, we implemented a pilot study involving a sample of 50 wine consumers. Then, we created an efficient design using Ngene software (ChoiceMetrics Ltd.), based on the priors obtained through a pilot study (as suggested by [42]). To minimise respondents' fatigue in order to ensure their engagement until the end of the survey, each participant was exposed to five choice sets. The sample was random-

Figure 2. Example of a choice set.

ly divided into two blocks to maintain variation and balance in presentation.

2.3 Econometric model and Latent Class Analysis

Discrete Choice Models derive from McFadden's Random Utility Theory [43] and Lancaster's [44] consumer studies. Their theoretical framework posits that a consumer tends to act rationally by choosing among various market options the one that provides them with the maximum utility. Simultaneously, the utility of a good is the result of the characteristics that the good possesses. Therefore, the utility U that individual *i* obtains by opting for alternative *n* in a choice set *k* is:

$$U_{ink} = \boldsymbol{\beta}'\mathbf{X}_{ink} + ASC + \varepsilon_{ink} \quad (1)$$

In Equation 1, $\boldsymbol{\beta}'$ represents a vector of coefficients encompassing the impact of each level $\mathbf{X}_{ink}$ of every attribute on the utility function. The term ASC (Alternative Specific Constant) is a constant that encapsulates all the product characteristics present in the scenario but not considered within the experimental design (serving as the baseline image). ε_{ink} is the stochastic component of utility, identically and independently distributed. In our study, during data processing the price was considered a continuous variable, while the environmental labels were treated as categorical variables.

Based on these assumptions, the probability (Equation 2) of choosing a product in a scenario is linked to the utility that the option has compared to the other options [45]. Therefore, it is the ratio between the deterministic component of the utility of alternative n and the sum of the deterministic component of the utility of all the possible alternatives.

$$Pr_{in} = \frac{e^{\beta' \mathbf{X}_{in}}}{\sum_1^K e^{\beta' \mathbf{X}_{ik}}} \quad (2)$$

$\mathbf{X}_{in}$ represents the vector of the attributes for individual *i* for alternative *n*, while $\mathbf{X}_{ik}$ is the same vector for alternative *k*.

Given the assumption of heterogeneous consumer preferences [46–48], we applied Latent Class Analysis (LCA) to analyse the DCE data. LCA enables the identification of distinct latent classes based on individual response patterns. The analysis was conducted using Latent Gold Choice 4.5 (Statistical Innovation Inc.).

To profile the identified classes, we employed Chi-squared Automatic Interaction Detection (CHAID) analysis, which performs chi-squared tests to assess whether class membership is significantly associated with selected variables. In our study, the dependent variable was class membership as defined by the latent class analysis. CHAID was used to explore class differences across a set of psychographic, sociodemographic, and behavioural variables, and served as the basis for describing class profiles. Although CHAID does not imply causal relationships or offer predictive power, it provides a robust exploratory framework for interpreting latent class structures and identifying the variables that most clearly differentiate one segment from the others. Data processing was conducted using SICHAID Define (version 4.0.5.18305).

2.4 Sample description

The survey was disseminated to a sample of Italian consumers across various social platforms from November 2023 to January 2024. Out of the 437 Italians who initially agreed to participate in our questionnaire, 56 were excluded as they were not responsible for food purchases, and an additional 47 declared never consuming wine. After this screening, the remaining 334 consumers were considered. Among them, 34 reported purchasing wine for more than 14.99 € per litre. Consequently, our final sample consisted of 300 consumers (Table 3). The sample is well-distributed by gender and includes participants from a broad age range. When it comes to wine consumption, our sample primarily spends between 5 and 10 euros on a Bordeaux bottle for regular home consumption, and, additionally, 88% of respondents stated consuming wine more than once a month, with one-third of the sample consuming it at least once every two days.

3. RESULTS

3.1 Discrete choice experiment and latent class analysis

To choose the best model for our analysis, we explored different options with varying numbers of

Table 3. Sociodemographic and behavioural traits related to wine in the sample of 300 Italian consumers who took part in the DCE.

Variable	Sample (%)
Gender	
Male	144 (48%)
Female	151 (50%)
Other	5 (2%)
Age	
18-33	100 (33%)
34-53	93 (31%)
>53	107 (36%)
Usual spending on wine consumed at home	
0-4.99 €	90 (30%)
5-9.99 €	152 (51%)
10-14.99 €	58 (19%)
Frequency of wine consumption at home	
Less than once a month	25 (8%)
Once a month	11 (4%)
2-3 times a month	52 (17%)
1-2 times a week	110 (37%)
3-4 times a week	50 (17%)
More than 4 times a week	52 (17%)

Table 4. The tested models with their respective parameters. The highlighted model is the one chosen for the LCA.

Number of classes	LL	BIC	Npar	R^2
1	-1516	3067	6	3%
2	-1382	2838	13	19%
3	-1324	2762	20	37%
4	-1289	2732	27	44%
5	-1271	2737	34	51%
6	-1256	2746	41	53%
7	-1241	2756	48	58%

Note: LL represents log-likelihood, BIC stands for Bayesian Information Criterion, and N. Par denotes the number of parameters.

latent classes. Based on the Bayesian Information Criterion (BIC), which balances model fit and complexity, the 4-class model was selected, as it showed the lowest BIC value, while also ensuring the interpretability and significance of parameters [49,50] (Table 4).

The β coefficients related to the utility function are presented in Table 5. As for the size of the classes, the first class includes 35% of the sample, the second 30%, the third 24%, and the fourth 11%.

For Class 1, the price of wine does not pose a barrier, at least up to 14 €, which is the highest price point in our experiment. Conversely, all four environmental labels create disutility for these consumers, who prefer a bottle without such characteristics. Class 4 also diverges from the environmentally oriented segments, but does so by predominantly opting for the no-choice alternative—indicating limited engagement with the product options overall. Classes 2 and 3, by contrast, share similarities, as both show a preference for wines with an environmental label. While differences emerge in the relative importance attributed to price – higher for Class 2 than for Class 3 – a clearer understanding of their preferences can be gained by examining how each class evaluates the environmental labels included in the experiment. To this end, we analysed the distribution of preferences across the four labels for Classes 2 and 3. The results, shown in Figure 3, illustrate the relative importance attributed to each label.

As shown in Figure 3, Class 2 assigns greatest importance to labels indicating reduced water footprint and reduced pesticide use, while organic certification is considered less relevant, and carbon neutrality is the least valued. In contrast, Class 3 places highest importance on organic wine, followed by reduced pesticide use and carbon neutrality. The label referring to reduced water footprint receives the lowest importance in this class.

To better understand the underlying reasons behind the preference for environmental labels in Classes 2 and 3 (i.e., the two segments showing positive utility for environmental labels in the DCE) we analysed responses to a follow-up question included in the third section of the questionnaire. After completing the choice tasks, participants were asked to select their preferred label among the four options and indicate up to three reasons for their choice. For each class, we calculated the relative frequency of each reason by dividing the number of

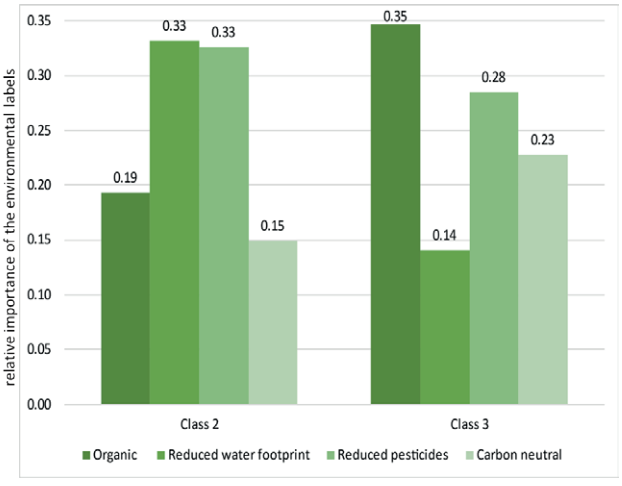


Figure 3. Relative importance of different environmental labels in classes 2 and 3.

Table 5. Beta coefficients for the model with 4 classes.

Attribute	Level	Class 1	Class 2	Class 3	Class 4
Price		-0.02	-0.17***	-0.10*	-1.71
Label	Organic	-0.90***	0.94*	5.24***	5.69
	Reduced water footprint	-1.95***	1.61***	2.13***	2.52
	Reduced pesticides	-0.97***	1.58**	4.30***	3.20
	Carbon neutral	-0.61**	0.72*	3.43***	2.79
ASC		0.80**	6.81***	3.16***	-2.84**

Note: *indicates a significance of 90%, **of 95%, and ***of 99%. For the *label* attribute, the reference category is the absence of any environmental label.

Table 6. Reasons why consumers preferred a particular label over others. Each respondent could specify up to 3 motivations. The data were collected in the third section of the questionnaire, where participants were asked to indicate their favourite environmental label and the reasons behind their choice.

Reason	Organic	Reduced water footprint	Reduced pesticides	Carbon neutral
Class 2				
Perceived reliability	23%	0%	18%	3%
Familiarity with the label	14%	0%	2%	0%
Concern for the specific issue	23%	40%	24%	31%
Personal relevance of the issue	3%	28%	11%	28%
General concern for sustainability	6%	30%	4%	31%
Perceived health benefits	17%	0%	35%	0%
Appeal of the label design	8%	2%	2%	7%
Expected sensory quality	6%	0%	4%	0%
Class 3				
Perceived reliability	39%	0%	7%	0%
Familiarity with the label	7%	0%	0%	6%
Concern for the specific issue	16%	33%	18%	35%
Personal relevance of the issue	7%	17%	20%	24%
General concern for sustainability	12%	33%	15%	29%
Perceived health benefits	13%	0%	38%	0%
Appeal of the label design	2%	0%	2%	6%
Expected sensory quality	4%	17%	0%	0%

times it was selected by the total number of responses given for that label. The results are presented in Table 6. Data for Classes 1 and 4 are not included, as Class 1 tended to avoid labelled wines, while Class 4 showed general indifference.

Cross-referencing the information from Figure 3 and Table 6 offers more specific insights into these two classes. Following the preference ranking expressed in the DCE, the reduced water footprint label, along with the reduced use of pesticides, emerges as most valued in Class 2. The preference for the reduced water footprint label appears to be driven primarily by a specific concern for this issue, followed by its perceived personal relevance and, to a lesser extent, a broader attention to sustainability. The preference for reduced pesticide use is particularly linked to health motivations. The organic certification, third in importance, is primarily appreciated for the trustworthiness of the certification scheme and for concern with pollution reduction as a specific issue. Finally, the carbon neutral label, although the least preferred, still gains support due to a perceived connection with the issue of emissions, personal relevance, and general sustainability awareness.

Class 3, with a strong preference for organic certification, favours this label primarily due to the trust placed in the certification scheme. The reduced pesticide label is also appreciated, primarily for health-related motivations. Preferences for the carbon neutral label

Table 7. The variables identified as significant in the CHAID analysis. For each class, the variables that distinguish them significantly from the rest of the sample are listed.

Class	Variable	LR Chi-Squared	df
Class 1	Ascription of responsibility**	8.16	1
	Age**	10.62	1
Class 2	Usual spending on wine consumed at home***	25.48	2
Class 3	Usual spending on wine consumed at home***	9.34	1
Class 4	Frequency of wine consumption at home***	9.55	1

Note: the sociodemographic, behavioural, and psychographic variables that are not statistically significant are not included in the table. **indicates a significance of 95%, and ***of 99%.

Table 8. Profiles of latent classes.

Class	Variable			
Class 1	Low-Responsibility Consumers – 35%			
	Ascription of responsibility	Class 1	Others	Total
	Medium-low	43%	57%	152
	High	27%	73%	148
Class 2	Budget-Conscious Young Adults – 30%			
	Age	Class 2	Others	Total
	Under 33	42%	58%	100
	Over 33	24%	76%	200
	Usual spending on wine consumed at home			
	Under 5€	49%	51%	90
	Over 5€	19%	81%	210
Class 3	Higher-Spending Wine Buyers – 24%			
	Usual spending on wine consumed at home	Class 3	Others	Total
	Under 5€	13%	87%	90
	Over 5€	28%	72%	210
Class 4	Frequent Wine Drinkers – 11%			
	Frequency of wine consumption at home	Class 4	Others	Total
	Less than once a week	3%	97%	88
	At least once a week	14%	86%	212

Note: For clarity, the underlined values highlight the variables through which each class differs most markedly from the rest of the sample. Percentages are to be read row-wise and should be interpreted in relation to the overall size of each class. For example, in Class 1 – which represents 35% of the total sample – having 43% of respondents with medium-low Ascription of Responsibility indicates a prevalence of this trait within the group.

reflect a combination of concern about emissions and broader sustainability considerations. The reduced water footprint label, although less central, is valued by some respondents due specific awareness of the issue and its perceived personal relevance.

3.2 Profiling

Table 7 reports the characteristics that were found to be significant in the CHAID analysis (AOR, age, usual spending on wine for domestic consumption, and frequency of wine consumption at home). The analysis was conducted for each class, aiming to understand the variables that distinguish each cluster from the rest of the sample. Finally, Table 8 illustrates how the variables reported in Table 7 distinguish the different classes.

Class 1, which shows a preference for wines without environmental labels, includes consumers who report lower levels of responsibility attribution for the environmental impact of their choices. Class 2 is primarily composed of individuals under the age of 33 who typically spend less than €5 per bottle for everyday wine consumed at home. Class 3 is similarly defined by wine expenditure, but in the higher range – consumers who usually spend more than €5 per bottle. Lastly, Class 4, identified by the frequent selection of the no-choice option in the DCE, predominantly includes respondents who drink wine on a daily basis.

4. DISCUSSION

The results highlight how environmental labels in the wine sector are perceived in ways that vary markedly across consumers, reflecting different priorities, cognitive filters, and expectations. Class 1, representing a substantial share of the sample, actively rejects environmental labels: the negative and significant coefficients in the utility function indicate that the presence of a label reduces product appeal. This suggests that, for these consumers, environmental labels may be perceived not simply as irrelevant, but as a disruption to the perceived authenticity of the wine. This is particularly relevant in the wine sector, where conventional practices that often involve chemical inputs are culturally associated with sensory quality and artisanal expertise. As noted by Delmas and Lessem [20], environmental label can conflict with quality expectations when they are seen as departing from tradition. In this context, environmental messaging might be interpreted as a signal of lower quality or as an ideological intrusion [51]. Communication strategies targeting this segment may therefore benefit from avoiding polarising framings (e.g., conventional vs. sustainable) and instead seek to embed sustainability within familiar narratives, for example by presenting reduced

pesticide use as a means of enhancing terroir expression and preserving traditional know-how [52].

Class 2 adopts a more pragmatic, issue-oriented perspective. These consumers, who are mostly younger and more price-sensitive, seem to evaluate environmental labels based on their perceived relevance to tangible issues, such as personal health or the protection of specific resources, rather than on broader ideological or abstract commitments. This may reflect the fact that younger generations have long been bombarded with sustainability-related messages, which could have contributed to a more pragmatic approach to such topics. It is possible that they view organic certification not as a response to a clearly defined environmental concern, but rather as a broad sustainability claim shaped by marketing language. Such evidence aligns with Schäufele and Hamm [23], who observe that younger consumers are not indifferent to sustainability, but need clear, targeted information to activate their interest and guide their choices. Similar results were obtained by Moscovici et al. [53]. This interpretation may also help explain why, in our results, organic certification was not particularly appreciated by this group: despite its environmental intentions, the label does not explicitly communicate specific benefits. As noted by Anagnostou and colleagues [54], the findings suggest that labels must clearly convey their specific environmental benefits to be valued by more pragmatic consumers. Communication strategies here should prioritise transparency, through direct and concise formats such as infographics or short claims, explicitly linking the label to specific benefits. Health-related concerns and the perceived relevance of water-related issues emerge as particularly effective drivers of interest in this group.

In contrast, Class 3 shows a clear preference for organic certification, which appears to be chosen primarily because it is considered trustworthy. While this preference seems to be driven by the perceived credibility of the label, our findings resonate with observations by Schäufele and Hamm [23], who suggest that, when consumers trust organic certification, it can also serve as a signal of quality. In this light, it is possible that, for this group, organic certification is seen not only as a marker of environmental responsibility but also as an indicator of overall product reliability or value. Communication strategies should therefore aim to reinforce this trust—by highlighting long-standing engagement with sustainability (e.g., "since 2010 we've worked to reduce our environmental impact") and by integrating organic certification within a broader set of recognised quality cues. These might include official designations of origin or endorsements such as awards and scores from reputable wine guides, which can contribute to a coherent and trustworthy product profile.

Lastly, Class 4, composed of frequent wine consumers, shows a marked tendency to opt for the no-choice alternative. The negative and significant constant associated with this option suggests that the wines presented in the experiment, regardless of their environmental labels, often failed to meet the expectations of these consumers. This may indicate that frequent drinkers tend to rely on well-established preferences and are oriented toward wines they already know and feel confident choosing. Their decision-making appears to be driven by the pursuit of a wine that delivers a satisfying taste at a reasonable price, rather than by interest in new sustainability attributes. In this context, environmental labels do not actively influence preferences, not necessarily because of opposition, but because they are not salient in the evaluation process. This finding resonates with previous studies that identify frequent wine drinkers as less susceptible to environmental label influence, unless such labels are strongly associated with trusted brands or quality cues [20]. Communication efforts aiming to reach this segment might therefore benefit from showing how sustainability can contribute to maintaining product quality and price accessibility rather than positioning it as an added or separate value.

Overall, these findings confirm that environmental labels are not universally interpreted nor uniformly influential. Their impact depends on how well they resonate with consumers' concrete concerns and decision-making logics, whether related to trust in the certification system, concerns about health, established consumption habits, or sensitivity to specific environmental issues. While some consumers appreciate environmental labels as a sign of credibility, others value them for addressing specific concerns such as pesticide use or water conservation, while others still disregard them altogether, seeing them as irrelevant or even at odds with their perception of what constitutes a "good wine". This reinforces the idea, supported in recent literature, that sustainability in wine is not a simple binary attribute but interacts with the symbolic, emotional, and contextual layers of consumer experience [23]. Recognising these differences is essential to avoid reductive assumptions, such as expecting all consumers to respond similarly to the same label [54], and to develop communication strategies that are attuned to the diversity of decision criteria that shape wine consumption. Rather than assuming uniform sensitivity to sustainability, it becomes necessary to acknowledge that wine remains a deeply cultural and experiential product, where tradition, pleasure, routine and expectations coexist in complex ways [55].

5. CONCLUSIONS

This study investigated how different environmental labels – organic, carbon neutral, reduced water footprint, and reduced pesticide use – are perceived by wine consumers and how they influence purchase preferences. Using a discrete choice experiment combined with latent class analysis, we identified four distinct consumer segments, each characterised by different sensitivities to environmental labels.

The results reveal that environmental labels do not have a uniform effect across the sample. For a significant portion of consumers, environmental labels reduce the perceived utility of the product, suggesting a potential tension between sustainability messaging and traditional expectations in wine. Others evaluate labels based on their perceived relevance to specific concerns, such as pesticide exposure or water conservation, while another group places particular value on organic certification, appreciating it for its reliability. A final segment shows limited responsiveness to any of the proposed alternatives, as indicated by a significant tendency to opt for the no-choice option, a behaviour that likely reflects reliance on habitual choices and a lack of interest in unfamiliar cues.

These findings underline the importance of tailoring sustainability communication to different interpretive frameworks. Labels are not neutral signals, but are filtered through existing beliefs, priorities, and heuristics. Clear, differentiated, and context-sensitive communication is therefore essential not only to enhance label effectiveness, but also to avoid misunderstandings about what each label actually conveys.

For producers and policymakers, this suggests that the success of sustainability initiatives in the wine sector depends not only on improving environmental performance, but also on fostering more nuanced forms of engagement with consumers: acknowledging the plurality of motivations that shape wine choices, and the cultural and experiential nature of the product itself.

While the study offers relevant insights into how consumers interpret different environmental labels in the wine sector, some limitations also point to productive directions for future research. As with any stated preference method, the discrete choice experiment relies on a hypothetical setting. Future studies could explore how preferences observed here translate into actual purchasing behaviour. Moreover, the environmental labels tested were kept general by design, in order to reflect their current state of development and limited standardisation in the Italian market. Future work may investigate how consumer preferences vary when labels are framed with more detailed wording, design elements, or institutional endorsements. Finally, while our findings are grounded in the Italian context, they open avenues for cross-national comparisons aimed at understanding how cultural heritage interacts with sustainability perceptions in other wine-producing countries.

ACKNOWLEDGEMENT

The authors wish to thank the Oenotrace project, funded by the Ministero dell'agricoltura, della sovranità alimentare e delle foreste under the ICT AGRIFOOD of ERA-NET programme.

REFERENCES

[1] R. Buttinelli, R. Cortignani, G. Dono, 2021. Financial sustainability in Italian Organic Farms: An analysis of the FADN sample. *Economia agro-alimentare*: XXIII, 3, 2021, 1-32. https://doi.org/10.3280/ecag2021oa12766

[2] N. di Santo, I. Russo, R. Sisto, 2022. Climate change and natural resource scarcity: A literature review on dry farming. *Land*, *11*(12), 2102. https://doi.org/10.3390/land11122102

[3] L. F. D. Lopes, D. J. C. da Silva, C. S. Teixeira, 2025. Innovation capacity of Brazilian wineries: an integrated approach using the fuzzy Delphi and random forest methods. *Wine Economics and Policy*. https://doi.org/10.36253/wep-16737

[4] T. Reinhardt, Y. Ambrogio, L. Springer, M. Tafel, 2024. Wine law, sustainable innovation and the emergence of a wine constitution. *Wine Economics and Policy*. https://doi.org/10.36253/wep-16041

[5] A. Zironi, P. Danese, P. Romano, R. Zironi, 2024. A Lean Six Sigma, Industry 4.0 and Circular Economy-driven methodology for wine supply chain process improvement. *Wine Economics and Policy*. https://doi.org/10.36253/wep-15803

[6] C. L. Beber, L. Lecomte, I. Rodrigo, M. Canali, A. S. Pinto, E. Pomarici, E. Giraud-Heraud, S. Pérès, G. Malorgio, 2023. The agroecological challenges in the wine sector: perceptions from European stakeholders. *Wine Economics and Policy*, *12*(2), 103-120. https://doi.org/10.36253/wep-15244

[7] M.L. Longbottom, P.R. Petrie, 2015. Role of vineyard practices in generating and mitigating greenhouse gas emissions. *Australian Journal of Grape and Wine Research*. 21, 522–536. https://doi.org/10.1111/ajgw.12187

[8] D. Bentivoglio, G. Chiaraluce, A. Finco, 2024. Water stress as a critical issue for Mediterranean viti-culture: economic evidence from the Montepulciano d'Abruzzo PDO grape based on a case study in central Italy. *Wine Economics and Policy*, *13*(1), 141-150. https://doi.org/10.36253/wep-15257

[9] L. Bavaresco, C. Squeri, 2022. Outlook on disease resistant grapevine varieties. *BIO Web of Conferences*. 44, 06001. https://doi.org/10.1051/bioconf/20224406001

[10] I. Pertot, T. Caffi, V. Rossi, L. Mugnai, C. Hoffmann, M. S. Grando et al., 2017. A critical review of plant protection tools for reducing pesticide use on grapevine and new perspectives for the implementation of IPM in viticulture. *Crop Protection*. 97, 70–84. https://doi.org/10.1016/j.cropro.2016.11.025

[11] E. Lamonaca, A. Seccia, F. G. Santeramo, 2023. Climate Cha (lle) nges in global wine production and trade patterns. *Wine Economics and Policy*, *12*(2), 85-102. https://doi.org/10.36253/wep-13852

[12] S. Massaglia, T. Verduna, V. Varchetta, F. Brun, S. Blanc, S., 2023. The impact of alternative packaging on the life cycle of wine on tap. *Wine Economics and Policy*, *12*(1), 51-62. https://doi.org/10.36253/wep-13016

[13] R. Buttinelli, R. Cortignani, F. Caracciolo, 2024. Irrigation water economic value and productivity: An econometric estimation for maize grain production in Italy. *Agricultural Water Management*, *295*, 108757. https://doi.org/10.1016/j.agwat.2024.108757

[14] A. Muller, C. Schader, N. El-Hage Scialabba, J. Brüggemann, A. Isensee, K. H. Erb, P. Smith, P. Klocke, F. Leiber, M. Stolze, U. Niggli, 2017. Strategies for feeding the world more sustainably with organic agriculture. *Nature Communications*, 8(1), 1-13. https://doi.org/10.1038/s41467-017-00377-5.

[15] M. A. Delmas, O. Gergaud, 2021. Sustainable practices and product quality: Is there value in eco-label certification? The case of wine. *Ecological Economics*, 183, 107-114. https://doi.org/10.1016/j.ecolecon.2021.106955.

[16] T. P. Lyon, A. W. Montgomery, 2015. The means and end of greenwash. *Organization & environment*, *28*(2), 223-249. https://doi.org/10.1177/108602661557533

[17] D. Brécard, 2014. Consumer confusion over the profusion of eco-labels: Lessons from a double differentiation model. *Resource and energy economics*, *37*, 64-84. https://doi.org/10.1016/j.reseneeco.2013.10.002

[18] M. A. Delmas, O. Gergaud, J. Lim, 2016. Does organic wine taste better? An analysis of experts' ratings. *Journal of Wine Economics*, *11*(3), 329-354. https://doi.org/10.1017/jwe.2016.14

[19] M. G. Luchs, R. W. Naylor, J. R. Irwin, R. Raghunathan, 2010. The sustainability liability: Potential negative effects of ethicality on product preference. *Journal of marketing*, *74*(5), 18-31. https://doi.org/10.1509/jmkg.74.5.018

[20] M. A. Delmas, N. Lessem, 2017. Eco-Premium or Eco-Penalty? Eco-Labels and Quality in the Organic Wine Market. *Business & Society*. 56(2), 318–356. https://doi.org/10.1177/0007650315576119

[21] E. Parga-Dans, R. Vecchio, A. Annunziata, P. A. González, R. O. Enríquez, 2023. A certification for natural wine? A comparative analysis of consumer drivers in Italy and Spain. *Wine Economics and Policy*, 12(1), 23-35. https://doi.org/10.36253/wep-12890

[22] G. Giannoccaro, D. Carlucci, R. Sardaro, 2019. Assessing consumer preferences for organic vs eco-labelled olive oils. *Organic Agriculture*. 9, 483–494. https://doi.org/10.1007/s13165-019-00245-7

[23] I. S. Schäufele, U. Hamm, 2017. Consumers' perceptions, preferences and willingness-to-pay for wine with sustainability characteristics: A review. *Journal of Cleaner Production*, 147, 379-394. https://doi.org/10.1016/j.jclepro.2017.01.113.

[24] F. Solfanelli, S. Mandolesi, I. Silvestri, S. Naspetti, R. Zanoli, 2025. Debating wine health-warning labels using Q methodology. *Wine Economics and Policy*. https://doi.org/10.36253/wep-17056

[25] J.J. Czarnezki, 2011. The future of food eco-labeling: Organic, carbon footprint, and environmental life-cycle analysis. *Stanford Environmental Law Journal*. 30, 3. https://digitalcommons.pace.edu/lawfaculty/914/

[26] P. Tait, C. Saunders, P. Dalziel, P. Rutherford, T. Driver, M. Guenther, 2019. Estimating wine consumer preferences for sustainability attributes: A discrete choice experiment of Californian Sauvignon blanc purchasers. *Journal of Cleaner Production*, 233, 412-420. https://doi.org/10.1016/j.jclepro.2019.06.312.

[27] ISTAT (2024). Spese delle famiglie. Available at: https://www.istat.it/informazioni-sulla-rilevazione/spese/. Accessed on 08/04/2025.

[28] Il fatto alimentare (2024). Vini più bevuti dagli italiani: il prezzo come fattore determinante. Available at: https://ilfattoalimentare.it/vini-piu-bevuti-dagli-italiani-prezzo.html. Accessed on 08/04/2025.

[29] Y.K. Huang, M.A. Palma, J. Rangel, 2024. Can a Local Food Label Nudge Consumer Behavior? Implications of an Eye-tracking Study of Honey Products. *Journal of Agricultural and Applied Economics*. 1–19. https://doi.org/10.1017/aae.2024.2

[30] G. Piracci, T. Fantechi, L. Casini, 2024. Emerging trends in healthy and sustainable eating: The case of fresh convenience plant-based foods. *Plant-Based Food Consumption*, 83-103.

[31] Z. Pieniak, W. Verbeke, S. O. Olsen, K. B. Hansen, K. Brunsø, 2010. Health-related attitudes as a basis for segmenting European fish consumers. *Food Policy*, 35(5), 448-455. https://doi.org/10.1016/j.foodpol.2010.02.004.

[32] E. J. Van Loo, C. Hoefkens, W. Verbeke, 2017. Healthy, sustainable and plant-based eating: Perceived (mis) match and involvement-based consumer segments as targets for future policy. *Food Policy*, 69, 46-57. https://doi.org/10.1016/j.foodpol.2017.02.004.

[33] J. Joireman, M. J. Shaffer, D. Balliet, A. Strathman, 2012. Promotion orientation explains why future-oriented people exercise and eat healthy: Evidence from the two-factor consideration of future consequences-14 scale. *Personality and Social Psychology Bulletin*, *38*(10), 1272-1287. https://doi.org/10.1177/01461672124493

[34] W. Abrahamse, L. Steg, 2011. Factors related to household energy use and intention to reduce it: The role of psychological and socio-demographic variables. *Human Ecology Review*. 18(1), 30–40. https://doi.org/http://www.jstor.org/stable/24707684.

[35] W. Abrahamse, L. Steg, R. Gifford, C. Vlek, 2009. Factors influencing car use for commuting and the intention to reduce it: A question of self-interest or morality? *Transportation Research Part F: Traffic Psychology and Behaviour*. 12(4), 317–324. https://doi.org/10.1016/j.trf.2009.04.004

[36] S.R. Jaeger, J.M. Rose, 2008. Stated choice experimentation, contextual influences and food choice: A case study. *Food Quality and Preference*. 19(6), 539–564. https://doi.org/10.1016/j.foodqual.2008.02.005

[37] F. Boncinelli, C. Contini, F. Gerini, C. Romano, G. Scozzafava, L. Casini, 2020. The role of context definition in choice experiments: A methodological proposal based on customized scenarios. *Wine Economics and Policy*. 9(2), 49–62. https://doi.org/10.36253/wep-7978

[38] E. Pabst, A. M. Corsi, R. Vecchio, A. Annunziata, S. M. Loose, 2021. Consumers' reactions to nutrition and ingredient labelling for wine–A cross-country discrete choice experiment. *Appetite*, 156, 104843. https://doi.org/10.1016/j.appet.2020.104843.

[39] M. Corduas, L. Cinquanta, C. Ievoli, 2013. The importance of wine attributes for purchase decisions: A study of Italian consumers' perception. *Food Quality and Preference*. 28(2), 407–418. https://doi.org/10.1016/j.foodqual.2012.11.008

[40] S.R. McCann, 2023. Certainty, wine and haematology. *Bone Marrow Transplantation*. 58(12), 1293–1295. https://doi.org/10.1038/s41409-023-01990-3

[41] V. A. Sottini, E. Barbierato, I. Bernetti, I. Capecchi, S. Fabbrizzi, S. Menghini, 2019. Winescape perception and big data analysis: An assessment through social media photographs in the Chianti Classico region. *Wine Economics and Policy*, 8(2), 127-140. https://doi.org/10.1016/j.wep.2019.09.003.

[42] M. C. J. Bliemer, J. M. Rose, 2011. Experimental design influences on stated choice outputs: an empirical study in air travel choice. *Transportation Research Part A: Policy and Practice*. 45(1), 63–79. https://doi.org/10.1016/j.tra.2010.09.003

[43] D. McFadden, 1972. Conditional logit analysis of qualitative choice behavior. In: P. Zarembka (Ed.), Frontiers in Econometrics. Academic Press, New York, 105–142.

[44] K.J. Lancaster, 1966. A new approach to consumer theory. *Journal of Political Economy*. 74(2), 132–157. https://doi.org/10.1086/259131

[45] K. E. Train, 2009. Discrete choice methods with simulation. Cambridge University Press.

[46] F. Caracciolo, M. Furno, M. D'Amico, G. Califano, G. Di Vita, 2022. Variety seeking behavior in the wine domain: A consumers segmentation using big data. *Food Quality and Preference*. 97, 104481. https://doi.org/10.1016/j.foodqual.2021.104481

[47] S. Hynes, N. Hanley, R. Scarpa, 2008. Effects on welfare measures of alternative means of accounting for preference heterogeneity in recreational demand models. *American Journal of Agricultural Economics*. 90(4), 1011–1027. https://doi.org/10.1111/j.1467-8276.2008.01148.x

[48] R. Scarpa, M. Thiene, T. Tempesta, 2007. Latent class count models of total visitation demand: days out hiking in the eastern Alps. *Environmental and Resource Economics*, 38, 447-460. https://doi.org/10.1007/s10640-007-9100-0.

[49] H. Andruff, N. Carraro, A. Thompson, P. Gaudreau, B. Louvet, 2009. Latent class growth modelling: a tutorial. *Tutorials in Quantitative Methods for Psychology*. 5(1), 11–24. https://doi.org/10.20982/tqmp.05.1.p011

[50] R. Scarpa, M. Thiene, 2005. Destination choice models for rock climbing in the Northeastern Alps: a latent-class approach based on intensity of preferences. *Land Economics*, 81(3), 426-444. https://doi.org/10.3368/le.81.3.426.

[51] M. Simeone, C. Russo, D. Scarpato, 2023. Price quality cues in organic wine market: is there a veblen effect?. *Agronomy*, *13*(2), 405. https://doi.org/10.3390/agronomy13020405

[52] M. Wagner, P. Stanbury, T. Dietrich, J. Döring, J. Ewert, C. Foerster, M. Freund, M. Friedel, C. Kammann, M. Koch, T. Owtram, H. R. Schultz, K. Voss-Fels, J. Hanf, 2023. Developing a sustainability vision for the global wine industry. *Sustainability*, *15*(13), 10487. https://doi.org/10.3390/su151310487

[53] D. Moscovici, J. Gow, L. Valenzuela, R. Rana, A. A. Ugaglia, R. Mihailescu, 2024. Assessing the age effect on consumer attitudes and willingness to pay for sustainably produced wine: A transnational analysis. *Journal of Sustainability Research*, *6*(3), 1-18. https://doi.org/10.20900/jsr20240048

[54] E. Anagnostou, T. Tsiakis, I. Zervas, 2025. Highlighting Wine Labels: A Systematic Literature Review of Dominant Informational Parameters as Communicative Elements. *Beverages*, *11*(1), 12. https://doi.org/10.3390/beverages11010012

[55] A. Dias, B. Sousa, V. Santos, P. Ramos, A. Madeira, 2023. Wine tourism and sustainability awareness: A consumer behavior perspective. *Sustainability*, 15(6), 5182. https://doi.org/10.3390/su15065182

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Depetris Chauvin, N., Pinède, A. & Rodrigues, H. (2025). Perceptions of canned wine drinkers in outdoor leisure settings: a vignette study with swiss residents. *Wine Economics and Policy* 14(1): 31-45. doi: 10.36253/wep-16720

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Perceptions of canned wine drinkers in outdoor leisure settings: a vignette study with swiss residents

Nicolas Depetris Chauvin[1]*, Antoine Pinède[1], Heber Rodrigues[2]

[1] *Haute Ecole de Gestion de Genève, HES-SO, Carouge, Switzerland*
[2] *Yayin Sense, London, United Kingdom*
*Corresponding author. Email: nicolas.depetris-chauvin@hesge.ch

Abstract. This study explores the prejudices of Swiss residents toward consumers of canned wine in the context of outdoor leisure activities. Despite the convenience and environmental benefits of canned wine, it faces resistance from wine consumers based on prejudices. We investigate whether holiday outdoor settings such as *beach resorts*, *ski stations*, *desert safaris*, and *outdoor parties* could mitigate these prejudices, as leisure contexts might reduce the ritualistic consumption patterns associated with wine drinking. Using a vignette study, Swiss residents evaluated the personality traits of canned wine consumers across different scenarios. Our findings reveal that, overall, canned wine drinkers are judged negatively, particularly in the *beach resort* scenario, where traits like "health consciousness" and "environmental friendliness" are rated lower. Demographic factors, including age, gender, and education, as well as cultural background, significantly influence these judgements. Younger respondents and expatriates showed less prejudice compared to older and more traditional Swiss residents, suggesting a generational and cultural divide in attitudes. These results underscore the need for targeted marketing strategies to address persistent stereotypes and foster a more positive image of canned wine among diverse consumer segments.

Keywords: consumer perceptions, wine packaging, outdoor leisure activities, sustainability.

1. INTRODUCTION

Whether emerging from a busy week at work or embarking on an annual holiday, outdoor spaces provide the perfect escape for individuals to refresh their minds and uplift their spirits [1, 2]. Traditionally, outdoor leisure encompasses stunning landscapes such as forests, coasts, lakes, and mountains [3]. From the paradisiacal islands of the Caribbean to the winter wonderlands of the Swiss Alps, these destinations offer diverse opportunities for relaxation and recreation [4, 5]. Whether enjoying a meal on a sun-drenched beach, savouring a drink after skiing, or camping under a starry sky, these experiences are integral to holidays, inviting individuals to connect with nature and indulge in specially chosen food and beverages [6, 7, 8]. Never-

theless, this interaction with the environment can lead to significant waste, particularly from beverage consumption. Millions of wine bottles are consumed annually during holidays, contributing to greenhouse gas emissions and a larger carbon footprint [9, 10]. An eco-friendly alternative, such as canned wine, could mitigate this impact, offering convenience and sustainability.

When compared to glass bottles, aluminium cans offer several advantages: they are infinitely recyclable, lightweight, and convenient to carry over long distances, which can influence consumption patterns [11, 12, 13]. While canned wine tins are typically smaller in size (ranging from 187ml to 375ml -approximately two glasses of wine) compared to a standard 750ml bottle, their portability can lead to a significantly higher number of cans being carried. Additionally, cans, particularly those used for beers and spirits, have been linked to an increase in binge drinking episodes, especially among young people [14, 15].

Despite these benefits, canned wine raises some quality concerns. Wines packaged in aluminium cans may accumulate higher levels of hydrogen sulphide (H_2S), resulting in a "rotten egg" aroma, and are more susceptible to issues such as leakage and compromised seals compared to glass bottles [16, 17]. Additionally, aluminium's high thermal conductivity makes cans more vulnerable to rapid temperature fluctuations during storage and transportation, potentially affecting the wine's stability [18]. Consumer perceptions regarding the sustainability and quality of wine in cans can also influence acceptance [19]. While aluminium cans are often praised for their recyclability and lower carbon footprint, they still face resistance from consumers [20]. However, it is worth considering whether individuals might be more open to canned wines during holidays and outdoor leisure activities, where the convenience of cans may be more appealing.

This study aims to explore the potential for consumers to shift towards eco-friendly wine packaging alternatives during outdoor recreation. Specifically, it investigates whether biases associated with everyday wine consumption extend to perceptions of canned wine drinkers in outdoor holiday contexts. We employed various scenarios representing outdoor leisure destinations and surveyed a representative sample of Swiss residents.

1.1 Consumer attitudes towards wine packaging

The packaging of a product fulfils several functions, playing an essential role as a protective device as well as a bridge for the communication between the producer and the final consumer [21]. This often impacts their purchase intentions and choices [22, 23]. In the case of wine, packaging is especially important as it acts as a first extrinsic cue influencing the quality evaluation of wines before the consumer tastes it [24]. In this case, the packaging works as a visual stimulus through its shape, colour, label design, and written information [25, 26]. Interestingly, as demonstrated by Piqueras-Fiszman and Spence [27], the wine packaging is also a tactile stimulus. These authors showed that only by holding the bottle in their hands consumers can gauge the price and assess the quality of the wines, deciding that better, or at least more expensive, wines come in heavier bottles. These results are important to keep in mind because if consumers associate wines in heavier bottles as being of higher sensory quality, this presents an environmental issue, as their positive attitude toward heavy bottles contributes to a larger carbon footprint [28] and perhaps diminishes their likelihood of positively evaluating alternative wine packaging options [29].

1.2 The prejudice towards canned wine consumption

Historically, canned food began to emerge in the 19th century, with the utilisation of tin cans developed to meet military needs during the Napoleonic Wars, which marked a significant milestone in food preservation [30, 31]. Although commercial applications were initially modest in the 1930s, canned wines have only recently made a substantial impact in the retail market. The global canned wine market generated $235.7 million in revenue in 2021 and is projected to grow to $571.8 million by 2028 [17, 32]. Despite its advantages and presence in the market, the consumption of canned wines faces significant challenges. In a recent study, Ruggeri et al. [15] investigated Italian wine consumers' preferences and willingness to pay for canned wine through a survey and the contingent valuation method. The authors collected data from 551 consumers regarding attitudes and preferences about their wine consumption, alternative packaging acceptance, and motivations for accepting and refusing to purchase it. The results showed that only a minority of the respondents declared they would buy canned wine, while the majority would refuse for reasons related to low-quality perception and poor consideration of alternative wine packaging. Therefore, it seems stereotypes and prejudice linked to its consumption could be an important casual factor discouraging the consumption of canned wine.

Stereotypes and prejudices are two concepts with old historical roots in the disciplines of anthropology and psychology. Lippmann [33] first conceptualised *stereotypes* as 'pictures in our heads' – later operational-

ised as cognitive schemas employed by social perceivers to interpret information about others [34]. In contrast, *prejudices* encompass an affective or attitudinal dimension, defined as a predisposition to respond unfavourably to individuals or objects based on their membership in a particular class or category [35]. Beyond their cognitive functions of simplification and categorisation, these shaping elements of 'bias' also generate behavioural expectations and result in specific behavioural consequences [36], as it was recently demonstrated by Depetris-Chauvin et al. [37]. In this study, the authors sought to investigate whether the country of origin (COO) of wines induces implicit biases – shaped by the stereotypes and the prejudices attached to the COO – in the judgments of wine experts. Twenty-two wine traders from ten different countries were asked to evaluate their liking and provide sensory descriptions of eight Pinot Noir wines sourced from Argentina, Brazil, France, and Switzerland, under both blind and informed conditions. Their results reveal that COO bias significantly influences wine experts' perceptions; once the COO was disclosed, the likeability ratings for wines from Argentina and Brazil decreased as well as the evaluative language used by assessors to describe the wines. Under informed conditions, Brazilian and Argentinean wines were frequently described using negative hedonic terms. Conversely, when participants were aware of the wines' origins, French and Swiss wines were often described by positive sensory descriptors.

Following recent research by Trochtová et al. [38], which indicates that outdoor leisure activities can transform an individual's values, particularly in relation to their educational and personal development, one might consider whether these recreational occasions could contribute to a less stereotypical perception of canned beverages and could potentially foster a more positive image while reducing stereotypes and prejudices.

1.3 Problematic and research questions

There is a growing body of research [15, 39] that documents the existence of a negative connotation associated with the consumption of wine in cans. For that reason, in the present study we aim to examine whether outdoor scenarios could help to mitigate those prejudices. This could be the case because when enjoying outdoor recreation, people are usually more relaxed, experience less ritualistic consumption activities and are often more open to novelty than when indoors in their everyday life. Furthermore, outdoor leisure spaces are typically shared among individuals, and it is well established in the literature [40, 41] that individuals often engage in social imitation. This tendency to align behaviours with those of their peers reinforces group cohesion and facilitates collective decision-making. If this is the case, it could potentially encourage others to adopt this specific drinking behaviour.

Therefore, the aim of this study is to evaluate whether different outdoor leisure scenarios would lead people to judge the canned wine drinker more positively. Concretely, this research asks the following two questions:

> Question 1: How is the canned wine drinker judged in different outdoor leisure scenarios, and does the judgment vary depending on the specific scenario?
> Question 2: Do the demographic characteristics of the respondents influence their judgements of canned wine drinkers?

2. STUDY DESIGN

The study explores Swiss residents' judgements of individuals consuming canned wine using a vignette study methodology. Participants in an online questionnaire were randomly assigned to one of four outdoor recreational contexts (*beach resort, ski station, desert safari,* or *outdoor party*) and were asked to evaluate sixteen personality traits of an individual drinking canned wine on a seven-point Likert scale. The survey data are analysed through a multi-step approach, including t-tests, MANOVA, and OLS regressions, to assess potential prejudices in personality judgements based on context and demographic factors.

2.1 Respondents

A total of 795 Swiss residents participated in the study, with demographic information detailed in Table 1. Data collection occurred between October 2021 and January 2022. Invitations to complete the online questionnaire were sent via email to a nationally representative database of 15'000 Swiss adults. This database is maintained by the Haute Ecole de Gestion de Genève for different market studies, and it is updated periodically. The final sample excluded incomplete responses and participants who identified as foreign residents. The sample size used in the analysis is larger than those reported in comparable studies [42, 43]. Based on a medium effect size (Cohen's f = 0.25), an alpha of 0.05, and a desired power of 0.80, the required sample size per group for a study with four groups is approximately 179 respondents. This results in a total sample size of around 714 respondents. Given that our study includes 795 respond-

Table 1. Demographic information of the sample.

Variables	%
Scenarios	
Beach Resort	20.50
Desert Safari	36.73
Outdoor Party	20.63
Ski Station	22.14
Language of the respondents	
German	49.69
French	34.97
Italian	9.81
English	5.53
Female	52.45
Age cohort	
18 to 29 years old	12.70
30 to 39 years old	12.70
40 to 49 years old	18.11
50 to 59 years old	26.54
60 to 69 years old	17.23
70 years or more	12.70
Highest level of formal education achieved	
Primary school	0.38
High School	2.64
Tertiary education (technical, vocation	33.46
University: Bachelor degree	29.69
University: Master/Doctorate degree	33.84
Wine consumption	
Never	8.18
Less than once a month	12.83
At least once a month	20.75
Around once a week	32.70
Several times a week	25.53
Have drunk canned wine	10.69
Number of Respondents	795

ents, this exceeds the required sample size, ensuring sufficient statistical power to detect meaningful effects.

The decision to focus on a sample of Swiss residents for this study is based on several compelling justifications that enhance its relevance and impact. Although canned wine has yet to achieve widespread popularity in Switzerland compared to Anglo-Saxon countries, it has the potential to occupy a unique position in a market where wine consumption ranks among the highest per capita globally [44]. This context provides a fertile ground for exploring emerging trends, particularly the introduction of innovative packaging such as canned wine, which may attract new consumers prioritizing convenience and sustainability [45]. Switzerland's diverse wine landscape, with several production regions, presents an opportunity to examine consumer judgements in a market characterised by openness and variety [46]. Notably, around two-thirds of the wine consumed in Switzerland is imported, making it one of the more accessible markets in Continental Europe for diverse wine offerings. This diversity allows for a more nuanced understanding of how different wine styles, including canned options, are perceived against a backdrop of traditional preferences. Additionally, the Swiss population's linguistic and cultural variety offers a rich tapestry for examining how demographic and cultural factors influence attitudes toward wine consumption. While this study focuses on Swiss residents, the diversity within the Swiss population may provide valuable insights to inform broader discussions on consumer behaviour in markets with high per capita wine consumption and openness to diverse wine offerings. However, we present this as a potential hypothesis, recognizing that the generalizability of these findings to other markets should be further explored in future research. The insights gained from this specific demographic are nonetheless valuable for advancing both academic understanding and industry practices in the evolving landscape of wine consumption.

In our sample, 8.18% of respondents identified as non-wine drinkers. Their inclusion is essential for capturing a broader perspective on societal perceptions of eco-friendly wine packaging, particularly canned wine in outdoor recreational settings. The acceptance of wine in cans may be influenced not only by individual preferences but also by the attitudes and biases of others, including non-wine drinkers, who help shape social norms and purchasing decisions. Understanding these external perceptions is crucial, as they can impact the broader acceptance and integration of alternative packaging formats. By incorporating both wine consumers and non-consumers, we aim to provide a more comprehensive analysis of societal attitudes, offering deeper insights into the potential shift toward sustainable packaging solutions.

2.2 Methodology

In this study, we employ a vignette study methodology, a common and effective approach for examining people's social perceptions and attitudes in various contexts (see Atzmüller & Steiner [47] for a literature review). Vignette studies allow researchers to present participants with controlled hypothetical scenarios, enabling them to assess judgments and impressions based on limited information. This method is particularly well-suited for our objective of exploring judgements of individuals consuming canned wine, as it facilitates the examination of how context influences personality attributions, prejudices, and

stereotypes. Vignette studies have been widely used in similar contexts, particularly in the field of consumer behaviour, to investigate the social implications of food and beverage consumption. For instance, studies have demonstrated how judgements of individuals based on their food choices can significantly impact perceptions and attitudes [48–50]. These studies highlight that the context in which food or beverages are consumed often shapes the social judgments that individuals make about others.

In our study, participants were informed that they were being tested on how well they could assess an individual's personality based on very little information. They were randomly assigned to one of four conditions that differed in terms of the context presented. They read the description: "*Imagine you are on holidays. You are at a beach resort /or/ ski station /or/ desert safari /or/ outdoor party, and you see a person drinking wine from a can*." After the description of the context, participants were asked to project themselves into the scenario until they could describe the person consuming the wine in a can. They were invited to rate their impression of the drinker according to 16 personality attributes on a scale from 1 to 7 (see the personality traits in Table 2). Additionally, participants indicated whether they thought the person was a man, a woman, or either of the two, and how old they perceived the person to be. The instructions and scenarios were presented in the native language of the subjects.

While vignette studies provide valuable insights, we acknowledge the limitations regarding ecological validity, particularly the extent to which hypothetical scenarios reflect real-world contexts. To address this, we carefully selected contexts familiar to the Swiss population, ensuring a reasonable degree of relatability. Additionally, we conducted a pre-test with a smaller sample to ensure the clarity and realism of the scenarios. This process helped refine the scenarios, providing greater methodological transparency.

Given the familiarity of the Swiss population with the *beach resort*, *outdoor party*, and *ski station* contexts and the potential unfamiliarity with the *desert safari* context, the randomization consisted of a 20% chance of receiving one of the familiar contexts and a 40% chance of receiving the unfamiliar *desert safari* context. In our final sample, 21% of respondents were presented with the *beach resort* context, 21% with the *outdoor party*, 22% with the *ski station*, and 36% with the *desert safari*. This strategic design enables us to explore the interplay between context, beverage choice, and perceived personality traits, contributing valuable insights into consumer behaviour and the social dynamics surrounding food and drink consumption.

We conducted preliminary checks on the distribution of key variables across contexts and found that while most variables met strict homogeneity criteria, some deviations were present. Recognizing the importance of addressing potential discrepancies, our primary approach involves controlling for demographic factors such as language, gender, age, education, and wine consumption within our regression models. By integrating these sociodemographic controls, we ensure that any observed effects are adjusted accordingly, minimizing potential biases arising from differences in sample composition, which remain marginal.

To minimize social desirability bias, we ensured the anonymity of responses and maintained confidentiality throughout the data collection process. The use of randomization and multiple context scenarios further reduced the likelihood of socially desirable responses. Nevertheless, we acknowledge that social desirability bias remains a potential limitation of self-reported data, and we will address this limitation in the discussion section.

2.3 Data analysis

The analysis aims to assess whether the perceived personality traits of canned wine drinkers are subject to prejudice and stereotype, particularly negative ones, and whether these judgements vary across different recreational contexts and are influenced by demographic and cultural factors. To achieve this, a multi-step methodological approach is employed, encompassing t-tests, Multivariate Analysis of Variance (MANOVA), and regression analysis.

The initial step involves conducting a series of one-sample t-tests to evaluate whether the judgement of each personality trait significantly deviates from neutrality. Specifically, each trait is tested against a neutral value of 4 (on a Likert scale ranging from 1 to 7) to determine if there are any significant biases -positive or negative- in the judgement of canned wine drinkers. This step is crucial for identifying any overarching prejudice and stereotype in how canned wine consumers are judged. The results of these t-tests provide an initial understanding of whether general stereotypes or preconceived notions about canned wine drinkers exist.

Building on this, MANOVA is employed to assess whether these judgements, once identified, differ across various recreational contexts, such as *beach*, *desert*, *party*, or *ski*. MANOVA is chosen for its capability to simultaneously test for differences across multiple dependent variables (in this case, the sixteen personality traits), providing a comprehensive view of how context-driven variations might alter these pre-existing prejudices and

stereotypes. Four common test statistics -Wilks' Lambda, Pillai's Trace, Lawley-Hotelling Trace, and Roy's Largest Root- are applied to evaluate the overall significance of the contextual effect, determining whether the leisure scenarios significantly influence the combined judgments of traits.

Following the MANOVA, a series of ordinary least squares (OLS) regression analyses are conducted to further investigate the role of individual characteristics and contextual factors in shaping judgements. Sixteen separate regressions, one for each personality trait, are performed to disentangle the specific effects of contextual variables and demographic covariates -such as age, gender, education level, and cultural background- on perceived traits. Dummy variables represent each leisure scenario, with the beach scenario serving as the baseline for comparison. Additional predictors include self-reported familiarity with wine to control for experience-based biases. This approach allows for a detailed exploration of how judgements of canned wine consumers vary not only by context but also by individual respondent characteristics, providing insights into the nuanced ways these factors interact.

Through this multi-step methodology, the study systematically tests the hypotheses that there may be prejudices and stereotypes in the perceived personality traits of canned wine drinkers and that these prejudices and stereotypes are context-dependent and influenced by demographic factors, offering a comprehensive understanding of the drivers behind these judgements.

3. FINDINGS

Our first objective is to establish which personality traits are perceived for a person that consumes wine in cans in different outdoor recreational activities and to test if those traits are context dependent. The results of the analysis are shown in Table 2. The table displays the average judgements of a canned wine consumer's personality traits across our four leisure scenarios. The scale proposed to the participants ranged from 1 to 7, with a midpoint of 4 representing a neutral assessment. Values above or below this midpoint indicate a positive or negative skew in perception, respectively, and asterisks denote the statistical significance of the difference from the neutral point.

In the *beach resort* scenario, the personality traits associated with canned wine consumers are generally judged negatively (13 out of the 16 traits). For example, traits such as " Health Conscious" (3.13), " Environmentally Friendly" (2.96), and "Vulgar" (2.99) are significantly below the neutral point, suggesting that these consumers are not particularly health-conscious or environmentally friendly and are perceived as less elegant. Traits like "Disciplined" (3.60) and "Popular" (3.52), though still below the neutral point, suggest that while these consumers are not perceived as highly disciplined or popular, they are not judged extremely negatively in these areas. The strongest positive trait is "Extroverted" (4.49), showing these consumers as more extroverted compared to the neutral assessment.

For the *desert safari* scenario, similar patterns emerge. Consumers are judged as less "Health Conscious" (2.91) and less "Environmentally Friendly" (2.79), both significantly below the midpoint. In total, eleven traits are considered negative, four are neutral, and only one is positive. The perception of being "Imaginative" (3.84) or "Rich" (3.89) is slightly more favourable compared to the *beach resort* scenario. Overall, the traits remain below or near neutral, with "Extroverted" (4.53) standing out as a distinctly positive attribute.

In the *outdoor party* scenario, there are slightly more favourable judgements. There are nine negative personality traits, five neutrals and two positives. The "Extroverted" trait scores the highest (4.54), followed by "Satisfied" (4.26). Traits like "Gracious" (3.94), "Interesting" (3.92), and "Emotional" (3.90), which, while not statistically different from the neutral point, suggest a somewhat less negative image of canned wine consumers in this context. Despite this, negative judgements persist for traits like "Environmentally Friendly" (3.00), "Vulgar" (3.05) and " Education Level" (3.30).

In the *ski station* scenario, consumers are again perceived similarly to other scenarios, with "Health Conscious" (3.11) and "Vulgar" (2.85) being notably negative traits. However, traits like "Beautiful" (3.91) and "Conscious" (3.92) are perceived less negatively, though not statistically different from the neutral. "Extroverted" (4.47) continues to be the most positively skewed trait, suggesting a consistently extroverted image across scenarios.

Overall, the results in the table reveal that consumers of wine in cans are generally perceived as more extroverted across all scenarios but are seen less favourably in terms of most other personality traits, including "Health Consciousness", "Environmental Friendliness", and "Elegance". The *outdoor party* scenario seems to offer slightly more positive judgements compared to the *ski station* and *desert safari* contexts, and the *beach resort* scenario seems to generate the worst judgement.

Our previous analysis suggested some differences across scenarios, and we used Multivariate Analysis of Variance (MANOVA) to explore this further. MANOVA is a statistical technique used to examine the differences

Table 2. Personality traits of canned wine drinkers across outdoor leisure scenarios.

Personality traits	Scenarios			
	Beach Resort	Desert Safari	Outdoor Party	Ski Station
Undisciplined - Disciplined	3.60***	3.28***	3.68***	3.60***
Not health Conscious - Health Conscious	3.13***	2.91***	3.29***	3.11***
Not Environmentally Friendly - Environmentally Friendly	2.96***	2.79***	3.00***	3.14***
Unimaginative - Imaginative	3.76**	3.84*	3.77*	3.66***
Unpopular - Popular	3.52***	3.50***	3.52***	3.67***
Boring - Interesting	3.65***	3.80**	3.92	3.72***
Unemotional - Emotional	3.82*	3.96	3.90	3.84
Vulgar- Elegant	2.99***	2.98***	3.05***	2.85***
Ungracious - Gracious	3.84*	3.69***	3.94	3.81**
Dissatisfied - Satisfied	4.17*	4.14	4.26**	4.05
Introverted - Extroverted	4.49***	4.53***	4.54***	4.47***
Unconscious - Conscious	4.07	3.87	3.91	3.92
Low Education Level - High Education Level	3.33***	3.42***	3.30***	3.41***
Poor - Rich	3.59***	3.89	3.22***	3.60***
Ugly - Beautiful	3.85*	3.74***	3.80**	3.91
Bad - Good	3.85*	3.73***	3.92	3.81**
Number of respondants	163	292	164	176

* p<0.10; ** p<0.05; *** P<0.01.

between groups on multiple dependent variables simultaneously. In our case, it helps determine whether different consumption contexts (*beach resort*, *ski station*, *desert safari*, and *outdoor party*) significantly influence the combined set of dependent variables (the sixteen personality traits).

The results of the four common MANOVA test statistics are as follows:

- Wilks' Lambda (W), which tests whether the consumption context accounts for a significant portion of the variance in the personality traits, yielded a value of 0.9160. This value is close to 1, indicating a moderate effect. However, the F-statistic (F(42, 2308.7) = 1.65) with a p-value of 0.0056 ($p < 0.05$) suggests a statistically significant difference across scenarios.
- Pillai's Trace (P), a robust measure that sums the contribution of each canonical dimension, was 0.0858 (F(42, 2340.0) = 1.64, p = 0.0060; $p < 0.01$). While the value suggests a modest effect, the significant result confirms that the context has an influence on judgments.
- Lawley-Hotelling Trace (L), sensitive to smaller samples, showed a value of 0.0897 (F(42, 2330.0) = 1.66, p = 0.0051; $p < 0.05$). This significant result supports the finding that the perception of personality traits varies across different contexts, though the effect size remains moderate.
- Roy's Largest Root (R), which focuses on the largest canonical correlation, was 0.0574 (F(14, 780.0) = 3.20, p = 0.0001; $p < 0.01$). This indicates a strong effect of context, particularly on the dominant dimension.

Overall, these results suggest that the context of consumption significantly influences judgements of personality traits associated with canned wine consumers (our first research question), although the magnitude of this effect is generally moderate. This nuanced finding highlights the importance of context in shaping judgements, while acknowledging that other factors may also play a role.

Building on these findings, we further explore the role of additional factors that may influence judgements of canned wine drinkers, as articulated in our second research question. We propose that demographic factors -specifically age, gender, and social status (proxied by education level)- and the respondent's culture (proxied by language) significantly affect participants' judgements of individuals consuming wine from cans. A previous study [15] suggests that younger participants and those with lower educational attainment are more likely to ascribe positive, casual, and trendy characteristics to the canned wine drinker. In contrast, older participants and those with higher education levels tend to attribute more negative or neutral traits. The study did not find any difference across gender groups. Additionally, the cultural background of respondents may also play a crucial role in shaping these judgements [51]. To test the effects of

these factors, we conduct a regression analysis in which age, gender, education level, and culture of origin serve as predictors in addition to the context of consumption, and the sixteen personality traits are the outcome variables. Furthermore, we include self-reported familiarity with wine in our model to account for any experience-based biases that could influence judgements.

The results of our regression analysis are presented in Table 3. We run sixteen regressions using ordinary least square, one for each personality trait. The analysis is based on our sample of 795 respondents in all cases. The F-statistic indicates that the regression models are significant for 15 out of the 16 traits, except for "Beautiful", where the model does not fit well. While context, demographics, culture, and wine knowledge account for some of the variation in the perceived traits of canned wine drinkers, much of the variation remains unexplained by these factors, suggesting that additional influences are at play.

We first analyse the influence of consumption context on the judgments of the personality traits. We use dummy variables to capture the effect of each scenario. *Beach resort*, the scenario for which we found more negative prejudices and stereotypes, is the benchmark against which we compare the other three scenarios. When we compare the *desert safari* versus *beach resort*, those drinking canned wine in the desert are judged as less "Disciplined", less "Health Conscious", and less "Conscious" but "Richer". In the comparison between the *outdoor party* and *beach resort*, there is only one significance difference, the canned wine drinker in the party is judged "Poorer". Interestingly, there are no significant differences in trait judgement between canned wine drinker in *ski station* and *beach resort*. These results put our previous findings in a better perspective, once we have controlled for several relevant covariates, the judgements of the personality traits do not vary significantly across scenarios. On average, there seems to be a negative bias among Swiss resident against those consuming canned wines across several outdoor leisure activities.

Our dataset consists only of Swiss residents so we cannot extend our findings to other cultural contexts. However, our survey was offered in four different languages, three of the four national languages: German, French and Italian (Romansh, a language spoken by less than 1% of the Swiss population, was not included) and English as lingua franca for the many foreigners living and working in Switzerland. Our regression analysis allows us to compare Swiss respondents from the French, German, and Italian speaking subpopulation *vis-à-vis* expats living in Switzerland (those who responded in English). Here we found significant differences. In nine of the sixteen traits the French speakers showed a significantly more negative judgement of the canned drinker versus those answering in English. The same is the case for seven traits both among the German and Italian speaking Swiss residents. The speakers of the three national languages agree in four traits, they consider the canned wine drinker as less "Health Conscious", less "Environmentally Friendly", less "Imaginative", and less "Interesting" than those who answered the questionnaire in English. It is worth noticing that our results also show two cases where the estimated coefficients are positive. Swiss German speakers judged canned wine drinkers more "Gracious" and "Extroverted" than the English speakers living in Switzerland.

Our estimations reveal a significant influence of age on the judgement of canned wine drinkers' personality traits. For all traits except "Rich", the estimated coefficients are negative, indicating that younger respondents tend to have a less negative view of these consumers. Although only nine out of these fifteen negative coefficients are statistically significant, the overall pattern suggests a notable generational divide: younger respondents exhibit a markedly lower negative prejudices towards canned wine consumers.

We also examine the influence of respondents' gender and educational level. Our findings indicate that female participants tend to perceive canned wine consumers as less "Health Conscious" and less "Environmentally Friendly" but judge them as more socially "Popular" compared to men. Additionally, higher educational levels are associated with more negative judgements of canned wine consumers regarding traits such as "Elegance", "Conscientiousness", "Education", and moral character ("Good"). However, respondents with higher educational levels are more likely to judge these consumers as "Extroverted".

Finally, we use an ordinal categorical variable representing self-reported familiarity with wine to account for experience-based biases in judgements. This variable has five levels, ranging from "Never" to "Several times a week," reflecting increasing frequency of wine consumption. In our sample, this variable shows a positive and statistically significant association with three attributes: "Health Consciousness", "Environmentally Friendly", and "Gracious". However, this construction may obscure the fact that both non-drinkers and very frequent wine drinkers might judge canned wine drinkers negatively, albeit for different reasons. Indeed, when we replace the ordinal categorical variable with dummy variables for each frequency category, we observe more nuanced results. Those who never drink wine perceive canned wine drinkers as less "Health-Conscious" and less

Table 3a. Determinants of perceived personality traits (0LS regression results).

	(1) disciplined	(2) health conscious	(3) environmentally friendly	(4) imaginative	(5) popular	(6) interesting	(7) emotional	(8) elegant
Desert Safari	-0.320***	-0.254**	-0.174	0.010	-0.0716	0.0809	0.0678	0.0150
	(-2.76)	(-2.13)	(-1.26)	(0.07)	(-0.54)	(0.59)	(0.51)	(0.12)
Outdoor Party	0.058	0.082	-0.032	-0.038	-0,016	0.253	0.088	0.0212
	(0.44)	(0.61)	(-0.21)	(-0.23)	(-0.11)	(1.64)	(0.58)	(0.15)
Ski Resort	0.001	-0.056	0.167	-0.081	0.145	0.077	0.030	-0.124
	(0.01)	(-0,42)	(1.10)	(-0.50)	(0.99)	(0,50)	(0.20)	(-0.87)
Swiss French	-0.391**	-0.662***	-0.835***	-0.832***	-0.356	-0.738***	-0.249	-0.403*
	(-2.00)	(-3.29)	(-3.59)	(-3.40)	(-1.59)	(-3.18)	(-1.10)	(-1.85)
Swiss German	-0.302	-0.568***	-0.921***	-0.950***	-0.508**	-0.480**	-0.181	-0.739***
	(-1.54)	(-2.82)	(-3.96)	(-3.89)	(-2.27)	(-2.07)	(-0.80)	(-3.40)
Swiss Italian	-0.278	-0.629***	-0.531**	-0.690**	-0.601**	-0.557**	-0.295	-0.217
	(-1.23)	(-2.72)	(-1.98)	(-2.45)	(-2.34)	(-2.09)	(-1.14)	(-0.86)
Age	-0.033	-0.082***	-0.135***	-0.184***	-0.050	-0.177***	-0.169***	-0.056*
	(-1.11)	(-2.70)	(-3,83)	(-4.96)	(-1.48)	(-5.04)	(-4.93)	(-1.68)
Female	0.066	-0.243***	-0.330***	0.045	0.204**	0.042	0.096	0.021
	(0.76)	(-2.71)	(-3.19)	(0.41)	(2.05)	(0.41)	(0.96)	(0.21)
Education level	-0.075	-0.055	-0.091	0.00003	-0.024	-0.047	0.031	-0.157***
	(-1.53)	(-1.10)	(-1.57)	(0.00)	(-0·43)	(-0.81)	(0.56)	(-2.89)
Wine expenence level	0.021	0.091**	0,075*	0.072	0.035	0.026	0.016	-0.004
	(0.58)	(2.49)	(1.78)	(1.62)	(0.86)	(0.62)	(0.38)	(-0.10)
Constant	4.226***	4.064***	4.539***	5.011***	4.024***	4.939***	4.429***	4.337***
	(12.63)	(11.84)	(11·43)	(12.01)	(10.55)	(12.49)	(11.50)	(11.67)
N	795	795	795	795	795	795	795	795
Prob > F	0.0105	0.0000	0.008	0.0000	0.0244	0.0000	0.0001	0.0001
R-s quare	0.032	0.044	0.059	0.065	0.025	0.053	0.0	0.050

t statistics parentheses. *p<0.10; **p< 0.05; *p<0.01.

"Beautiful", while those who consume wine several times a week judge them as less "Elegant" and less "Beautiful".

4. DISCUSSION

The present experiment, which examined how consumers of canned wine are judged across different outdoor leisure scenarios and considered the potential for greater acceptance of this alternative packaging, yielded several noteworthy findings. We discuss these below considering our research questions.

4.1 How is the canned wine drinker judged in different outdoor leisure scenarios, and does the judgment vary depending on the specific scenario?

Our first finding regarding the research question indicates that consumers of canned wine are generally judged negatively by respondents across all scenarios. Even in relaxed holiday settings, this context does not appear to consistently transform the act of drinking canned wine into a positive experience. The results indicate that, while the personality trait being "Extroverted" is consistently judged positively across all scenarios, many other traits are negative and context dependent. Negative judgements are especially pronounced in the *beach resort* setting, where consumers are seen as less "Health-Conscious", less "Environmentally Friendly", and more "Vulgar". This considerably negative judgement associated with the *beach resort* scenario may be influenced by historical representation of beach parties, along with the conflict between tourists' desires to consume an untouched, pristine natural environment and the remnants of beach parties, such as beer cans, as described by the concept of the 'tourist gaze' [52, 53]. In contrast, the *outdoor party* scenario elicited comparatively more favourable judgments, though negative prejudices and stereotypes persisted.

A second interesting outlet is that the MANOVA results further suggest that the outdoor scenario appears

Table 3b. Determinants of perceived personality traits (0LS regression results).

	(9) gracious	(10) satisfied	(11) extroverted	(12) conscious	(13) high education level	(14) rich	(15) beautiful	(16) good
Desert Safari	-0.133	-0.106	-0.0618	-0.236*	0.152	0.332***	-0.110	-0.102
	(-1.20)	(-0.76)	(-0.46)	(-1.70)	(1.24)	(2.72)	(-1.09)	(-0.96)
0utdoor Party	0.104	0.068	0.084	-0.198	-0.037	-0.371***	-0.053	0.064
	(0.84)	(0.44)	(0.56)	(-1.26)	(-0.27)	(-2.70)	(-0.47)	(0.54)
Ski Resort	-0.031	-0.142	-0.049	-0.170	0.147	0.011	0.067	-0.007
	(-0.26)	(-0.92)	(-0.33)	(-1.10)	(1.08)	(0.08)	(0.59)	(-0.06)
Swiss French	0.153	-0.534**	0.320	-0.738***	-0.579***	0.017	-0.175	-0.266
	(0.82)	(-2.28)	(1.41)	(-3.14)	(-2.80)	(0.08)	(-1.03)	(-1.48)
Swiss German	0.344*	-0.079	0.596***	-0.349	-0.529**	0.050	-0.031	-0.274
	(1.84)	(-0.34)	(2.62)	(-1.49)	(-2.56)	(0.24)	(-0.18)	(-1.52)
Swiss Italian	0.340	-0.677**	-0.053	-0.7()()***	0.047	0.030	-0.129	0.096
	(1.58)	(-2.51)	(-0.20)	(-2.59)	(0.20)	(0.13)	(-0.66)	(0.46)
Age	-0.009	-0.()74**	-0.127***	-().092**	-0.008	0.060*	-0.0003	-0.041
	(-0.34)	(-2.08)	(-3.67)	(-2.56)	(-0.25)	(1.93)	(-0.01)	(-1.50)
Female	0.029	0.052	-0.040	-0.091	0.055	-0.034	0.029	0.076
	(0.34)	(0.49)	(-0.40)	(-0.87)	(0.59)	(-0.37)	(0.38)	(0.95)
Education level	-0.073	0.042	0.159***	-0.113*	-0.128**	-0.036	-0.048	-0.090**
	(-1.55)	(0.72)	(2.80)	(-1.92)	(-2.47)	(-0.70)	(-1.12)	(-2.00)
Wine experience level	0.056*	0.069	0.0005	0.052	-0.022	-0.034	0.008	0.014
	(1.65)	(1.63)	(0.01)	(1.22)	(-0.59)	(-0.93)	(0.26)	(0.43)
Constant	3.684***	4.332***	3.974***	5.237***	4.336***	3.609* **	4.083***	4.469***
	(11.56)	(10.84)	(10.24)	(13.07)	(12.27)	(10.27)	(14.03)	(14.56)
N	795	795	795	795	795	795	795	795
Prob> F	0.0450	0.0007	0.0002	0.0015	0.0022	0.0000	0.5664	0.0275
R-square	0.021	0.037	0.042	0.033	0.034	0.046	0.018	0.026

t statistics parentheses. *p<0.10; **p< 0.05; *p<0.01.

to play a role in shaping the respondents' prejudice, albeit with a moderate effect size. This suggests that while the context influences these judgements it does not completely reshape them. The nuanced results, with varying degrees of negative and positive traits across outdoor scenarios, go in the same direction of the results of Ruggeri et al. [15], when studying the perception of Italians towards alternative packaging consumption acceptance, underscore the complexity of consumer perceptions and indicate that factors beyond context, such as underlying stereotypes or broader societal rules toward canned wine, might be at play. Even though this was not tested in the experiment, these negative judgements may arise from a general disapproval of the 'drinking' aspect within the scenario, rather than specifically targeting canned wine. Several studies [54, 55, 56, 57, 58] have shown that outdoor drinking is not always viewed positively by the public. Social drinking in public (i.e., in public outdoor spaces) is not universally accepted [59], often restricted for religious reasons in countries such as those with Muslim majorities, as well as for behavioural and political reasons in various Western nations. For example, in Chile, consuming alcohol in outdoor public spaces, such as by the beach, is prohibited, except on New Year's Eve when it is permitted. Similar restrictions are observed in other Western societies, including Norway, Poland, and certain states in the US, where drinking in outdoor public areas is frequently viewed as unacceptable or even outlawed.

4.2 Do the demographic characteristics of the respondents influence their judgements of the canned wine drinker?

Our regression analysis provided deeper insights into the role of demographic factors, cultural background, and wine familiarity in influencing these judgements. The generational divide in attitudes is particularly noteworthy. Younger respondents consistently displayed a lower negative prejudice towards canned wine consumers, suggesting a shift in attitudes that could be

leveraged by marketers targeting younger demographics. This generational gap may reflect broader changes in social norms and the growing acceptance of non-traditional wine formats among younger people.

Gender and education level also emerged as significant factors, though not always aligning with our initial expected results. Findings from previous studies suggest that we might expect female participants to associate more positive, casual, and trendy characteristics with canned wine drinkers [60, 61]. Contrary to expectations, female participants judged canned wine drinkers as less "Health-Conscious" and less "Environmentally Friendly", despite being more likely to attribute traits like "Popularity" to them. Similarly, previous studies suggest that participants with lower levels of formal education would probably judge canned wine drinkers more favourably than those with higher education. Our results partially support this. Education level had a dual effect: while respondents with lower educational attainment judged canned wine drinkers as less "Vulgar" and more "Conscious", those with higher education associated them with "Extroversion" but not with any other positive personality trait. These findings suggest that demographic variables interact in complex ways with consumer judgements, reflecting both individual experiences and broader societal values.

Cultural background, proxied by the language of response [62, 63], further complicates the picture. The significant differences observed between Swiss respondents of different linguistic backgrounds and expatriates suggest the role of cultural norms and regional identities in shaping attitudes, a well-known factor in cross cultural literature [64, 65, 66]. French, German, and Italian-speaking Swiss respondents generally held more negative views of canned wine drinkers than expatriates, particularly regarding traits like "Health Consciousness" and "Environmental Friendliness". This finding indicates that judgements are not only context-specific but also culturally contingent, shaped by regional values and social norms.

Our analysis of self-reported wine familiarity adds another layer of complexity to these judgements. Regular wine consumers displayed more nuanced views, associating canned wine drinkers with lower "Elegance" and "Beauty" but not necessarily other negative traits. This suggests that experience with wine might mitigate certain prejudices and stereotypes, though it does not eliminate them entirely. These results indicate that familiarity with traditional wine consumption may influence judgements of alternative formats in both positive and negative directions, depending on the attribute in question. These results are consistent with previous findings in the literature [15, 29, 39].

Overall, our findings suggest that while context and demographics are significant, they do not fully explain the variation in judgements. The persistence of negative prejudices and stereotypes across different scenarios and demographic groups indicates that canned wine still carries a stigma, despite its growing popularity.

5. CONCLUSIONS

Our study offers valuable insights into the complex, context-dependent perceptions of canned wine consumers. The data reveals a consistent pattern of negative prejudices, particularly in relation to "Health Consciousness," "Environmental Friendliness," and "Elegance," with variations across different leisure scenarios. While outdoor party settings generated slightly more favourable judgments, the overall outlook remains skewed toward the negative. This suggests that despite the rising popularity of canned wine, there may still be significant barriers to altering public perception, even in more informal or unconventional contexts.

Demographic factors further complicate these judgments. Younger respondents are generally less critical, indicating a potential generational shift in consumer attitudes. This could signal the emergence of a more favourable market for canned wine among younger consumers, who may be more open to innovative packaging. Gender and education also play important roles, though not always in predictable ways. These insights suggest that marketers could benefit from adopting more nuanced strategies, targeting specific demographic groups in ways that address the varied and often unexpected nature of consumer biases.

Cultural factors are equally influential. The observed differences in perception among Swiss linguistic groups highlight the importance of aligning marketing strategies with regional cultural norms. Swiss respondents were generally more negative in their assessments compared to expatriates, suggesting that local cultural dynamics may either hinder or facilitate the acceptance of canned wine. These findings underscore the importance of developing marketing approaches that not only appeal to younger, more open-minded consumers but also address entrenched prejudices among more traditional segments of the population. Tailoring strategies to these varying cultural contexts will be critical in reshaping consumer perceptions.

To mitigate negative biases and capitalize on the growing consumer interest in sustainability, wine marketers should emphasize the environmental benefits of canned wine, such as recyclability, reduced carbon foot-

prints, and the convenience of lightweight packaging. Campaigns that highlight these environmental advantages are likely to resonate with an increasingly eco-conscious consumer base. Moreover, incorporating sustainability labels or certifications could play a significant role in shifting perceptions, as they have been effective in positively influencing consumer attitudes toward other eco-friendly products.

Promotional strategies will be key in overcoming stereotypes and encouraging trial purchases within the wine sector. Tasting events could provide consumers the opportunity to challenge their preconceived notions about canned wine, while eco-labelling would reinforce the sustainability message. Given the evident generational divide in perceptions, focusing on younger consumers, who are more open to innovative packaging could serve as a crucial entry point into the market. Producers might also benefit from positioning canned wine at the centre of sustainability-focused campaigns, particularly in contexts where convenience and environmental impact are paramount, such as outdoor leisure activities or travel.

Beyond the immediate marketing strategies for canned wine, it is essential to consider broader societal shifts, including changing attitudes toward convenience, health, and environmental concerns, all of which significantly influence wine consumption trends. As consumer preferences increasingly prioritize convenience and sustainability, the demand for innovative packaging such as canned wine may grow. Canned wine offers a convenient, portable, and easy-to-store option, appealing to consumers seeking practicality, especially in outdoor settings or on-the-go lifestyles. Additionally, the shift toward healthier consumption patterns may contribute to a broader acceptance of alternatives to traditional wine bottles, as consumers may perceive canned wine as a lighter, more manageable option. With its recyclable packaging and reduced carbon footprint, canned wine aligns with the growing eco-consciousness of today's consumers. By highlighting the intersection of convenience, health, and sustainability, marketers can tap into evolving consumer priorities and strengthen the appeal of canned wine.

This study also offers important insights for industry stakeholders and policymakers, underscoring the role of public policy in supporting sustainable innovation within the wine sector. As consumer attitudes shift towards convenience and health-conscious choices, it becomes vital for policies to encourage eco-friendly packaging and sustainable production practices. Industry players can benefit from policies that incentivize the development of convenient and sustainable packaging solutions, while governments can help educate the public on the health and environmental benefits of alternatives like canned wine. By aligning marketing strategies with these broader societal shifts, the wine industry can better meet consumer demand for convenience, health, and sustainability, positioning itself as a progressive sector that meets the needs of modern consumers while contributing to environmental and societal goals.

While our study illuminates the complexities of consumer perceptions, it also highlights areas for further research. Understanding the underlying reasons for these prejudices and stereotypes will be critical for future marketing efforts. Social identity, media portrayal, and the role of tradition may all play a part in shaping these judgments, and further investigation into these factors could provide deeper insights. Additionally, exploring consumer attitudes beyond Switzerland would offer a more global perspective on the market potential for canned wine. We acknowledge the limitations inherent in our study, particularly the low R^2 values in our regression models and the reliance on self-reported data, which may be influenced by social desirability bias. Despite these limitations, the statistically significant findings and model validity underscore the broader patterns identified. Future research could refine our understanding of these consumer attitudes and address the challenges associated with measuring perceptions and prejudices.

In conclusion, while there is clear potential for expanding the market for canned wine - especially among younger, more open-minded consumers -significant challenges may remain. Overcoming the negative associations tied to health consciousness, environmental impact, and elegance will be crucial for gaining broader acceptance. To this end, producers and marketers should develop targeted messaging that highlights the practical advantages of canned wine, such as its convenience and sustainability, while also addressing the deep-rooted stereotypes that persist, particularly among older and more traditional consumer segments. By doing so, they can help reshape consumer perceptions and position canned wine as a viable and responsible choice for modern, eco-conscious consumers.

6. REFERENCES

[1] K. Korpela, K. Borodulin, M. Neuvonen, O. Paronen, L. Tyrväinen, Analyzing the mediators between nature-based outdoor recreation and emotional well-being, J. Environ. Psy. 37 (2014) 1-7. https://doi.org/10.1016/j.jenvp.2013.11.003

[2] R. C. Mannell, Leisure, health and well-being, W. Leis. J. 49(3) (2007) 114-128. https://doi.org/10.1080/04419057.2007.9674499

[3] S. Bell, L. Tyrväinen, T. Sievänen, U. Pröbstl, M. Simpson, Outdoor recreation and nature tourism: A European perspective, Living Rev. Landscape Res. 1(2) (2007) 1-46.

[4] U. Schirpke, R. Scolozzi, A. Kiessling, U. Tappeiner, Recreational ecosystem services of mountain lakes in the European Alps: Preferences, visitor groups and management implications, J. Outdoor Recreation & Tourism, 35 (2021) 100421. https://doi.org/10.1016/j.jort.2021.100421

[5] A. G. Wood, (Ed.). The business of leisure: Tourism history in Latin America and the Caribbean, U of Nebraska Press, 2021

[6] D. Dimitrovski, V. Joukes, N. Scott, Food and wine presence and pairing within traditional restaurants' menus as regional heritage promotional behaviour: Gemeinschaft or Gesellschaft? J. Sustainable Tourism, (2024) 1-19. https://doi.org/10.1080/09669582.2024.2309202

[7] M. Hogue, An Illustrated History of the Picnic Table, Places Journal, 2018

[8] C. Roden, Everything tastes better outdoors, Alfred A. Knopf, 1984

[9] M. A. Bellis, K. Hughes, L. Jones, M. Morleo, J. Nicholls, E. McCoy, J. Webster, H. Sumnall, Holidays, celebrations, and commiserations: measuring drinking during feasting and fasting to improve national and individual estimates of alcohol consumption, BMC medicine, 13 (2015) 1-12. https://doi.org/10.1186/s12916-015-0337-0

[10] T. Colman, P. Päster, Red, white, and 'green': the cost of greenhouse gas emissions in the global wine trade, J. Wine Res. 20(1) (2009) 15-26. https://doi.org/10.1080/09571260902978493

[11] C. Chivu-Draghia, A. O. Antoce, Understanding consumer preferences for wine: a comparison between Millennials and Generation X, Sci. Papers Series Manag., Econ. Eng. Agr. & Rural Dev. 16(2) (2016) 10.

[12] A. Mierczynska-Vasilev, The future of wine packaging—A perspective, Sustain. Agri & Env. 1(1) (2024)

[13] G. Ruggeri, C. Mazzocchi, S. Corsi, B. Ranzenigo, No more glass bottles? Canned wine and Italian consumers, Foods, 11(8) (2022) 1106. https://doi.org/10.3390/foods11081106

[14] R. Engineer, A. Phillips, J. Thompson, J. Nicholls, Drunk and disorderly: a qualitative study of binge drinking among 18-to 24-year-olds. London: Home Office, (2003)

[15] R. A. Grucza, K. E. Norberg, L. J. Bierut, Binge drinking among youths and young adults in the United States: 1979–2006, J. Am. Acad. Child Adolesc. Psychiatry, 48(7) (2009) 692-702. https://doi.org/10.1097/CHI.0b013e3181a2b32f

[16] G. L. Robertson, Food packaging: principles and practice, CRC press. (2005). https://doi.org/10.1201/9781420056150

[17] M. J. Sheehan, J. H. R. Suarez, M. M. Benefeito, J. M. Goddard, G. L. Sacks, Hydrogen Sulfide Formation in Canned Wines: Variation Among Can Sources, Am. J. Enol. Vitic. 75(1) (2024) DOI: 10.5344/ajev.2023.23069

[18] H. Hopfer, P. A. Buffon, S. E. Ebeler, H. Heymann, The combined effects of storage temperature and packaging on the sensory, chemical, and physical properties of a Cabernet Sauvignon wine, J. Agric. Food Chem. 61(13) (2013) 3320-3334. DOI: 10.1021/jf3051736

[19] M. Borrello, R. Vecchio, L. Barisan, D. Franceschi, E. Pomarici, L. Galletto, Is wine perception influenced by sustainability information? Insights from a consumer experiment with fungus resistant grape and organic wines, Food Res. Int. (2024) 114580. https://doi.org/10.1016/j.foodres.2024.114580

[20] J. Mesidis, L. Lockshin, A. M. Corsi, B. Page, J. Cohen, Measuring the effect of product and environmental messaging attributes on alternative wine packaging choices, J. Cleaner Prod. 431 (2023) 139502. https://doi.org/10.1016/j.jclepro.2023.139502

[21] H. Lindh, H. Williams, A. Olsson, F. Wikström, Elucidating the indirect contributions of packaging to sustainable development: A terminology of packaging functions and features, Packag. Technol. Sci. 29(4-5) (2016) 225-246. https://doi.org/10.1002/pts.2197

[22] N. Barber, B. A. Almanza, Influence of wine packaging on consumers' decision to purchase, J. Foodservice Bus. Res., 9(4) (2007) 83-98. https://doi.org/10.1300/J369v09n04_06

[23] M. Corduas, L. Cinquanta, C. Ievoli, The importance of wine attributes for purchase decisions: A study of Italian consumers' perception, Food Qual. Pref. 28(2) (2013) 407-418. https://doi.org/10.1016/j.foodqual.2012.11.007

[24] M. P. Sáenz-Navajas, E. Campo, A. Sutan, J. Ballester, D. Valentin, Perception of wine quality according to extrinsic cues: The case of Burgundy wine consumers, Food Qual. Pref. 27(1) (2013) 44-53. https://doi.org/10.1016/j.foodqual.2012.06.006

[25] M. T. F. D. A. D. B. Faro, Judging a wine by its bottle: the influence of wine packaging on consumers (Doctoral dissertation), (2021). http://hdl.handle.net/10400.14/35305

[26] B. Rocchi, G. Stefani, Consumers' perception of wine packaging: a case study, Int. J. Wine Marketing, 18(1) (2006) 33-44. DOI: 10.1108/09547540610657669

[27] B. Piqueras-Fiszman, C. Spence, The weight of the bottle as a possible extrinsic cue with which to estimate the price (and quality) of the wine? Observed correlations, Food Qual. Pref., 25(1) (2012) 41-45. https://doi.org/10.1016/j.foodqual.2012.01.001

[28] A. A. Martins, A. R. Araújo, A. Graça, N. S. Caetano, T. M. Mata, Towards sustainable wine: Comparison of two Portuguese wines, J. Cleaner Prod. 183 (2018) 662-676. https://doi.org/10.1016/j.jclepro.2018.02.057

[29] C. Ferrara, V. Zigarelli, G. De Feo, Attitudes of a sample of consumers towards more sustainable wine packaging alternatives, J. Cleaner Prod. 271 (2020) 122581. https://doi.org/10.1016/j.jclepro.2020.122581

[30] P. Lyon, D. Kinney, Convenience and choice for consumers: the domestic acceptability of canned food between the 1870s and 1930s, Int. J. Consumer Studies, 37(2) (2013) 130-135. https://doi.org/10.1111/j.1470-6431.2012.01103.x

[31] K. R. Whitfield, Canning foods and selling modernity: the canned food industry and consumer culture, 1898-1945, Louisiana State University and Agricultural & Mechanical College, 2012

[32] Grand View Research, Canned Wine Market Size, Share & Trends Analysis Report by Product (Sparkling, Fortified), By Distribution Channel (Supermarket & Hypermarket, Online), By Region (APAC, North America), And Segment Forecasts, 2021 - 2028. Vol. GVR-4-6803. San Francisco, CA, 2021

[33] W. Lippmann, Public opinion, New York: Harcourt Brace, 1922

[34] J. L. Hilton, W. Von Hippel, The role of consistency in the judgment of stereotype-relevant behaviors, Personality Soc. Psyc. Bul. 16(3) (1990) 430-448. https://doi.org/10.1177/0146167290163003

[35] J. F. Dovidio, M. Hewstone, P. Glick, V. M. Esses, Prejudice, stereotyping and discrimination: Theoretical and empirical overview, Prejudice, stereotyping and discrimination, 12 (2010) 3-28

[36] H. Rodrigues, C. Goméz-Corona, D. Valentin, Femininities & masculinities: sex, gender, and stereotypes in food studies, Current Op. Food Sci. 33 (2020) 156-164. https://doi.org/10.1016/j.cofs.2020.05.002

[37] N. Depetris-Chauvin, D. Valentin, J. H. Behrens, H. Rodrigues, Country-of-Origin as bias inducer in experts' wine judgments-A sensory experiment in a world wine fair, Int. J. Gastronomy Food Sci. 35 (2024) 100883. https://doi.org/10.1016/j.ijgfs.2024.100883

[38] L. Trochtová, J. Pospíšil, H. Pospíšilová, The role and importance of outdoor leisure activities on the change of values: impacts on personal development and education, In INTED2021 Proceedings (pp. 5334-5340). IATED, (2021). doi: 10.21125/inted.2021.1090

[39] M. Orlowski, S. Lefebvre, R. M. Back, Thinking outside the bottle: Effects of alternative wine packaging, J. Ret. Consumer Serv. 69 (2022) 103117. https://doi.org/10.1016/j.jretconser.2022.103117

[40] A. Flache, M. Mäs, T. Feliciani, E. Chattoe-Brown, G. Deffuant, S. Huet, J. Lorenz, Models of social influence: Towards the next frontiers, J. Artificial Societies Soc. Simulation, *20*(4) (2017) 2. DOI: 10.18564/jasss.3521

[41] C. D. Frith, U. Frith, Mechanisms of social cognition, Annual Rev. Psy. 63(1) (2012) 287-313. https://doi.org/10.1146/annurev-psych-120710-100449

[42] T. A. Brunner, T. Schnetzer, M. Delley, Emergence of new segments of Swiss wine consumers: a comparison with a segmentation study from 2011, Aus. J. Grape Wine Res. 2023(1) (2023) 6103015. https://doi.org/10.1155/2023/6103015

[43] C. Staub, F. Michel, T. Bucher, M. Siegrist, How do you perceive this wine? Comparing naturalness perceptions of Swiss and Australian consumers, Food Qual. Pref. 79 (2020) 103752. https://doi.org/10.1016/j.foodqual.2019.103752

[44] OIV, State of the world vine and wine sector in 2023. Dijon. France, 2023

[45] E. C. Villanueva, N. Depetris-Chauvin, V. Pinilla, The wine industry: drivers and patterns of global transformation in: M. Kipping, T. Kurosawa, D. E. Westney (eds), The Oxford Handbook of Industry Dynamics (online edn, Oxford Academic, 13 Oct. 2021), https://doi.org/10.1093/oxfordhb/9780190933463.013.38

[46] P. Masset, J. P. Weisskopf, Producing and consuming locally: Switzerland as a local market, The Palgrave handbook of wine industry economics, (2019) 507-522. https://doi.org/10.1007/978-3-319-98633-3_27

[47] C. Atzmüller, P. M. Steiner, Experimental vignette studies in survey research, Methodology, (2010). https://doi.org/10.1027/1614-2241/a000014

[48] C. Hartmann, M. B. Ruby, P. Schmidt, M. Siegrist, Brave, health-conscious, and environmentally friendly: Positive impressions of insect food prod-

uct consumers, Food Qual. Pref. 68 (2018) 64-71. https://doi.org/10.1016/j.foodqual.2018.02.001

[49] K. M. Mooney, E. Lorenz, The effects of food and gender on interpersonal perceptions, Sex Roles, 36 (1997) 639-653. https://doi.org/10.1023/A:1025622125603

[50] M. B. Ruby, S. J. Heine, Meat, morals, and masculinity, Appetite, 56(2) (2011) 447-450. https://doi.org/10.1016/j.appet.2011.01.018

[51] A. Suárez, H. Rodrigues, S. Williams, P. Fernández-Zurbano, N. Depetris-Chauvin, G. Dunn, M. P. Sáenz-Navajas, Effect of culture and familiarity on wine perception: a study with British and Spanish wine experts, OENO One, (2023). https://doi.org/10.20870/oeno-one.2023.57.2.7127

[52] A. Kraack, J. Kenway, Place, time and stigmatised youthful identities: bad boys in paradise, J. Rural Studies, 18(2) (2002) 145-155. https://doi.org/10.1016/S0743-0167(01)00033-X

[53] J. Urry, Consuming places. Routledge London, 1995

[54] B. Ander, M. Wilińska, "We are not like those who/.../sit in the woods and drink": the making of drinking spaces by youth, Qual. Social Work, 19(3) (2020) 424-439. https://doi.org/10.1177/1473325020911681

[55] E. M. Anderson Goodell, E. Kuntsche, F. Labhart, J. Thrul, Drinking location moderates the association between social group size and alcohol consumption among young adults: An event-level study, Drug Alc. Rev. 41(1) (2022) 238-245. https://doi.org/10.1111/dar.13340

[56] E. L. Davies, R. Cooke, L. J. Maier, A. R. Winstock, J. A. Ferris, Where and what you drink is linked to how much you drink: an exploratory survey of alcohol use in 17 countries, Subst. Use Misuse, 56(13) (2021) 1941-1950. https://doi.org/10.1080/10826084.2021.1958864

[57] E. Single, S. Wortley, Drinking in various settings as it relates to demographic variables and level of consumption: findings from a national survey in Canada, J. Stu. Alc. 54(5) (1993) 590-599. https://doi.org/10.15288/jsa.1993.54.590

[58] E. M. Trell, B. van Hoven, P. P. Huigen, 'In summer we go and drink at the lake': young men and the geographies of alcohol and drinking in rural Estonia, Child. Geo. 12(4) (2014) 447-463. https://doi.org/10.1080/14733285.2013.824740

[59] A. Pennay, R. Room, Prohibiting public drinking in urban public spaces: A review of the evidence, Drugs Edu. Prev. Pol. 19(2) (2012) 91-101. https://doi.org/10.3109/09687637.2011.640719

[60] C. Aqueveque, "Consumers' preferences for low-priced wines' packaging alternatives: the influence of consumption occasion, gender, and age", Brit. Food J. Vol. 125 No. 3 (2023) pp. 781-793. https://doi.org/10.1108/BFJ-09-2021-1040

[61] S. Mueller, L. Lockshin, How important is wine packaging for consumers? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods (2008), (Doctoral dissertation, Academy of Wine Business Research).

[62] F. Boas, Language and culture. In Studies in the history of culture: The disciplines of the humanities (pp. 178-184). Banta, 1942

[63] C. Laesser, P. Beritelli, S. Heer, Different native languages as proxy for cultural differences in travel behaviour: insights from multilingual Switzerland, Int. J. Cul. Tour. Hosp. Res. 8(2) (2014) 140-152. DOI: 10.1108/IJCTHR-02-2014-0010

[64] A. Bisconsin-Júnior, H. Rodrigues, J. H. Behrens, M. A. A. P. da Silva, L. R. B. Mariutti, "Food made with edible insects": Exploring the social representation of entomophagy where it is unfamiliar, Appetite, 173 (2022) 106001. https://doi.org/10.1016/j.appet.2022.106001

[65] F. Guillemin, Cross-cultural adaptation and validation of health status measures, Scandinavian J. Rheumatology, 24(2) (1995) 61 63. https://doi.org/10.3109/03009749509099285

[66] G. Hofstede, National cultures in four dimensions: A research-based theory of cultural differences among nations, Int. Stud. Man. Org. 13(1-2) (1983) 46-74. https://doi.org/10.1080/00208825.1983.11656358

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Solfanelli, F., Mandolesi, S., Silvestri, I., Naspetti, S. & Zanoli, R. (2025). Debating wine health-warning labels using Q methodology. *Wine Economics and Policy* 14(1): 47-61. doi: 10.36253/wep-17056

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Debating wine health-warning labels using Q methodology

Francesco Solfanelli[1], Serena Mandolesi[1]*, Ileana Silvestri[1], Simona Naspetti[2], Raffaele Zanoli[1]

[1] *Dipartimento di Scienze Agrarie, Alimentari e Ambientali (D3A), Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy*
[2] *Dipartimento di Scienze e Ingegneria della Materia, dell'Ambiente ed Urbanistica (SIMAU), Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy*
*Corresponding author. Email: mandolesi@agrecon.univpm.it

Abstract. In Europe, alcohol-related diseases have an increasingly high impact on healthcare costs every year. Hence, rising consumer consciousness regarding the risks and harms of drinking alcohol is a primary goal of the EU Commission. Recently, the Commission has been discussing the mandatory adoption of health-warning labels (HWLs) on all alcoholic beverages, including wine. This study investigated expert and non-expert perceptions of adopting health-warning labels on wine bottles. The research used Q methodology, a mixed-method approach to explore subjective viewpoints regarding adopting health-warning labels for the wine sector. Respondents were evenly distributed among wine experts and consumers. The results provided four different views based on participants' perceptions of HWLs. Factor 1 (the "Nationalism" view) strongly opposes the proposal, which is considered extremely dangerous for the entire wine market. Factor 2 (the "Market-oriented" view) believes that health warnings will increase transparency in the market and help consumers make informed choices, thereby respecting consumer autonomy. Factor 3 (the "Health-first" view) strongly believes that informing consumers through health labels on all alcoholic beverages is necessary to protect public health. Lastly, Factor 4 (the "Keep Us Alive" view) underestimates warning labels' effectiveness in promoting the right behaviours. The findings highlight different "sides" of this debating topic and provide valuable insight into how policymakers can investigate new strategies, always considering and respecting consumer choice.

Keywords: health-warning labels, labelling, wine, attitudes, Q methodology.

1. INTRODUCTION

The European Union is characterised by the most significant production, consumption and export of wine worldwide, with thousands of manufacturing companies [1]. Italy is one of Europe's top wine producers, focusing on quality-labelled food products, including PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication). Regarding consumption, the EU area accounted for 48% of world wine consumption, and Italy is

the second largest consumer of wine after France: 10.3% and 10.7% in 2021 respectively [1]. Wine consumption has been experiencing a continuous decrease since 2008 [1–3]. Although more conscious consumers have spread the consumption of organic and more natural wine and those with lower alcoholic content, wine consumption is expected to fall by 2031 [1,4,5]. Furthermore, the high rates of alcohol consumption have raised considerable attention [6,7]. Indeed, the harmful use of alcoholic beverages is one of the main causes of mortality as well as many negative short-term effects (i.e., lack of coordination and accidents) and long-term effects (i.e., non-communicable diseases including cancer, brain damage, heart and liver diseases) [5,7,8]. According to recent estimates by the World Health Organisation [6], every year, around 1.7 million people worldwide die due to alcohol-related causes. However, many drinkers worldwide have scarce knowledge of the related risks and potential harm [8,9]. Among the most successful policy actions to reduce the harmful consumption of alcohol, initiatives that enhance the consumer perception of risk, such as the use of health-warning labels (HWLs), are considered by some scholars as highly beneficial [5,8,10–12].

Currently, wine labelling rules are subjected to CMO Regulation - [13] - which was already amended in 2018 by the CAP Amending Regulation - [14]. European Commission aims to improve wine labels, including more nutrition information and health warnings. In the EU, the adoption of HWLs on alcohol products is still voluntary, and some member states have already adopted optional measures imposing the communication of potential hazards of alcohol consumption in particular conditions (e.g., "alcohol consumption during pregnancy"; "drinking alcohol and driving") [8]. Ireland first posed the issue regarding the mandatory adoption of detailed health-warning labels on all alcoholic beverages and, in 2023, introduced new regulations with a specific law [15]. The Irish case generated controversial debates, which have also been fuelled by the European Commission's no objection [1]. Most leading wine-producing countries, such as Italy, France, and Spain, strongly oppose this new Irish rule, as they believe that wine must be considered an essential part of their producing national tradition and cultural heritage [16]. In Italy, wine consumption culture has a deep impact on individual's perspective, as it influences various aspect of every day's life. These goes from health perspectives to social identity. In Italy, as in other European countries, the inclusion of wine within the context of the Mediterranean diet principles [5,17] reinforces the idea that moderate consumption may be associated with certain health benefits. From a social identity perspective, wine, more than other traditional and regional products, represent a symbol of cultural heritage [18]. Furthermore, wine is an essential part of the culinary culture of many Italian regions, offering numerous opportunities for wine tourism activities [18].

In this framework, this study aims to provide insights into the subjective views of consumers and wine experts regarding the potential implementation of health warnings on wine labels. To discover these viewpoints, we used Q methodology, which offers a valuable approach for identifying and comparing the diversity of participants' views [19,20]. Since the introduction of the method, Q methodology has primarily been used in psychology [20]. In the last decades, Q methodology has gained considerable attention, and its use has rapidly increased in different research topics regarding consumer behaviour, food acceptance, agriculture, environmental science, and others [21–29]. More recently, Q methodology was also applied in the field of the wine business to support the development of sectorial policies [30–32]. The structure of the article is as follows. The following section describes Q methodology, presenting the main steps of this approach and how data were collected and analysed. The "Results" section then shows the four perspectives, describing the similarities and differences. In the next section, the results are discussed in relation to previous research studies. The conclusions focus on the advantages and shortcomings of Q methodology, highlighting the relevance of the finding for the wine sector as well as the limitations of the current study.

2. MATERIAL AND METHODS

Q methodology, first introduced in 1935 by the physicist and psychologist William Stephenson [19,20,33], is a technique designed to explore people's subjectivity and attitudes. More specifically, the Q method allows us to find groups of people with similar perspectives and attitudes towards a given topic [10,20,34]. The method is advantageous for gaining a well-defined snapshot of a complex and novel debating matter. In a Q study, participants sort a sample of statements with each other and on their viewpoint along a scale. This ranking process provides subjective beliefs (called *Q sorts*) representing participants' attitudes. In Brown's words (1980), a Q sort is *"such a picture, being an individual's conception of the way things stand"* [20]. Then, *Q sorts* are correlated and factor-analysed to identify the dominant and shared *"patterns of belief"* [20,35–37]. In other words, common views are defined and statistically modelled as factors, which in a Q study provide clusters of persons

who ranked the statements similarly. The emerging factors or perspectives are *"spontaneous"* and obtained from *"a set of acts"* and not from a single response [36,38]. Also, Q method allows for discovering critical areas of divergence and consensus among participants, highlighting the different positions [39,40].

Q methodology can be considered a mixed method and combines the advantages of both qualitative and quantitative research approaches [10,41]. First, it offers valid results [10,42], enabling the exploration of the main perspectives more in depth than traditional surveys [43]. Second, a Q study provides more structure than qualitative methods traditionally employed in social science (i.e., interviews or focus groups) thanks to *"numerical results"* [20,44]. Third, Q methodology takes distances from the conventional rule of numbers, where the validation of results is fortified by the dimension of the participants' group [45]. For this reason, because of its intensive orientation Q studies usually require a small participant sample (P sample), which is built to encompass and run out the full range of attitudes towards the topic in the study [20,41,42]. In a Q study, a subset of statements defining the "universe of communicability" (called concourse) is higher in number than the non-random sample of participants (P sample) [20]. Contrary to classical factor analysis, here, the "variables" are people performing the Q sorts, not the statements [41]. Stephenson first clarified that Q methodology was not developed to substitute R methodology, which concerns the relationship across objective variables using many respondents to make inferences [33,37,45]. Since the aim of the Q analysis is to reveal *"an in-depth portrait of the typologies of perspectives that prevail in a given situation"* [37], the statistical generalizability of Q results to a larger population of individuals is not of interest [33,46]. Indeed, factors are themselves generalizations of views which can be expected to exist outside the study's participants. Fourth, the strength of Q method passes through the well-known mathematical method of factor analysis, which is instead applied to the individuals' viewpoints expressed with the Q sorts [35,42]. This *"inverted"* factor analysis simply allows to reveal the structure of factors using the correlation among the participants' views and not, like in R methodology, among the traits [20,37]. Q factor analysis allows to synthesize straightforwardly and flexibly the divergent opinions of participants into a smaller subset of perspectives (i.e., the "factors") [20,45]. Finally, Q methodology works well when it is necessary to explore novel topics allowing a public debate *"to take place regarding values"* and without imposing *"meanings a priori"* [24,37,41]. Typically, a Q study comprises of five steps [42]: 1) the collection of the *concourse*; 2) the selection of the *Q sample*; 3) the definition of the *P sample*; 4) *Q sorting* task; and, 5) factor analysis and interpretation of results.

2.1 Concourse

The set of statements to be ranked is obtained theoretically from a larger group, namely the "concourse", or "population of statements" [20]. For Stephenson [47], the concourse *"refers to conversational and not merely informational possibilities, and is arrived at empirically for every concept, every declarative statement, every wish, every object in nature when viewed subjectively"*. The concourse can include verbal statements gathered from interviews, focus groups, participant observation etc. The selection of the population of statements is guided by the research question. In this case, the research question relies with the public debate regarding the adoption of health-warning labelling, and it can be defined as follows: "*What do diverse consumers and wine experts view the adoption of health-warning labels for the wine sector to promote healthier behaviours?"*. Consequently, the main goal was to include a wide a range of viewpoints or opinions concerning the topic under investigation. The concourse was obtained by searching inside websites, social networks, and interviews ready-made statements using specific keywords [42]. Another important aspect is that the statements should be self-referent (e.g., *"for me...."*, *"I believe..."*) [20]. The use of statements such as "For me..." or "In my opinion..." are essential for stimulating the self-involvement of the participants' ranking process (Q sorting). Finally, over 240 subjective and contrasting written statements composed the concourse.

2.2 Conditions of instruction

Q analysis must be considered *de facto* a behavioural experiment, in which the subject is instructed to operate with the statements under *"conditions of instruction"* guided by the theory and the specific aims of the study [20]. In most studies, like this one, the instruction *"rank the statements to represent your own point of view"* is all that is called for to let operantly emerge the principles governing the subject's behaviour.

2.3 Q sample

A subset of statements drawn from the concourse forms the Q sample, built to provide a *"miniature"* of the original concourse to guarantee enough variety and

Table 1. Structured 8-cell matrix [52].

		Toulmin's types of claims			
		Definitive "Concerns the meaning of terms"	Designative "Issues of fact"	Evaluative "Expressions of the worth of something"	Advocative "Something that should or should not exist"
Attitude	Positive	5	5	5	5
	Negative	5	5	5	5

representativeness [48]. Regarding the Q sample dimension, the number of statements may vary between 30 to 60 [20,49,50]. Typically, the statements sampling is tied to the Fisher's experimental design [20,51]. This structured approach provides a theoretical way for selecting the statements. In this study, the structured matrix used for the selection was obtained by adapting one proposed by a previous study [52]. In their four-by-four original matrix [52] included four categories relating to different discourse elements and four types of claims extracted from [53]. For this study, we adopted four levels in one variable (*the Toulmin's claims*: definitive, designative, evaluative and advocative) cross-classified with two levels in a second variable (*Attitude*: positive and negative) in a 4´x2 factorial arrangement. The 8-cell matrix is reported in Table 1. All statements were first classified in the matrix, and after eliminating the redundant and unclear statements, five different statements were selected for each cell. The final balanced Q sample included 40 self-referent statements for administering the sorting task. Due to the diverse audience, the Q sample was also pre-tested to revise the clarity of each statement.

2.4 P set

Q methodology works with few participants: *"enough subjects to establish the existence of a factor for purpose of comparing one factor with another. What proportion of the population belongs in one factor rather than another is a wholly different matter and one about which Q technique as such is not concerned"* [20]. In traditional by-item factor analysis (R technique), [54] suggests a minimum of ratio of two participants per variable. In Q technique, the ratio should be reversed. Because the aim of the methodology is to prove the existence of relevant and natural discourses, adding more participants to the study does not add any information *"unless the extra individuals are truly different"* [52]. Relevant studies were carried out with few participants, or even with a single participant to whom multiple Q sorts were administered with different condition of instruction – the so-called "intensive" studies [24,25,42,55]. In any case, the main criterion for sampling participants was seeking the maximum variation and emphasis on higher quality [25]. Consequently, the number of participants is less important than the representativeness of their selection [20]. Following the methodology, participants were strategically – not randomly – sampled including those with pivotal view regarding the subject [41]. More specifically, to provide the broadest diversity of opinions, both wine consumers and experts, who are more familiar and involved with the topic, formed the participant sample or P set [22]. We included at least six participants per group [56]. In more detail, the P set included twelve consumers and seven experts. Among the experts were three resellers/distributors, two sommeliers, one agronomist, and one enologist. Contacted wine growers preferred to refer to their own consultant, either enologist or agronomist. Participants were contacted via mail and phone to schedule a convenient time and location. The P set included 19 participants, nine males and ten females with different ages (range 22-66 years), education and occupation.

2.5 Q sorting and post-sort interviews

The forty statements were provided to participants as printed cards randomly numbered. Participants were asked to rank-order the statements along a continuum from "most agree" ("+4") to "most disagree" ("-4") into a forced quasi-normal distribution (Figure 1). The sorting distribution is generally symmetrical about the middle (the "0" represents the neutral area). It is important to note that no effect on the results is produced by the rating and the shape of the distribution [42]. By ranking all statements, participants "operantly" impose their individuality or view on the distribution, producing the self-referent Q sorts [38]. Before starting the Q sorting, each participant was instructed to read all the statements and divide them into three piles: "agree", "disagree" and "neutral". Then, the participant was asked to start rating the "agree" pile, moving from the right to the left. Due to

the symmetrical distribution, the same procedure is followed for the "disagree" pile, in this case, moving from the left to the right. Finally, the remaining neutral statements are placed into the distribution. Then, open-ended interviews (usually on the highest and lowest ranked statements) were gathered after the Q sorting to facilitate the interpretation of results.

2.6 Factor analysis

The analysis was conducted using the KADE software [57]. All Q sorts are cross-correlated and factor analysed. The calculation of the correlation matrix is necessary to prepare the data for revealing the factor structure [20,48]. Then, the correlation matrix is used as raw material for the factor analysis. Factor analysis in a Q-study is used to reduce the variety of Q sorts into a finite set of "discourses" or "factors". The initial n x n correlation matrix is reduced to n x m matrix, where n is the number of Q sorts and m is the number of factors, with m<n [20]. The factor analysis allows to group Q sorts highly correlated with one other into one "family" and reports how many different families exist [20,45,47]. Here, seven factors were initially extracted automatically using the centroid method [20,35] Table 2. The first output of the factor analysis are the factor loadings which are correlation coefficient indicating the extent to which each Q sort is associated with each factor [20,42]. At this point, it is important to define how many factors should be retained for the interpretation. There is not a unique way to establish how many social factors to extract. For this study, three criteria were followed. First, one method is to accept those factors with at least two significant factor loadings [20]. The factor loading of one Q sort can be considered statistically significant or "*defining*" for a given factor if it exceeds ±2.58 x (standard error) (with p<0.01); where the standard error is $1/\sqrt{(n\ of\ staements)}$) [20,55]. For this study, a defining Q sort has a loading which exceeds ± 0.4079. Second, the Scree-plot analysis was also followed. According to this method, eigenvalues for each factor, calculated by summing the squared loadings for each factor, are plotted on a line graph and the number of factors to extract are those where the line changes slope [49]. Third, the Kaiser-Guttman criterion guides the selection of those factors with eigenvalue over 1 [20]. In Table 2, the eigenvalues for all unrotated factors are reported. The results of these criteria and theoretical considerations were considered to select four factors [41]. Once extracted, the factors are usually subjected to rotations. The four factors were rotated using a combination of varimax and the judgemental rotation to fit more in focus the connection between similar Q sorts. The solution was also motivated by low correlations between couples of factors, indicating the minor similarities between each perspective. The study variance and the factor score correlations for the four-factor solution are reported in Table 3. Table 4 shows all factor loadings with the 'defining' Q sorts [20].

Other coefficients, namely the z-scores and the factor-scores, are usually calculated to complete the analysis and facilitate the interpretation of factors. Those scores

Table 2. Eigenvalues of unrotated factors.

	F1	F2	F3	F4	F5	F6	F7
Eigenvalues	4,9517	2,2941	1,365	1,2402	0,7917	0,4855	0,4978

Table 3. Characteristics of the four rotated factors.

	F1	F2	F3	F4
% of explained variance	26	11	6	9
Cumulative % of explained variance	26	37	43	52
Factor score correlations				
F1	1	-0,1619	-0,08	0,1189
F2		1	-0,2981	0,1323
F3			1	0,0758
F4				1

Table 4. Factor loadings (those loadings "flagged" in bold indicate significant Q sorts).

Q sort	Type	F1	F2	F3	F4
1	Consumer	0,1149	-0,0066	0,0397	**0,8224**
2	Expert	**-0,7443**	0,2126	0,0836	0,269
3	Expert	**0,7547**	0,0468	-0,3076	-0,0232
4	Consumer	0,058	**0,5165**	0,0197	-0,1122
5	Consumer	**0,7239**	0,0743	-0,0849	0,0767
6	Consumer	-0,4467	**0,4889**	-0,1602	0,0645
7	Expert	0,1737	-0,0472	-0,0145	**0,7587**
8	Consumer	**0,5092**	0,3606	-0,2473	0,1633
9	Expert	**0,7571**	-0,2384	0,0027	-0,0773
10	Expert	0,0162	-0,3653	0,1615	0,1693
11	Consumer	**0,8326**	-0,0183	0,3138	-0,1181
12	Consumer	0,2544	**0,5378**	0,1113	-0,0345
13	Consumer	**0,7332**	0,2968	-0,0126	0,0678
14	Expert	**0,7522**	0,2348	-0,1589	-0,0387
15	Consumer	-0,2831	**0,7195**	-0,0147	0,3254
16	Consumer	0,0442	0,093	**0,4143**	-0,0997
17	Consumer	0,1698	-0,1178	0,3495	0,17
18	Consumer	0,0035	-0,4039	**0,6675**	0,0888
19	Expert	**0,5645**	0,2284	-0,1112	0,2628

are typically used to describe factors and to facilitate their interpretation [20,42,47]. The z-scores, indicating the relation between statements and factors, are calculated for each factor as a weighted average of the scores given by the *"flagged"* Q sorts [20]. Then, the z-scores are converted in the form of the original "+4" to "-4" metric to produce rounded factor scores [20,42,44]. The factor scores report the scores for each statement *"computed as ideal Q sorts from the highly loaded sorts"* [42]. In other words, factor scores are *"empirical generalizations of a subjective viewpoint shared by those whose individual sorts are significantly loaded on the same factor"* [42]. The methodology also allows the calculation of the distinguishing statements, those that significantly differ from one factor to another [20].

3. RESULTS

From the nineteen Q sorts, nine loaded significantly on Factor 1, four on Factor 2, two on Factor 3, and two on Factor 4. Two Q sorts were not assigned to any factor. The variance explained for each factor was respectively: 26% for Factor 1, 11% for Factor 2, 6% for Factor 3 and 9% for Factor 4. The total variance explained was 52%. The interpretation of factors was based using the most positively characteristic statements (+4, +3, +2) and most negatively characteristic statements (–4, –3, –2) and the most distinguishing statements [20,25]. Factor scores for most relevant statements are reported respectively in The adoption of HWLs was not seen as an attack on the national economy. Also, the participant strongly disagreed that the adoption of HWLs will damage the Mediterranean diet and added, *"What does the Mediterranean diet have to do with alcohol?"*.

Table 5, Table 6, Table 7 and Table 8. To better identify the divergent views four labels were selected for each factor.

3.1 Factor 1: The "Nationalism" view

The first factor is bipolar; eight of the nine defining Q sorts have positive loadings, and only one (Q sort 2) is negative [20,58]. For this reason, the bipolar factor composed of discourses 1A and 1B. The latter can be considered a 'mirror image' Q sort to that of 1A [59]. The most distinguishing and high ranked statements are reported in .

Table 5. The positive loadings of this factor (Factor 1A) perceive the adoption of health warnings on wine labels with solid hostility. For the 'pro- Nationalism' view, the proposal appears dangerous for the wine market, especially for the Italian one. Participants belonging to Factor 1A believe that these labels are essentially an attack on the Italian economy. This negative perception is drawn from their 'anti-European' position, which made it strongly different from all other factors. The participants who shared this attitude felt protection towards national interests against European policies (4, +4**; 27, +3**; 33, -4*; 40, +2). According to this viewpoint, wine is an ambassador of Made in Italy and part of the national culinary tradition. For this reason, the national government should protect the Italian wine sector by contrasting the use of HWLs (9, -3**). Looking at the post-sort interviews, some participants stated: *"The government should oppose it because it is not the right solution to the problem of alcoholism" (P3); "It is an attack on Italy, on our economy, which will surely cause strong repercussions" (P11).* Adopting warning labels is also wrong for other reasons. First, if wine bottles would be treated as cigarettes - adopting HWLs - a precious sector which involves thousands of companies will be compromised (5, +3**; 21, -3). Second, warning labels are considered "useless" and an instrument for imposing "psychological terrorism" on consumers (8, +4; 25, -4). Third, this view supports the moderate consumption of wine in accordance with the Mediterranean diet principles (38, +3**). Lastly, for participants, the proposal is not supported by scientific basis (31, -1**). Regarding discourse 1B, factor scores should be reversed, e.g., statements 9, 25, 33 engender a strong agreement, and statements 4, 5, 27, 38 engender a strong disagreement. It is important to underline that Factor 1B focuses on the same relevant topics of Factor 1A but with a negative view. The participant (Q sort 2) provided some comments that might verify his position. For example, it takes distance from 'victimhood', which characterise the 'pro-Nationalism' opinions (Factor 1A). In particular, referring to the statement 27, which disagrees, this participant stated: *"How boring is this sovereignist victimhood?"*. The adoption of HWLs was not seen as an attack on the national economy. Also, the participant strongly disagreed that the adoption of HWLs will damage the Mediterranean diet and added, *"What does the Mediterranean diet have to do with alcohol?"*.

3.2 Factor 2: The "Market-oriented" view

An optimistic attitude towards the adoption of health warnings mainly characterizes this second factor Table 6. According to this view, health warnings will help to increase transparency in the market and help consumers to make informed choices. The factor has a strong focus on market dynamics and does not perceive that warning labelling adoption would negatively com-

Table 5 Factor scores for Factor 1 (distinguishing statements with ** indicates a significance of p<0.01, with * of p<0.05).

n	Statement	F1A	F1B	F2	F3	F4
4	For me, the European policies supporting the wine sector have proved incapable of defending quality products again.	+4**	-4**	-1	-1	-2
5	I think Europe cannot treat a bottle of wine like a pack of cigarettes.	+3**	-3**	-1	-4	-2
8	I think that we should not engage in psychological terrorism but use proper communication (e.g., on social media, TV, etc.) to educate citizens about the consumption of wine.	+4	-4	+4	-1	+3
9	In my view, the Italian government should not oppose using health warnings on labels.	-3**	+3**	+1	+2	0
10	I think the labels should also include information to protect the health wine consumers as in other countries (e.g., Ireland).	-2*	+2*	-1	+3	0
21	In my opinion, using warning labels does not risk compromising the role of wine as an ambassador of a system that respects the environment and local traditions.	-3	+3	+2	-2	-3
25	I find it helpful to indicate on the labels that drinking wine is seriously damaging to own health.	-4	+4	-2	+4	+1
27	For me, using these labels is a concrete attack on Italian wine. It is unclear why wanting to tackle this problem and hypocritically hide other issues under the carpet (e.g., fine dust, pollution, etc.).	+3**	-3**	-2	+1	-2
31	For me, using health warnings on the label is supported by a scientific basis.	-1**	+1**	+1	+4	+3
33	I don't think that the introduction of these labels represents an attempt by some northern European countries to demonise sectors that represent a heritage of our food and wine culture and tradition.	-4*	+4*	+3	0	-2
38	For me, these labels risk damaging the Mediterranean diet, a fundamental tool for protecting health. Recent studies have shown how the moderate use of wine could benefit health.	+3**	-3**	-3	0	-4
40	For me, adopting such labels is irresponsible and would create difficulties in a vital supply chain, one of the most relevant to our agri-food sector.	+2	-2	-3*	+3	-1

promise the image of Italian wine worldwide (21, +2**) and the economy of the entire sector, including turnover, employment and total exports (6, -3*; 24, -4**; 40, -3*). Some participants stated: *"I do not think that these labels will do devastating damage to the world of wine, particularly Italian wine, which remains an excellent quality product"* (P15); *"Those who take a healthy and consistent approach to wine will not change the way they consume it, so I don't think exports would be affected"* (P12). Furthermore, for this view, HWLs will not create obstacles to the free circulation of goods nor increase wine costs or prices for the final consumer (17, -2**). One participant stated: *"I believe that adopting health warning labels is useful and low-cost"* (P6). Contrary to perspectives 1 and 4, this view does not perceive these labels with hostility as an attempt by other European countries to penalize Italian wines (33, +3**). Regarding this point one affirmed: *"Good communication is necessary to ensure that people are educated on the correct consumption of wine"* (P6). Also, adopting warning labels with proper communication could add more value to wines produced responsibly (35, +2**), inform consumers, and promote moderate and responsible consumption (26, +4).

3.3 Factor 3: The "Health-first" view

More than all the other views, this third view shows a strong focus on health aspects and has high expectations towards the ability of HWLs to protect consumers' health Table 7. One participant affirmed: *"Health is the first element to protect"* (P16). Looking at the most distinguishing statements, adopting health warnings is perceived as necessary to protect public health, which contrasts mainly with the first perspective (10, +3**, 25, +4**). For example, concerning the statement 25, one stated: *"I find these labels useful for highlighting the motivations"* (P18). Overall, this view particularly trusts the use of measures based on labelling to inform consumers about health risks (7, -3*). The overconfidence with HWLs of those belonging to this factor is also supported by a scientific base (31, +4) and by the belief that consumers will pay high for those health-related information (22, -3**). Distinct from all other viewpoints, this third perspective is not worried about the aesthetic impact of warning labels on wine bottles (14, -4**) and retained that this is a low-cost measure (28, -3**). However, this view raises some concerns about the possible price increase (17, +3*). Regarding this last point, one participant confirmed: *"Anything that affects wine damages it; if it doesn't damage it, it causes problems for those who consume it"* (P18).

3.4 Factor 4: The "Keep us alive" view

This last view is mainly characterised by an evident scepticism regarding adopting health-warning labels

Table 6. Factor scores for Factor 2 (distinguishing statements with ** indicates a significance of p<0.01, with * of p<0.05).

n	Statement	F1A	F1B	F2	F3	F4
6	In my opinion, with these labels, Europe risks causing enormous damage to the world of wine, which in Italy alone involves millions of employees and produces a significant annual turnover.	+2	-2	-3*	0	-1
8	I think that we should not engage in psychological terrorism but use proper communication (e.g., on social media, TV, etc.) to educate citizens about the consumption of wine.	+4	-4	+4*	-1	+3
17	I believe these labels are a clear obstacle to the free circulation of goods and involve additional costs which will increase the price of wine to final consumers.	+1	-1	-2**	+3	0
18	I think that the use of these labels represents a sort of 'disclaimer' by those who impose them.	+2	-2	-2**	+1	+4
21	In my opinion, using warning labels does not risk compromising the role of wine as an ambassador of a system that respects the environment and local traditions.	-3	+3	+2**	-2	-3
24	I think it is a fact that the adoption of such labels will cause severe setbacks for wine exports.	+1	-1	-4**	+1	-1
26	I think there is nothing wrong with creating labels inviting moderate consumption. It could be a way to encourage responsible alcohol consumption without scaring consumers with too negative information.	-1	+1	+4	+2	+1
32	I believe using these labels will negatively affect the promotion policy of alcoholic beverages, wine included.	+1	-1	-2**	+2	+2
33	I don't think that the introduction of these labels represents an attempt by some northern European countries to demonise sectors that represent a heritage of our food and wine culture and tradition.	-4	+4	+3**	0	-2
35	I think that inserting some important analytical values on the back of the label is not so harmful; on the contrary, it could - together with other precautions - lead to a greater valorisation of wines produced responsibly.	-1	+1	+2**	-2	-2
39	I believe that to reduce the adverse effects that introducing these labels would have on the wine sector, the Italian government should intervene with economic-financial support to all operators in the sector.	-1	+1	-3**	+2	+1
40	For me, adopting such labels is irresponsible and would create difficulties in a vital supply chain, one of the most relevant to our agri-food sector.	+2	-2	-3*	+3	-1

Table 7. Factor scores for Factor 3 (distinguishing statements with ** indicates a significance of p<0.01, with * of p<0.05).

n	Statement	F1A	F1B	F2	F3	F4
7	For me, using these labels is wrong because the habit of getting drunk should be fought by adopting a different cultural approach to wine, drunk with meals and in limited quantities.	+2	-2	0	-3**	+3
10	I think the labels should also include information to protect the health wine consumers as in other countries (e.g., Ireland).	-2	+2	-1	+3**	0
14	For me, using these labels ruins the aesthetic and valuable sense of wine bottles.	0	0	-1	-4**	0
17	I believe these labels are a clear obstacle to the free circulation of goods and involve additional costs which will increase the price of wine to final consumers.	+1	-1	-2	+3**	0
22	I think that information policies on bottles related to the risks of alcohol abuse cannot be based solely on labels because these warnings receive very minimal attention from consumers	+1	-1	+3	-3**	+2
25	I find it helpful to indicate on the labels that drinking wine is seriously damaging to own health.	-4	+4	-2	+4**	+1
28	I think using warning labels is a low-cost deterrent measure because it does not involve public investment, awareness campaigns or particular commitment by the public administration.	-1	+1	+3	-3**	+1
31	For me, using health warnings on the label is supported by a scientific basis.	-1	+1	+1	+4	+3

Table 8. Participants from this view are conscious of the risks related to alcohol abuse and underline how, in the end, there are no safe amounts of alcohol consumption for health. Adopting HWLs for wine does not make sense for them (12, +4**). On the other hand, this viewpoint recognises that these labels are supported by scientific basis (+31, +3). However, for participants who share this view, governments should not impose limits on the consumption of wine (3, -3). This viewpoint expresses a "fatalistic" approach to health behaviour, supporting the idea that many foods could negatively affect individuals' health (36, +3**). In this sense, showing a warning label on wine bottles that informs on the potential adverse effects of wine consumption is useless (22, +2), with the only result of ruining the pleasure of drinking a good wine (19, -3**). The strategy to use health-warning

Table 8. Factor scores for Factor 4 (distinguishing statements with ** indicates a significance of p<0.01, with * of p<0.05).

n	Statement	F1A	F1B	F2	F3	F4
3	I think nobody wants to ban drinking, but at the same time, the government should limit individual choices if this negatively impacts public health.	-1	+1	+1	+1	-3
7	For me, using these labels is wrong because the habit of getting drunk should be fought by adopting a different cultural approach to wine, drunk with meals and in limited quantities.	+2	-2	0	-3	+3
8	I think that we should not engage in psychological terrorism but use proper communication (e.g., on social media, TV, etc.) to educate citizens about the consumption of wine.	+4	-4	+4	-1	+3
12	For me, there are no safe amounts of alcohol consumption for health.	-2	+2	-4	-2	+4**
18	I think that the use of these labels represents a sort of 'disclaimer' by those who impose them.	+2	-2	-2	+1	+4*
19	In my opinion, using these labels would not change consumption in any way, and it would ruin the pleasure of drinking wine at the table.	0	0	0	0	-3**
22	I think that information policies on bottles related to the risks of alcohol abuse cannot be based solely on labels because these warnings receive very minimal attention from consumers	+1	-1	+3	-3	+2
30	I believe that freedom of choice in our society is a thing of fact. In any case, being free to drink as much as you like is separate from being correctly informed about the possible risks.	0	0	+3	0	+2
31	For me, using health warnings on the label is supported by a scientific basis.	-1	+1	+1	+4	+3
36	I think there are a lot of carcinogenic foods today. From meat to vegetables. You only live once, and it will certainly not be these labels that influence my alcohol consumption. If you don't die of one thing, you die of another.	0	0	0	-1	+3**

labels is unacceptable also because it represents a sort of disclaimer by politicians (18, +4*). For this perspective, similar to the first perspective, it would be more effective a radical cultural change (7, +3). Regarding this last point, one participant confirmed: "*Nowadays, practically everyone knows the side effects of many substances, and yet they continue to abuse them. If there is genuine interest, a radical change in lifestyle must be done*" (P1).

4. DISCUSSION

The results identify four key perspectives on adopting HWLs on wine bottles, each offering valuable insights into consumer and expert opinions within the wine sector. The results generally reveal a broad awareness of the health impact associated with wine consumption across all factors. However, the four viewpoints differed substantially in their responses to the mandatory adoption of HWLs.

The results showed that, for Factors 2 and 3, mandatory HWLs on all alcoholic beverages, including wine, could raise awareness of health-related risks and support consumers make better-informed choices. This suggests a potential positive impact of HWLs on wine bottles, offering hope for a more informed and healthier consumer base. Nevertheless, significant differences exist between the viewpoints of Factor 2 and Factor 3 regarding the HWLs on wine bottles. According to the latter (the "Health-first" view), Italian consumers still have a low level of awareness about the health risks associated with alcohol consumption. Therefore, HWLs on wine container could be crucial in raising awareness about the dangers of alcohol consumption. Previous studies [9,11], highlighting that only a small percentage of alcohol consumers are aware of the health-related risks associated with alcohol consumption. However, while HWLs may enhance awareness of these risks, their effectiveness ultimately depends on an individual's perception. As found in [60] and [11], risk perception can strongly affect an individual's level of engagement with a risky situation (e.g., beverage alcohol consumption) and, consequently, his acceptance of the related consequences [61]. According to some scholars [11] and [62], peoples' perceptions of health-related risks from alcohol consumption do not necessarily increase after being exposed to HWLs. The findings of [63] support this, showing that society tends to have higher acceptability for voluntary risks (e.g., smoking, drinking alcohol) compared to involuntary risks (e.g., flooding, storms, earthquakes). Furthermore, as also raised by [64] research suggests that HWLs alone may not be sufficient to reduce alcohol consumption.

According to [61] an individual's perception of risk is strongly influenced by their knowledge of specific hazards, such as alcoholic beverages. The mandatory introduction of HWLs on wine bottles should be part of a broader strategy. This strategy should not only include HWL education campaigns but also support programs targeting at-risk populations, highlighting the complexity of the issue, and pressing the need for multi-faceted solutions.

Similarly to the previous viewpoint, Factor 2 (the "Market-oriented" view) is also favourable for adopting of HWLs. People who are part of this factor consider the mandatory adoption of detailed HWLs on wine containers (e.g., bottles and cans) an effective policy tool to regulate the alcohol market and address various externality costs, including those related to public health impact [65]. According to this view, mandatory HWLs can be considered both a regulatory instrument and an informational tool used by the government to establish the socially optimal level of alcohol consumption. Moreover, according to this "Market-oriented" viewpoint, the mandatory adoption of HWLs on wine containers does not necessarily cause a decrease in wine consumption. According to a previous study, improving knowledge and understanding of wine health related risks may lead to a general increase in consumption [64]. According to [66], responsible wine consumption should be promoted through national and international programmes to reduce alcohol abuse. At the same time, consumers should be educated to consume alcohol based on cultural norms and healthy lifestyles. Typical examples of other regulatory instruments governments could adopt include licensing restrictions to retailers and bars, setting a minimum legal drinking age, and restricting alcohol advertising addressed to young people and adolescents [67]. Health taxes on alcoholic products, which can also be defined as Pigouvian taxes, are considered one of the main economic instruments implemented in many countries worldwide [65,68,69]. In the UK, where excise duty on alcohol has been in place for many years, the government has recently proposed changing the tax from a product volume tax to an alcohol volume tax [70]. These taxes can be complemented with other economic instruments, such as incentives to alcohol-free beverage productions. According to [71], wine with reduced alcohol content or de-alcoholised wine has proven to be an effective measure in reducing the potential health-related effects of alcohol consumption. Governments must implement economic strategies, including price incentives and subsidies, to promote the production and consumption of No-and Low-Alcohol (No-Lo) beverages. As the production of No-Lo wine is still more expensive than traditional wines, supporting innovations in production techniques through R&D projects is necessary [72].

Factor 4 (the "Keep us alive" view) is characterised by a limited interest in adopting HWLs, primarily due to perceptions of limited effectiveness in promoting positive behaviours. The scepticism associated with this factor stems from the belief that individuals who consume wine in moderation will continue to do so, regardless of the presence of HWLs. As reported in the literature, the moderated consumption of wine is considered important for reducing the risk of cardiovascular diseases (CHD). This was first explored by [73], whose findings are often referred to as the "French paradox". According to this study, despite the relatively high consumption of food rich in saturated fatty acids (e.g., cheese and meat), the mortality rate of the French population due to cardiovascular disease was lower compared to that in other countries with similar diets. This has been partially attributed to the effect of moderate red wine drinking [73]. Regular consumption of red wine is beneficial in many other recent studies conducted in Mediterranean countries [74,75]. The challenge lies in finding effective strategies for those who abuse alcoholic beverages, including wine, and preventing harmful behaviour, especially among younger individuals. According to the Factor 4 viewpoint, if decreasing alcohol abuse is the main objective of the EU Commission, this goal cannot be achieved using labelling alone, which could be seen as a way of discharging responsibility from institutions. Achieving meaningful changes in drinking behaviour requires enhancing knowledge and understanding of the potential health-related hazards connected to the consumption of alcoholic beverages. According to [7,76], the use of HWLs on alcoholic beverages should be only part of a broader campaign to educate people about the health-related risks of alcohol consumption. Public health agencies should implement several other information strategies at the member state level to address misinformation about the alcohol use (and abuse), particularly among the younger generation [68]. These include implementing evidence-based advertising restrictions [77] and school-based preventive alcohol use interventions for adolescents [78,79]. Moreover, a notable feature of the Mediterranean Diet, inscribed in 2013 on the UNESCO list of the Intangible Cultural Heritage of Humanity [80,81] for its cultural significance and health-related benefits, is the moderate consumption of wine.

Factor 1 (the "Nationalism" view) strongly criticised HWLs for reasons beyond the health implications of alcohol use. From this perspective, the labelling is seen as a threat to the national wine industry. Consequently, contrasting the adoption of HWLs on wine bottles is essential to protect domestic and international demand for wine, as this product plays a crucial role in the national economy. These findings are consistent with those in [76], which highlight the general resistance of the alcohol industry to include public health information on the label. The wine industry and farmers have a strong interest in protecting their sector. The Italian wine industry plays a significant role in the global wine market [82]. According to [83], in 2023, Italy produced

about 49 million hectolitres of wine, 40% of which was exported in EU and non-EU countries. In Italy, winemaking is performed by over 30,000 wineries, most of which are smallholder grape growers, and involves about 690,000 hectares of vineyard area [83]. The valorisation and protection of this important sector are also seen as important for the Factor 4 viewpoint. This perspective brings the view that introducing HWLs could be an attempt by northern European countries to undermine a key sector of Italy's economy and cultural heritage. Among typical products, such as Geographical Indication (GI) products, wine represents a strong connection between geographical, environmental and cultural contexts. Some authors [84,85] define this concept as terroir, which refers to the interaction between environmental factors (i.e., biological and physical) and winemaking practices applied in each context that can provide distinctive characteristics to the final product.

5. CONCLUSIONS

This study provides a preliminary investigation into the perception and acceptance of health warning labels (HWLs) on wine bottles, focusing on experts and non-experts within the Italian context, where wine is deeply rooted in national culinary tradition. Using Q methodology, a systematic approach to studying human subjectivity, the research highlights a lack of consensus on mandatory HWLs for wine in Italy. While Factor 2 (the "Market-oriented" view) and Factor 3 (the "Health-first" view) reflect a more positive stance towards HWLs, accounting for the majority of consumers, Factor 1 (the "Nationalism" view) and Factor 4 (the "Keep us alive" view), mainly represented by wine industry professionals, oppose such measures. Despite these divergent views, there is shared recognition of the need to distinguish between alcohol abuse and moderate consumption. Different countries have varying regulations; in regions with less stringent warnings, companies may leverage this to market their products more aggressively. The Irish regulation on alcoholic products, among the strictest in the EU, has sparked widespread debate, illustrating the complexity of implementing HWLs across diverse cultural and market contexts. Discussions in Italy and other major EU wine-producing countries are intensifying due to the potential implications for the wine industry. As this debate unfolds, a nuanced and multi-faceted approach is essential for evaluating the potential effects of HWLs on both abusive and social wine consumption, particularly among younger generations. Future research should analyse the impact of HWLs in countries where such measures are already enforced, by promoting real-world studies, and comparing the findings with existing experimental research in Italy.

In some cases, companies may view HWLs as a competitive disadvantage. Stricter regulations on health warnings may push companies to innovate or differentiate their products in ways that comply without compromising appeal. On the other side, companies might use health warnings strategically to enhance their image by appearing responsible and socially conscious, thus potentially gaining a competitive edge in the marketplace.

In this framework, harmonizing HWL designs with international regulatory frameworks, such as the Trans-Pacific Partnership (TPP), could be crucial to minimize disruptions to both domestic and export markets. Careful alignment with existing EU and member state wine legislation is equally important. Health warnings can serve as a competitive measure in the marketplace, nevertheless, the effectiveness of these warnings often depends on various factors, including cultural context, consumer behaviour, and regulatory enforcement.

While this study sheds light on critical perspectives, it is limited by its focus on the Italian context and the exclusion of wine growers from the participant set. Replicating the research in other EU countries and incorporating additional stakeholders would provide a broader understanding of the varied responses to HWLs, offering valuable insights for future policy development.

ETHICAL STATEMENT

The experimental procedure was approved by Università Politecnica delle Marche ethical committee and conducted in accordance with the principles outlines in the Declaration of Helsinki.

CRediT AUTHORSHIP CONTRIBUTION STATEMENT

Conceptualization: Francesco Solfanelli and Serena Mandolesi; Data curation: Francesco Solfanelli, Serena Mandolesi, Simona Naspetti and Ileana Silvestri; Investigation: Francesco Solfanelli, Serena Mandolesi and Ileana Silvestri; Methodology: Serena Mandolesi; Formal analysis: Francesco Solfanelli and Serena Mandolesi; Validation: Raffaele Zanoli; Writing - original draft: Francesco Solfanelli and Serena Mandolesi; Writing - review & editing: Francesco Solfanelli, Serena Mandolesi, Simona Naspetti and Raffaele Zanoli; Supervision: Francesco Solfanelli.

REFERENCES

[1] European Parliament, The EU wine sector, 2023. https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/751399/EPRS_BRI(2023)751399_EN.pdf.

[2] E. Fiorio, Wine, Italy: despite a growing consumer base, Italy's overall wine consumption is declining, (2022). https://www.winemeridian.com/english-news/wine_italy_despite_a_growing_consumer_base_italy_s_overall_wine_consumption_is_declining/#:~:text=The number of people who,half a liter per day.

[3] M. Lanfranchi, A. Alibrandi, A. Zirilli, G. Sakka, C. Giannetto, Analysis of the wine consumer's behavior: an inferential statistics approach, British Food Journal 122 (2020) 884–895. https://doi.org/10.1108/BFJ-08-2019-0581.

[4] European Commission, EU agricultural outlook for markets, income and environment, 2021-2031, DG Agriculture and Rural Development, Brussels, 2021. https://doi.org/10.2762/753688.

[5] A. Annunziata, L. Agnoli, R. Vecchio, S. Charters, A. Mariani, Health warnings on wine labels: a discrete choice analysis of Italian and French Generation Y consumers, Wine Economics and Policy 8 (2019) 81–90. https://doi.org/10.1016/j.wep.2019.03.001.

[6] WHO, Global status report on alcohol and health 2018, 2018. http://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf%0Ahttp://www.ncbi.nlm.nih.gov/pubmed/29355346 (accessed June 25, 2023).

[7] WHO, Global strategy to reduce the harmful use of alcohol, (2010) 1–38.

[8] A. Annunziata, L. Agnoli, R. Vecchio, S. Charters, A. Mariani, The Influence of Alcohol Warning Labels on Consumers' Choices of Wine and Beer, Wine Economics and Policy 9 (2020) 3–21. https://doi.org/10.36253/web-8189.

[9] K. Vallance, T. Stockwell, J. Zhao, S. Shokar, N. Schoueri-Mychasiw, D. Hammond, T.K. Greenfield, J. McGavock, A. Weerasinghe, E. Hobin, Baseline assessment of alcohol-related knowledge of and support for alcohol warning labels among alcohol consumers in northern canada and associations with key sociodemographic characteristics, J Stud Alcohol Drugs 81 (2020) 238–248. https://doi.org/10.15288/JSAD.2020.81.238.

[10] S. Ramlo, Mixed Method Lessons Learned From 80 Years of Q Methodology, J Mix Methods Res 10 (2016) 28–45. https://doi.org/10.1177/1558689815610998.

[11] C. Staub, M. Siegrist, How health warning labels on wine and vodka bottles influence perceived risk, rejection, and acceptance, BMC Public Health 22 (2022) 1–13. https://doi.org/10.1186/s12889-022-12564-8.

[12] C. Staub, C. Fuchs, M. Siegrist, Risk perception and acceptance of health warning labels on wine, Food Qual Prefer 96 (2022) 104435. https://doi.org/10.1016/j.foodqual.2021.104435.

[13] European Parliament and of the Council, Regulation (EU) No 1308/2013, 2013. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02013R1308-20230101.

[14] European Parliament and of the Council, Regulation (EU) 2021/2117, 2021. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2021.435.01.0262.01.ENG.

[15] Minister for Health, S.I. No 249/2023 - Public Health (Alcohol) (Labelling) Regulations, 2023.

[16] FoodNavigator, Should alcohol health warnings and ingredient lists appear on-label, off-label, or not at all?, (2022). https://www.foodnavigator.com/Article/2022/04/12/New-alcohol-labelling-on-label-off-label-via-QR-codes-or-not-at-all.

[17] S. Minzer, R. Estruch, R. Casas, Wine Intake in the Framework of a Mediterranean Diet and Chronic Non-Communicable Diseases: A Short Literature Review of the Last 5 Years, Molecules 25 (2020). https://doi.org/10.3390/molecules25215045.

[18] F.G. Santeramo, A. Seccia, G. Nardone, The synergies of the Italian wine and tourism sectors, Wine Economics and Policy 6 (2017) 71–74. https://doi.org/10.1016/j.wep.2016.11.004.

[19] W. Stephenson, Technique of factor analysis, Nature 136 (1935) 297–297. https://doi.org/10.1038/136297b0.

[20] S.R. Brown, Political subjectivity: Applications of Q methodology in political science, 1980.

[21] J. V. Stanton, D.T. Guion, Consumer attitudes toward organic foods: An exploration of U.S. market segments, Elsevier, 2010. https://doi.org/10.1108/S0885-2111(2010)0000012004.

[22] S. Naspetti, S. Mandolesi, R. Zanoli, Using visual Q sorting to determine the impact of photovoltaic applications on the landscape, Land Use Policy 57 (2016) 564–573. https://doi.org/10.1016/j.landusepol.2016.06.021.

[23] C. Hall, Identifying farmer attitudes towards genetically modified (GM) crops in Scotland: Are they pro- or anti-GM?, Geoforum 39 (2008) 204–212. https://doi.org/10.1016/j.geoforum.2007.06.003.

[24] S. Mandolesi, S. Naspetti, R. Zanoli, Exploring edible insects' acceptance through subjec-

tive perceptions: a visual Q study, J Insects Food Feed 8 (2022) 565–577. https://doi.org/10.3920/jiff2021.0016.
[25] P. Walder, J. Kantelhardt, The Environmental Behaviour of Farmers – Capturing the Diversity of Perspectives with a Q Methodological Approach, Ecological Economics 143 (2018) 55–63. https://doi.org/10.1016/j.ecolecon.2017.06.018.
[26] K.B. Song, S. Lê, H.R. Kim, S.M. Yoo, M.S. Kang, H.N. Chu, I.S. Hwang, J.H. Hong, Consumer-driven characterization of healing foods using Q methodology and Q based sorting, Food Qual Prefer 117 (2024). https://doi.org/10.1016/j.foodqual.2024.105181.
[27] A. Goodluck, D.J. Otieno, W. Oluoch-Kosura, Understanding farmers' perceptions on advisory services in Tanzania: Comparative insights from principal component analysis and Q-methodology, Heliyon 10 (2024) e34541. https://doi.org/10.1016/j.heliyon.2024.e34541.
[28] L. Zagata, T. Uhnak, J. Hrabák, Moderately radical? Stakeholders' perspectives on societal roles and transformative potential of organic agriculture, Ecological Economics 190 (2021). https://doi.org/10.1016/j.ecolecon.2021.107208.
[29] N. Yarar, U.R. Orth, Consumer lay theories on healthy nutrition: a Q methodology application in Germany, Appetite 120 (2018) 145–157. https://doi.org/10.1016/j.appet.2017.08.026.
[30] A. Svanidze, M. Costa-Font, Revealing the challenges facing Georgia's wine industry from a natural winemaker perspective using Q-methodology, International Journal of Wine Business Research 35 (2023) 89–120. https://doi.org/10.1108/IJWBR-06-2021-0036.
[31] L. Jakšić, E. Ivanjko, M. Njavro, Q-methodology: theoretical framework for policy making in the Croatian wine sector, International Journal of Wine Business Research 30 (2018) 428–445. https://doi.org/10.1108/IJWBR-07-2017-0046.
[32] K.J. Winkler, K.A. Nicholas, More than wine: Cultural ecosystem services in vineyard landscapes in England and California, Ecological Economics 124 (2016) 86–98. https://doi.org/10.1016/j.ecolecon.2016.01.013.
[33] W. Stephenson, The study of behavior: Q-technique and its methodology, University of Chicago Press, Chicago, IL, US, 1953.
[34] S. Ramlo, Examining Subjectivity with Q Methodology, 1st Editio, Routledge, London, 2025.
[35] W. Stephenson, The inverted factor technique, British Journal of Psychology. General Section 26 (1936) 344–361. https://doi.org/10.1111/j.2044-8295.1936.tb00803.x.
[36] D.J. Delprato, S.R. Brown, Q Methodology and the Operant Construct, Operant Subjectivity 25 (2002) 139–147. https://doi.org/10.22488/okstate.02.100599.
[37] T.A. Steelman, L.A. Maguire, Understanding participant perspectives: Q-methodology in national forest management, Journal of Policy Analysis and Management 18 (1999) 361–388. https://doi.org/10.1002/(SICI)1520-6688(199922)18:3<361::AID-PAM3>3.0.CO;2-K.
[38] B.F. Skinner, Science and Human Behavior, 1953.
[39] A. Stirling, "Opening Up" and "Closing Down," Sci Technol Human Values 33 (2008) 262–294. https://doi.org/10.1177/0162243907311265.
[40] A. Wolf, Many Minds, Common Sense and Genetically Modified Food: A Role for Q Methodology, East Asian Sci Technol Soc 4 (2010) 565–583. https://doi.org/10.1007/s12280-010-9142-1.
[41] S. Watts, P. Stenner, Doing Q methodology: theory, method and interpretation, Qual Res Psychol 2 (2005) 67–91. https://doi.org/10.1191/1478088705qp022oa.
[42] B. McKeown, D.B. Thomas, Q Methodology (Quantitative Applications in the Social Sciences Book 66), 2nd ed., Sage Publications, 2013.
[43] C.H. Davis, C. Michelle, Q Methodology in Audience Research : Bridging the Qualitative / Quantitative ' Divide '?, Journal of Audience & Reception Studies 8 (2011) 559–593.
[44] A. Zabala, C. Sandbrook, N. Mukherjee, When and how to use Q methodology to understand perspectives in conservation research, Conservation Biology 32 (2018) 1185–1194. https://doi.org/10.1111/cobi.13123.
[45] S.R. Brown, Q Technique and Questionnaires, Operant Subjectivity 25 (2002). https://doi.org/10.22488/okstate.02.100594.
[46] D.B. Thomas, L.R. Baas, The Issue of Generalization in Q Methodology: "Reliable Schematics" Revisited, Operant Subjectivity 16 (1992) 18–36. https://doi.org/10.22488/okstate.92.100599.
[47] W. Stephenson, Protoconcursus: the concourse theory of communication*, Operant Subjectivity (1986) 37–58.
[48] S.R. Brown, A primer on Q methodology, Operant Subjectivity 16 (1993) 91–138. https://doi.org/10.1177/104973239600600408.
[49] G. Sneegas, S. Beckner, C. Brannstrom, W. Jepson, K. Lee, L. Seghezzo, Using Q-methodology in environmental sustainability research: A bib-

liometric analysis and systematic review, Ecological Economics 180 (2021) 106864. https://doi.org/10.1016/j.ecolecon.2020.106864.
[50] S. Mandolesi, E. Cubero Dudinskaya, S. Naspetti, F. Solfanelli, R. Zanoli, Freedom of Choice - Organic Consumers' Discourses on New Plant Breeding Techniques, Sustainability 14 (2022) 8718. https://doi.org/10.3390/SU14148718.
[51] R.A. Fisher, The design of experiments, 1960. https://doi.org/10.1136/bmj.1.3923.554-a.
[52] J.S. Dryzek, J. Berejikian, Reconstructive democratic theory, American Political Science Review 87 (1993).
[53] S.E. Toulmin, The Uses of Argument, Cambridge, United Kingdom: Cambridge University Press, 1958.
[54] P. Kline, An easy guide to factor analysis, 1st Editio, Routledge, London, London, UK, 1994. https://doi.org/https://doi.org/10.4324/9781315788135.
[55] S. Eden, A. Donaldson, G. Walker, Structuring subjectivities? Using Q methodology in human geography, Area 37 (2005) 413–422. https://doi.org/10.1111/j.1475-4762.2005.00641.x.
[56] T. Webler, S. Danielson, S. Tuler, Using Q method to reveal social perspectives in environmental research, Social and Environmental Research 01301 (2009) 1–54. http://www.seri-us.org/pubs/Qprimer.pdf.
[57] S. Banasick, KADE: A desktop application for Q methodology, J Open Source Softw 4 (2019) 1360. https://doi.org/10.21105/joss.01360.
[58] S. Watts, P. Stenner, Doing Q methodological research: theory, method and interpretation, 2012. https://doi.org/10.4135/9781446251911.
[59] J. Fisher, K. Brown, Wind energy on the Isle of Lewis: Implications for deliberative planning, Environ Plan A 41 (2009) 2516–2536. https://doi.org/10.1068/a41129.
[60] P. Lundborg, B. Lindgren, Risk perceptions and alcohol consumption among young people, J Risk Uncertain 25 (2002) 165–183. https://doi.org/10.1023/A:1020695730192.
[61] M. Siegrist, J. Árvai, Risk Perception: Reflections on 40 Years of Research, Risk Analysis 40 (2020) 2191–2206. https://doi.org/10.1111/risa.13599.
[62] K.M. Joyce, M. Davidson, E. Manly, S.H. Stewart, M. Al-Hamdani, A systematic review on the impact of alcohol warning labels, J Addict Dis 42 (2024) 170–193. https://doi.org/10.1080/10550887.2023.2210020.
[63] J. Rehm, D.W. Lachenmeier, R. Room, Why does society accept a higher risk for alcohol than for other voluntary or involuntary risks?, BMC Med 12 (2014) 1–6. https://doi.org/10.1186/s12916-014-0189-z.
[64] N. Gold, M. Egan, K. Londakova, A. Mottershaw, H. Harper, R. Burton, C. Henn, M. Smolar, M. Walmsley, R. Arambepola, R. Watson, S. Bowen, F. Greaves, Effect of alcohol label designs with different pictorial representations of alcohol content and health warnings on knowledge and understanding of low-risk drinking guidelines: a randomized controlled trial, Addiction 116 (2021) 1443–1459. https://doi.org/10.1111/add.15327.
[65] C.M. Doran, T.A. Jainullabudeen, Economic efficiency of alcohol policy, Appl Health Econ Health Policy 8 (2010) 351–354. https://doi.org/10.2165/11584830-000000000-00000.
[66] U. Fradera, N. Fritella, D. Gonzalez, G. Sandeman, E. de Diego, C. Terrien, Digital online training for wine professionals: From responsible service to a sustainable consumption of wine, BIO Web Conf 68 (2023) 3–6. https://doi.org/10.1051/bioconf/20236804011.
[67] WHO, Health Taxes Policy and Practice, 2022. https://doi.org/10.1142/9781800612396_bmatter.
[68] WHO, Global alcohol action plan, 2024.
[69] R. Griffith, M. O'Connell, K. Smith, Tax design in the alcohol market, J Public Econ 172 (2019) 20–35. https://doi.org/10.1016/j.jpubeco.2018.12.005.
[70] K. Anderson, G. Wittwer, Proposed alcohol tax reform in the United Kingdom: Implications for wine-exporting countries, Journal of Wine Economics 17 (2022) 117–126. https://doi.org/10.1017/jwe.2022.19.
[71] T. Bucher, K. Deroover, C. Stockley, Production and Marketing of Low-Alcohol Wine, in: Advances in Grape and Wine Biotechnology, 2019. https://doi.org/10.5772/intechopen.87025.
[72] K. Anderson, The emergence of lower-alcohol beverages: The case of beer, Journal of Wine Economics 18 (2023) 66–86. https://doi.org/10.1017/jwe.2023.8.
[73] S. Renaud, M. de Lorgeril, Wine, alcohol, platelets, and the French paradox for coronary heart disease, The Lancet 339 (1992) 1523–1526. https://doi.org/https://doi.org/10.1016/0140-6736(92)91277-F.
[74] A. Nieddu, L. Vindas, A. Errigo, J. Vindas, G.M. Pes, M.P. Dore, Dietary Habits, Anthropometric Features and Daily Performance in Two Independent Long-Lived Populations from Nicoya peninsula (Costa Rica) and Ogliastra (Sardinia), Nutrients 6 (2020) 1621. https://doi.org/10.3390/nu12061621.

[75] G. Benedetto, D. Carboni, The Health effects of wine: The case of longevity in Sardinia, BIO Web Conf 56 (2023) 1–9. https://doi.org/10.1051/bioconf/20235604004.
[76] P. O'Brien, D. Gleeson, R. Room, C. Wilkinson, Marginalising health information: Implications of the Trans-Pacific Partnership Agreement for alcohol labelling, 2017.
[77] N. Siegfried, D.C. Pienaar, J.E. Ataguba, J. Volmink, T. Kredo, M. Jere, C.D.H. Parry, Restricting or banning of alcohol advertising to reduce alcohol consumption in adults and adolescents, Cochrane Database of Systematic Reviews 2013 (2013). https://doi.org/10.1002/14651858.CD010704.
[78] E.A. Hennessy, E.E. Tanner-Smith, Effectiveness of brief school-based interventions for adolescents: A meta-analysis of alcohol use prevention programs, Prev Sci. 16 (2015) 463–474. https://doi.org/10.1007/s11121-014-0512-0.
[79] K.K. Strøm, F. Adolfsen, S. Fossum, S. Kaiser, M. Martinussen, Effectiveness of school-based preventive interventions on adolescent alcohol use: A meta-analysis of randomized controlled trials, Subst Abuse Treat Prev Policy 9 (2014) 1–11. https://doi.org/10.1186/1747-597X-9-48.
[80] UNESCO, What is Intangible Cultural Heritage?, (2010). https://ich.unesco.org/en/what-is-intangible-heritage-00003.
[81] A. Trichopoulou, Mediterranean diet as intangible heritage of humanity: 10 years on, Nutrition, Metabolism and Cardiovascular Diseases 31 (2021) 1943–1948. https://doi.org/10.1016/j.numecd.2021.04.011.
[82] E. Pomarici, A. Corsi, S. Mazzarino, R. Sardone, The Italian Wine Sector: Evolution, Structure, Competitiveness and Future Challenges of an Enduring Leader, Springer International Publishing, 2021. https://doi.org/10.1007/s40797-021-00144-5.
[83] ISMEA, Vino - I numeri del settore, (2024).
[84] P. Clingeleffer, Terroir: The Application of an Old Concept in Modern Viticulture, in: N.K. Van Alfen (Ed.), Encyclopedia of Agriculture and Food Systems, Academic Press, 2014: pp. 277–288. https://doi.org/https://doi.org/10.1016/B978-0-444-52512-3.00157-1.
[85] H. Johnson, The world atlas of wine: A complete guide to the wines spirits of the world, First Edit, Mitchell Beazley, 1971.

APPENDIX

Most disagree			Neutral					Most agree
-4	-3	-2	-1	0	+1	+2	+3	+4

Figure 1. The Q sorting distribution.

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Hansen, R. & Hess, S. (2025). Competitiveness of wine cooperatives in light of pricing strategies and marketing channels: Evidence from Germany. *Wine Economics and Policy* 14(1): 63-81. doi: 10.36253/wep-16253

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Competitiveness of wine cooperatives in light of pricing strategies and marketing channels: Evidence from Germany

Rebecca Hansen*, Sebastian Hess

Institute of Agricultural Policy and Markets, Research Centre of Cooperatives, University of Hohenheim, 70599 Stuttgart, Germany
*Corresponding author. Email: rebecca.hansen@uni-hohenheim.de

Abstract. For decades, the literature has engaged in a robust debate regarding the competitiveness of wine cooperatives. Many studies suggest that these cooperatives may exhibit lower pricing competitiveness compared to other enterprise forms, while others have found the opposite. To clarify these conflicting findings, this study employs two datasets focused on German winegrowers' cooperatives to compare their competitiveness across various price segments of the wine market through hedonic price analyses. The first dataset encompasses the premium wine segment, comprising 1,320 observations derived from wine guide data. The second dataset, which includes 18,740 observations, reflects the broader market characterized by lower average wine prices. The results reveal that the heterogeneity in cooperative sizes influences diverse marketing strategies within the German wine market. Especially larger cooperatives operating in the broader market at lower price segments tend to achieve relatively lower prices compared to other enterprise types. However, this competitive disadvantage dissipates within the high-price, high-quality segment, particularly for wines recognized in wine guides. The findings indicate that the organizational structure of cooperatives in the wine sector does not inherently confer a competitive disadvantage relative to other enterprise forms; rather, it is the heterogeneity among cooperatives that explains the variability in competitiveness. Furthermore, the findings suggest that wine prices in the lower price segments are particularly sensitive to signalling of quality attributes. Thus, cooperatives may enhance their competitiveness by emphasizing the quality attributes of their wines to offset any pricing disadvantages.

Keywords: competitiveness of cooperatives, wine cooperatives, hedonic price analysis, Hausman-Taylor estimation, quantile regression.

1. INTRODUCTION

The German wine market has been considered saturated since the 1970s and is under increasing competitive pressure from national and international producers [1,2].

In this market environment, agricultural cooperatives are often assumed to be providers of standard, low or inferior quality products in a direct com-

parison with other forms of enterprises [3]. The majority of the existing literature suggests that wine cooperatives are less competitive when marketing their wines [4–6]. In the case of German winegrowers' cooperatives, it is concluded that they receive lower prices for the wines they produce and have a lower reputation than non-cooperative winegrowers [5,7–9]. The somewhat negative reputation of cooperatives is based on the familiar structural problems leading to obstacles in decision-making processes and inefficiencies in marketing, as well as a disadvantage compared with competitors that have a different kind of organisational form. This is particularly apparent when the cooperatives' aim is to market products of higher quality [10].

However, winegrowers' cooperatives still account for one third of wine production in Germany. In some wine-growing regions, they even dominate in terms of regional acreage [11]. Their relevance for the German wine market can therefore not be neglected. Why then do different strands of the literature come to different conclusions about the competitiveness of wine cooperatives? Are the differences rooted in datasets that picture parts, but not all, of the wine market? Are certain estimation methods producing varying results or should the heterogeneity of wine cooperatives be taken into consideration?

To the best of the authors' knowledge, no previous cross-segment studies have simultaneously examined premium price segments and wines sold in food retail and discount outlets. This study aims to close this gap. It analyses the extent to which company characteristics and product attributes influence wine pricing. Specifically, the study investigates the effects of the organizational form and size of cooperatives, alongside production decisions related to product characteristics such as quality, reputation, vintage, and storage methods. The objective is to determine whether cooperatives market wines of equivalent quality at lower prices, at adjusted prices within lower quality segments, or at relatively high prices. This analysis seeks to provide a comprehensive conclusion regarding the competitiveness of cooperatives compared to wine producers operating under other organizational forms.

To gain clearer insights into the competitiveness of cooperatives compared to wine producers with other organizational forms, as well as the differences among cooperatives that market wines in various price segments of the German wine market, this article analyses two datasets:

First, a panel dataset of German wine guide ratings with 1,320 observations was used to analyse the premium wine segment. To include additional, i.e. lower price segments, the analysis was complemented by a dataset of 18,740 observations in the evaluations undertaken by the German Federal Wine Awards. This data set offers the ability to look into the structural differences of wine cooperatives (regarding size and the price segment in which they are marketing their wine) in a greater detail than previous studies did so far.

The following section provides a brief literature review of the competitive situation within the German wine market, specifically focusing on existing studies that have analysed the market position of wine cooperatives, as well as current model approaches to hedonic price analysis. Subsequently hypotheses are derived. In sections 3 and 4, the uniqueness of the data basis used for the present analysis is elaborated in detail and the underlying models are explained. The results of the estimated price models are then presented and discussed in order to derive recommendations for wine cooperatives out of the key findings of the analysis. The paper ends with conclusions.

2. LITERATURE REVIEW

2.1 Structural developments in the cooperative German wine sector

Geographically, Germany can be divided into 13 traditional wine-growing regions, which have been producing wine for over 200 years. In Germany in 2021, the market share of domestic wines was 45 %, followed by wines from Italy (17 %) and France (11 %) [12]. Primarily due to Germany's high income levels and almost constant wine consumption habits, the country offers an attractive trading platform for the European wine market in which German vintners and winegrowers in all forms of enterprises have to compete in terms of price, quality and marketing [13].

In fact of the high market competition, there has been a reduction in the number of vineyards in the German wine sector. Cooperatives are affected by this change, as can be seen in the decrease in winegrowers' cooperatives. The change in the structure of German wine cooperatives can therefore be described as a concentration to fewer, larger cooperatives with an increased number of members and a larger cultivated area [14]. However, the wine market is affected not only by structural changes among wine producers, but also by consumers focusing increasingly on quality attributes. Since wine is considered to be an experience good and can only be evaluated by consumers after consumption, evaluation platforms can help reduce uncertainty and information asymmetries on the part of consumers and support their purchase decision [15–17]. Therefore,

external ratings are used as a guide to build consumers' individual willingness to pay for a wine [18]. For wine producers, the listing in wine guides or independent organisations, such as the German Agricultural Society (DLG), can have a positive effect on the wine price achieved [8,19]. These rating institutions conduct external evaluations of the quality of the produced wine and the reputation of the wine producer, which is defined as the perception associated with the consistent production of high-quality products. Especially when there is uncertainty about the quality of a wine, reputation constructs can support consumers' decision-making [19]. Therefore, for wine producers the promotion of their wines' quality and reputation can lead to the development of consumers' preferences for these certain wine or winery that may evolve to consumer loyalty in the future [20].

However, a strand of literature suggests that wine cooperatives in Germany lack of success in using these wine guides: The arguments of Frick [4], Dilger [5] and Schäufele et al. [7] reveal that cooperatives would not invest in quality-oriented production efforts, might fail to serve consumers' preferences and would rather follow low-quality mass production strategies. As a result, they conclude that wine cooperatives achieve lower wine prices compared to non-cooperative wine producers.

Nonetheless, as it is well known that a cooperative's business performance is highly dependent on structural characteristics [21] and their market orientation [22], it is the logic consequence to incorporate these factors in the analysis of competitiveness.

The findings of Richter and Hanf [11] indicate that winegrowers' cooperatives are increasingly focussing on implementing quality management strategies, which include monitoring their members' production process, thereby aiming to enhance the quality of the wines produced [11]. These findings suggest certain cooperatives possess specific firm characteristics that allow them to overcome deficiencies and do not align with groups identified as less competitive. Studies by Schamel [23], Couderc and Marchini [22] and Valette et al. [24] provide supporting evidence from examples in France and Italy, demonstrating that winegrowers' cooperatives can operate competitively and secure price advantages in particular regions.

Schamel [23] compared the price premiums that cooperative and non-cooperative achieve for quality and reputation premiums. In the Alto Adige region of Italy, where 70% of wine production is marketed by cooperatives, it was found that cooperatives listed in a wine guide can achieve reputation and quality premiums. This suggests that in regions where cooperatives are prevalent, consumers are willing to pay more for high-quality wines from these organizations and associate them with the production of appealing wines.

Couderc and Marchini [22] examine structural patterns in wine cooperatives that lead to varying economic performances, finding that success of wine cooperatives is highly dependent on the development of marketing strategies that are both market- and demand-oriented.

Valette et al. [24] argued that wine cooperatives in France have a higher survival rate, defined as the ability to operate market-oriented, compared to non-cooperatives. Their findings indicate that cooperatives that leverage economies of scale, possess greater market power, and adapt to temporary market changes are better equipped to handle market instabilities than other business models. While Valette et al. employed a different approach in comparing the competitiveness of cooperatives versus non-cooperatives, their results suggest that cooperatives that exploit their strategic and structural advantages can successfully thrive in the market. However, this positive effect was not observed for German wine cooperatives [6]. Given the similarities between the market environments faced by cooperatives in Italy, France, and Germany [22], it appears likely that the findings of Schamel [23], Couderc and Marchini [22] and Valette et al. [24] could be applicable to cooperatives in Germany.

However, limited consideration has been given to the heterogeneity of German wine cooperatives with regard to their competitiveness, even though the structural difference between winegrowers' cooperatives determines the optimal design of the marketing strategy a cooperative should follow [11].

Small cooperatives are expected to involve their members more in decision-making processes as they are more dependent on individual members, thus individual preferences are given more weight than in larger cooperatives where the inclusion of each individual member would lead to a delay in decision-making processes [25]. It can also be assumed that larger winegrowers' cooperatives have more comprehensive member and quality management in order to prevent potential issues of free-riding and moral hazard. Therefore, cooperatives of varying sizes can be differentiated from each other and from other forms of enterprises by their internal structure and production-oriented motives [21,26].

What can be concluded from this review of existing literature is that the results vary with the applied method, the motivation and the depth of comparison. The higher the focus on structural differences between cooperatives the higher the differentiation of conclusions drawn regarding the competitiveness of the cooperatives.

2.2 State of the art in hedonic price analyses of wine

Against the backdrop of the price of a consumer good being determined by the sum of the implicit prices for its individual product characteristics or attributes, hedonic price analyses offer a suitable method for investigating the determinants of price formation in the wine market [23,27]. Following the hedonic pricing framework which says that the value of a good is defined by the sum of its product characteristics, i.e. attributes [28], cooperative competitiveness is rather understood as the ability of cooperatives to address consumers' preferences for certain product attributes and the consequent ability to attract consumers with higher willingness to pay better than their market competitors. As a consequence, a cooperative would be disadvantageous to other forms of enterprises if they are not able to offer wines with product characteristics that increase consumers' willingness to pay for a wine. Even though cooperatives may position themselves in low-price segments they could according to this logic still be competitive as long as they would be able to address consumers' desire for product attributes in those price segments. A number of articles therefore analyse the influence of product characteristics on the price of wine using hedonic price models emphasising that quality and reputation ratings play a key role in price determination [7,10,16,19]. For example, Lecocq and Visser [29] show that classification by a rating system, such as tasting and listing in a wine guide, has a positive influence on the wine price achieved. Costanigro and McClusky [27] examined the effect of quality attributes in different price segments and show that quality affects price mainly in the high-price segment. Therefore, wine guides' quality ratings can be seen as a proxy for quality. Schamel and Ros [16] provide a detailed overview of other hedonic price analyses and show that, in addition to the ratings of wine guides, other objective characteristics influence the price of wine.

The hedonic pricing framework applies to different price segments: Costanigro and McCluskey [27] show that pricing in the wine market is determined by segment-specific characteristics and that segmentation should be taken into account in applied pricing models [16] (for a detailed discussion of the theoretical assumptions about the factors influencing German wines, see Schäufele et al. [7]). Therefore, specific product characteristics may be addressed to match consumer preferences in each of the respective segments differently.

Articles that have studied the wine market with hedonic price analyses primarily use the Ordinary Least Squares (OLS) estimation method [6,7]. However, given that evaluations of quality and reputation have a subjective character, it was assumed that they correlate with both known and unknown product attributes, potentially leading to endogeneity problems that result in biased estimators when using a conventional least squares estimation.

2.3 Research hypotheses

This article aims to build on former analysis of the German wine market with a special focus on the pricing competitiveness of cooperatives to close the gap of a sufficient consideration of structural differences of cooperatives (including a range in area under cultivation from 100 ha to over 1000 ha), and the pricing segments the cooperatives position their wines (ranging from € 1.8 to € 69.5). To do so the following hypotheses were investigated:

H1: The German wine market is characterised by different price segments. Therefore, different product attributes can be identified as price determinants in these segments.
H2: The effect of the organisational form of "cooperative" on wine price differs in different price segments.
H3: The quality rating of a wine and the reputation rating of a wine producer or cooperative have a significant positive influence on the wine price in all segments.
H4: The size of a cooperative influences its marketing strategy, therefore the quality it produces and the market segment where it is positioned and thus the wine price achieved.

Methodologically, the Hausman-Taylor panel estimator (H-T) was used where applicable to overcome endogeneity bias. To take into account the heterogeneity between cooperatives and different price segments of the wine market, various wine evaluation formats were considered and quantile regressions were used.

3. DATA

Quality ratings of wines may differ across wine guides, particularly where evaluations are not based on blind tasting procedures [15,30]. As we aim to compensate for potential biases that occur in the wine guide ratings only wines are included to the sample that were rated in the following two wine guides [31,32]: The *Gault&Millau* wine guide, and the *Eichelmann*. The wines in the *Gault&Millau* wine guide are tasted both blindly and openly to assess the quality development of the wineries over time [33]. In the *Eichelmann* a comparable number of wines and wineries are evaluated using the international 100-point system for quality classification. Furthermore, 1-5 stars are awarded for the com-

pany's reputation. In contrast to *Gault&Millau*, however, tastings are repeated and are exclusively blind [34]. Even though the probability of biased ratings cannot be ruled out completely, the use of two wine guide ratings enables a visibility of potentially differing effects of the two wine guides on the wine price. Only wines that meet the wine guide's basic quality standards and are recommended for purchase are listed in these guides.

Tasting and listing of wines in a wine guide requires their active promotion by winemakers. With regard to this self-selection, the selection of wines tasted can only be regarded as random to a limited extent. However, the wines and vineyards in the sample in this analysis were randomly selected from all the wines listed in the wine guides.

The prices of a wine however are identical in these two guides. Each wine enters the dataset therefore with one price observation. 75.76 % of the wines included in the sample enter the dataset with two quality ratings, from *Gault&Millau* and *Eichelmann*, respectively, whereas the other 24.44 % have only one quality rating. Further explanatory variables used to estimate the effect on the achieved market price for wine are listed in Table A1.

In order to represent each growing region of Germany equal, the random draw of vineyards has been equally distributed over the growing regions. Two red and two white wines were selected for each winegrower or cooperative included: one from the upper price range and one from the lower price range. Figure A3 graphically explains the structure of data generation. The ratings of the wineries in the sample were observed over a period of five years.

As a wine guide's evaluation usually focuses on wines in the upper price segments (see Table A1, sample mean of the wine price per bottle between € 14.5 and € 16.8) and in the segment of wines sold in supermarkets the average price for a bottle of German wine is € 3.63 [35], it is unclear whether solely considering the quality ratings of wine guides provides representative results from which to draw conclusions for the entire wine market. The simultaneous consideration of several wine guides and the use of different evaluation platforms would help to reduce potential distortions.

The sample from the Federal Wine Awards (FWA) [36], an alternative evaluation format for the quality assessment of German wines, was used as a data basis for the second part of the analysis. The annual competition gives awards to 2500-3000 wines that have previously participated and passed an official quality test at federal state level. The highest award on this rating platform is the *Gold Extra* award, followed by *Gold*, *Silver* and *Bronze* awards. The FWA is considered a highly valuable rating for wine [37]. As it acts independently and not on behalf of a private company, tasting proceeded as a critical blind tasting [37] and assessments are carried out by various independent testing experts. For these reasons, we evaluate this rating platform as rather objective and independent. In addition to the wine price, other wine characteristics are also provided within this evaluation format (see Table A2) (for a detailed explanation on the structure of the FWA, see Schamel [37]). To identify whether a wine was produced by a cooperative or by another form of enterprise, the size of the enterprise was used in this dataset as a proxy. The assumption made by the publisher of the data is that enterprises cultivating an area of more than 100 ha are run as cooperatives[1]. One strength of the FWA dataset is the classification of the winegrowers' cooperatives by their size (for gradations of the categorial variable "coopsize", see Table A2). This allows a further systematisation of different types of cooperatives. It should be noted that there is no information about membership numbers in the winegrowers' cooperatives; an indicator of size only comes from the area under cultivation in hectares. However, Fanasch and Frick [38], for example, point to a positive correlation between the number of members and the area under cultivation.

4. METHODS

The hedonic price analysis applied here is based on Rosen's assumption that the value of a good is measured by the sum of its product characteristics, and thus both supply and demand of a product's attributes co-determine the respective market price [28]. The price p of a wine i is thus dependent on a vector z of n product attributes $z = (z_1, z_2, z_3, ..., z_n)$ where z_n measures the amount of the characteristics included in the product [28]. The market prices of the products under consideration depend on the respective product attributes, and can be represented by a hedonic price function $p_i(z_1, ..., z_n)$ [27].

Following Rosen's assumption [28, p. 83], from the consumer's point of view, the benefit (or utility gain) from purchasing a certain wine is determined by the combination of product attributes such as vintage, colour or storage type. We capture these product attributes through various categorical variables that are presented in Table A1 (column "Vector symbol").

[1] It has to be noted that this assumption excludes small wine cooperatives that cultivate less than 100 ha. While the structure of the data and the information gathered through personal contacts to the data source provided valuable insights, they currently limit our ability to characterize the group of cooperatives in greater detail.

The wine ratings of the two wine guides in question are available as panel data over time. It is therefore possible to account not only for wine attributes that drive consumers' willingness to pay but also to control for potential variations in the effect of quality attributes, i.e. the quality and reputation rating, on the wine price over time.

In our study, especially the time-invariant variable that indicates the form of enterprise (i.e. cooperative or not) is of major importance to test our core hypotheses.

We therefore turn to the estimation approach proposed by Hausman and Taylor [39]. Their Hausman-Taylor (H-T) panel data estimator allows for time-invariant regressors (e.g. in our case the form of enterprise) while addressing $Cov(\mu_i, X_{it}) \neq 0$ due to various forms of endogeneity of certain regressors through external and internally generated instruments.

In order to implement this approach, the variables were subdivided on the basis of their time (in)variance and their (non-)correlation with the individual effect. According to Hausman and Taylor [39] the model takes the following form:

$$y_{it} = X'_{1it}\beta_1 + X'_{2it}\beta_2 + Z'_{1i}\gamma_1 + Z'_{2i}\gamma_2 + \mu_i + \nu_{it}; \quad i = 1, \ldots, N;\ t = 1, \ldots, T \tag{1}$$

where X'_{it} defines a vector of time-varying variables and Z'_i defines a vector of time-invariant variables. The error terms $\mu_i IID(0,\sigma^2_\mu)$ and $\nu_{it} IID(0,\sigma^2_\mu)$ are considered to be independent of each other. The dependent variable of the wine price in € was expressed in a logarithmic form, as comparable hedonic price analyses of the wine market report that this functional form is preferable [7,10,31].

The applied H-T model allows for the partial correlation of the X_{it} and Z_i variables with the individual effect μ_i [40]. X_{it} and Z_i are divided into X_1 and Z_1, as exogenous parts of the vector of explanatory variables, and they are assumed to be non-correlated with the error term. In contrast, X_2 and Z_2, are variables that are correlated with the error term [41]. The assignment of the regressors to the four variable categories (X_{1it}, X_{2it}, Z_{1i}, Z_{2i}) can be found in Table A1. This assignment has been performed based on the following criteria: First, the variables have been assigned to the X or Z vector based on their time-(in)variance. Second, the variables that have been suspected to be endogenous are assigned to the X_2 or Z_2 vector. The quality and reputation ratings of the wine guides as well as the organisational form and the size of the cooperative expressed in terms of members are supposed to be potentially endogenous and therefore need to be instrumented. For a detailed overview of instrument generation, see Baltagi [42, p. 170 ff.]. Hausman [39] suggest using the instruments $A_{HT} = [QX_1, QX_2, PX_1, PZ_1]$, with P and Q as orthogonal projection letters that transform a vector of observations into a vector of group means (P) and a vector of deviations from group means (Q) and multiplying them by the transformed covariance matrix of the error term.

Based on the Durbin-Wu-Hausman test, a fixed-effects (FE) model was compared against the H-T model. The test result with $\chi^2 = 12.16$ and a p-value of 0.79 fails to reject the null hypothesis that both models are consistent. According to Baltagi et al. [43], this underlines the appropriateness of a H-T model in comparison to the FE model. The chosen instruments therefore appear to be valid while some but not all variables turn out to be correlated with the individual effects [42, p. 175,43].

The empirical application was carried out using the *plm*-package for a Hausman-Taylor estimation with Baltagi's [44] instrumentation method in R [45].

However, the second dataset in the sample from the Federal Wine Awards (FWA) had no time series character. It consisted of independent observations made over several years. Therefore, the analysis of the valuations of the FWA initially used the approach of a pooled OLS estimation. This dataset includes additional characteristics of both wines and cooperatives, and may this way be complementary to the characteristics results of the panel model. In order to consider possible differences between price segments, the quantile regression approach was used. Here, a conditional quantile function $Q_\tau(Y|X)$ was estimated for the respective quantiles $\tau = 0.25, 0.5, 0.75, 0.9$ [46]:

$$Q_\tau(y_i) = \alpha_0 + \beta_W(\tau)X_{iW} + \beta_Q(\tau)X_{iQ} + \beta_R(\tau)X_{iR} + \beta_F(\tau)X_{iF} + \beta_A(\tau)X_{iA} + \varepsilon_i \tag{2}$$

The subscripts W, Q, R, F and A, as presented in Table A2, denote the vectors of attributes that potentially influence the wine price. Possible price segments were assigned to the wine prices of the dataset by dividing them into q quantiles, which were examined for differences in the influence and effect strength of product attributes. Model goodness-of-fit for the quantile regression models were assessed and compared using the Pseudo-R^2 according to Koenker and Machado [47].

5. RESULTS

5.1 Descriptive statistics of the samples

In Tables A1 and A2 (column "wine price per bottle"), the indicated share of wines in the defined low and high-price segments revealed the difference between the FWA and the wine guide dataset described above.

Regarding the sample mean, the wine guides focus on the price segment above € 10.00 per bottle, while the majority of the wines evaluated by the FWA belong to the lower price segment at a price below € 10.00 per bottle. The price distribution of the two samples showed that the observed winegrowers' cooperatives sell their wines at a price that is around € 1.00-2.00 below that achieved by other forms of enterprise (Tables A1 and A2) and that non-cooperative companies offer more wines at higher prices, as shown by the upper outliers of the boxplots in Figures 1 and 2.

Furthermore, Figure 2 and Table A2 show that the price distribution of the FWA data differs from the wine guide data. As mentioned above, the average prices of the sample were concentrated around a lower price mean. The mean price for the cooperative enterprises is € 8.32, whereas for other forms of organisation it is nearly € 1.00 higher (€ 9.11). In comparison with the sample mean of the wine guides, a smaller difference between cooperatives and non-cooperatives was observed. It also showed that there are visible deviations in price segments above the 3rd quartile (price >= € 9.80). From 2016 onwards in particular, and especially in the case of wines from non-cooperatives, the prices are more dispersed. The distribution of the data may lead to a distortion of the results when the highest price of an evaluated wine in the sample is € 89.00, while the sample mean is concentrated around € 8.00-9.00. Figure 2 shows a comparison of the price distribution of the full sample (A, left) and the limited consideration of the 90 % quantile (maximum price = € 14.90) (B, right). This sample distribution underlines the appropriateness of the quantile regression approach to compare differences between price segments, comparable to the analysis of Rebelo et al. [48]. However, considering the average wine price charged in the food retail trade was € 3.63 per litre in 2024 [35], it can be concluded that the FWA sample provides adequate representation of the food retail segment, thereby supplementing the high-price segment encompassed by the wine guide sample.

A comparison of the average quality rating achieved by form of enterprise revealed that cooperative wines receive lower ratings on average, although this effect was less pronounced in the rating by the *Gault&Millau* wine

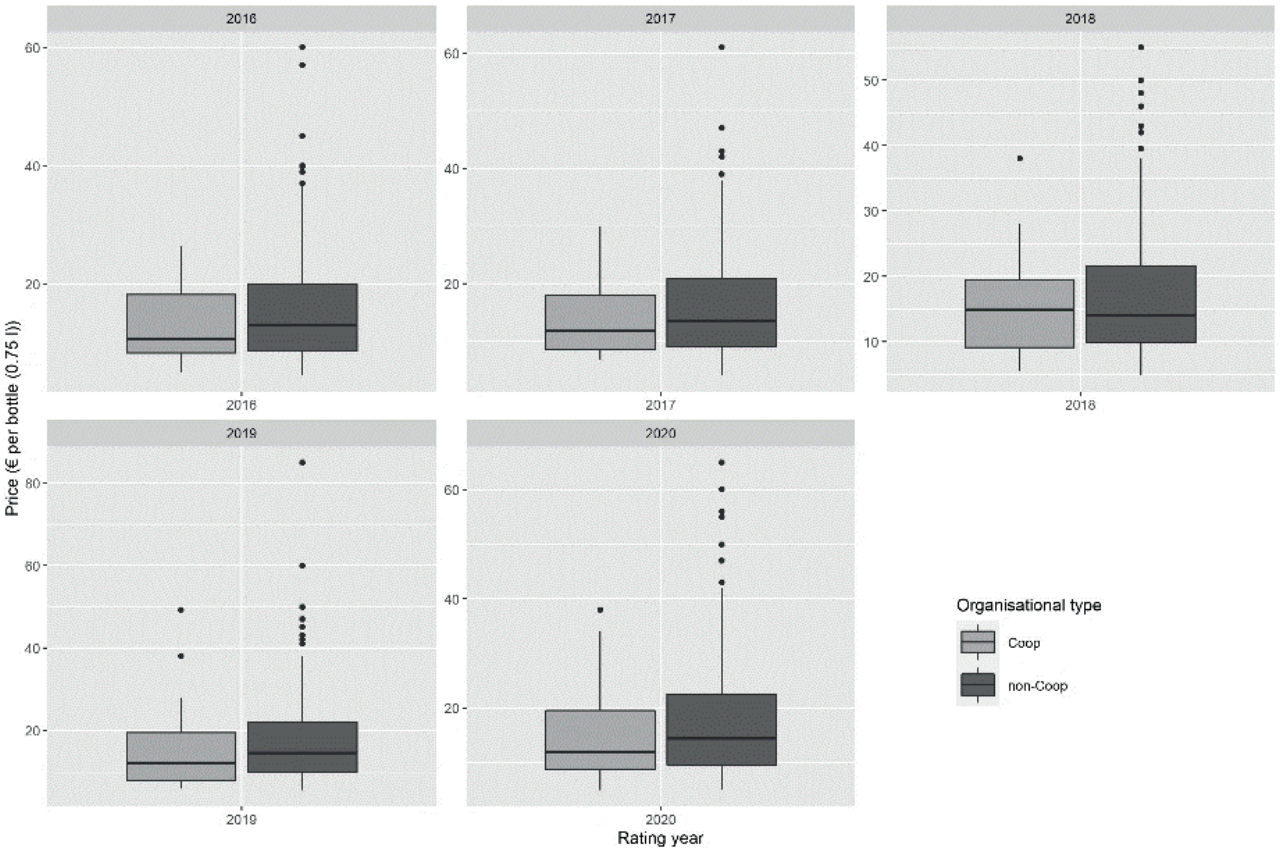


Figure 1. Price distribution of cooperative and non-cooperative wines listed in the wine guides.

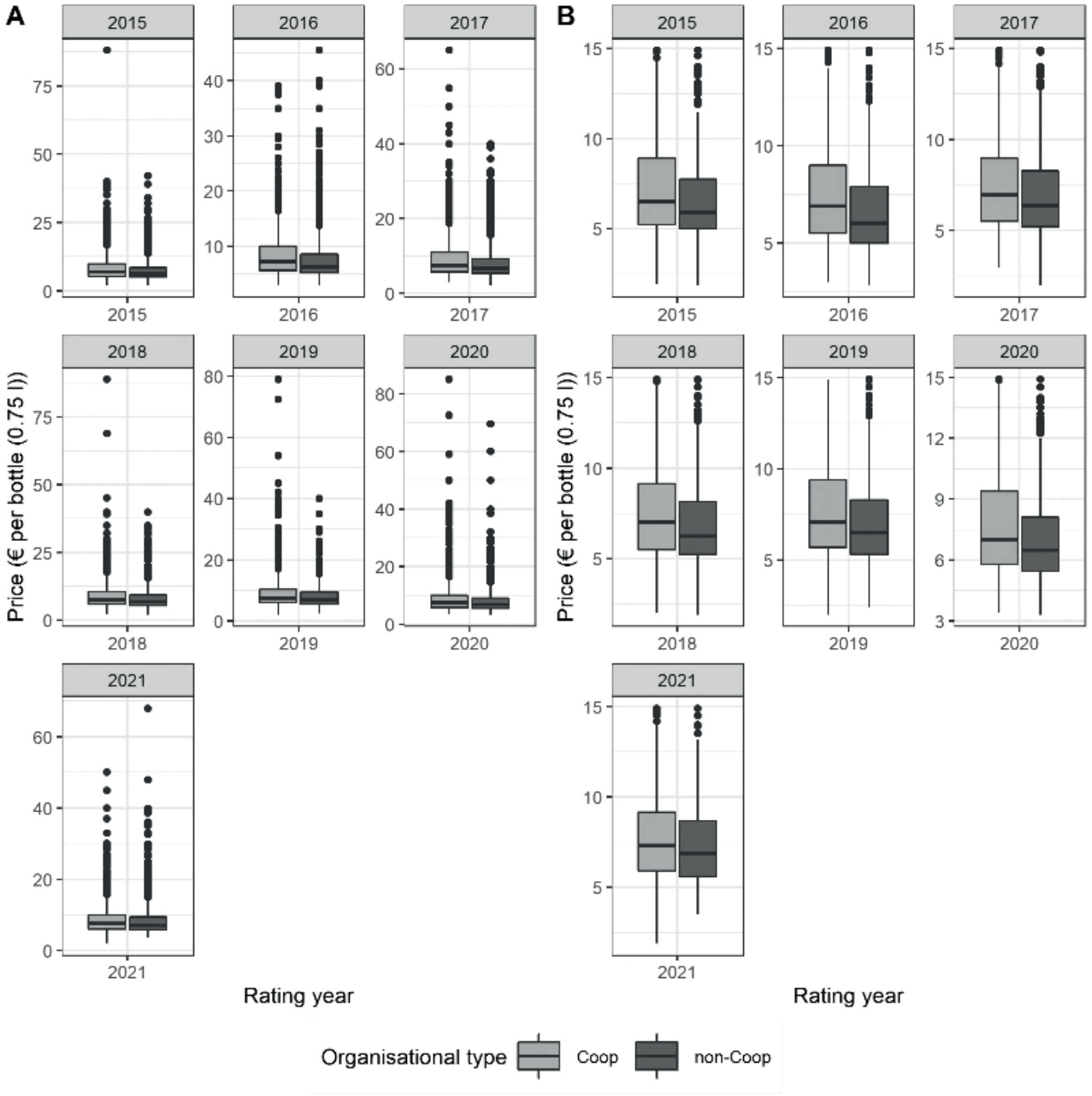


Figure 2. Price distribution of cooperative and non-cooperative wines graded by the FWA across years. Comparison of full sample (A) and 90 % quantile (B).

guide (1.0-point difference in the mean rating) than in the rating by *Eichelmann* (2.7 points difference in the mean rating). This trend was confirmed in the evaluation of the long-term performance of winegrowers' cooperatives as they have a lower reputation than their competitors with other business forms (see Table A1). It can be assumed that consumers are deterred from buying cooperative wines primarily by lower reputation ratings, as these reflect the image of the respective company.

Comparing the share of cooperatives that achieve an award at the FWA, it appears that the difference from other enterprises in this sample was only limited (differences < 1.00%). From a descriptive perspective, the quality differences therefore seemed to vary between the observed price segments and evaluation platforms (see Table A2).

The results of the wine guide panel models are presented below, followed by a discussion and comparison of FWA models with the wine guide models.

5.2 Panel models

With regard to its tested appropriateness (see section 4) an H-T model was estimated that corrected for potential endogeneity and included time-invariant variables at the same time. A Random Effects (RE) model was presented with the results to check for the robustness of the model.

Different wine guides evaluate a wine's quality differently. This fact needs to be taken into account when estimating the effect of quality evaluations on the wine price [15,30]. However, when two evaluations of the same wine from two different wine guides are included, the regression model may exhibit correlations in the error term. A Spearman's rank correlation test shows a moderately strong correlation between the two wine guide rating variables, i.e. QGM and QE (Spearman's rank correlation rho = 0.65). Therefore, in order to check the robustness of the model, two alternative models have been estimated, one for each of the wine guide ratings. Estimation results from these models did not differ substantially.

Table 1 presents a comparison of the model results. A linear hypothesis testing for joint significance of the dummy variables of the cultivation area rejects the null hypothesis that the effect of the cultivation area is zero (Table 1, p-values = 0.00). Therefore, price differences between the cultivation areas of wine are statistically significant. The results revealed that statistically significant effects on the achieved wine price come from long-term storage of the wines, storage in barrique barrels, and high quality ratings (Table 1). Examining the results of the H-T model in detail revealed that the quality rating of a wine guide has a statistically significant positive influence on the achieved wine price. This demonstrates that, according to the hedonic pricing framework, the quality rating of a wine guide affects the consumers' valuation and therefore the pricing of a wine. An increase in the quality rating of Gault&Millau by one point results in a 2.34 % price increase, or a 4.97 % price increase for a rating in the *Eichelmann* wine guide. The reputation rating of the wine guides in the year of tasting has no influence on price. However, a positive reputation rating in the *Gault&Millau* wine guide in the previous year (variable "lag(RGM)") has a positive influence on the wine price in the year of tasting. This shows that consumers are to a certain extent oriented towards the long-term performance rating of targeted vineyards and wine cooperatives. Thus, for this sample, H3 could not be rejected for the quality rating, but it could be rejected for the reputation rating. Other product attributes that define wine quality have a positive influence on the price of wine. Wine ageing in barrique barrels lead to price increases of 6.08 %. Long-term storage also has a positive influence on wine price, as revealed by the significant effects of the vintage variables (Table 1; storage dummy variables). A three-year storage period has the greatest effect, leading to a price increase of 15.00 % in the H-T model. An influence of the form of organisation could not be confirmed in this model. The wide dispersion of the confidence interval for the cooperative enterprise variable [-0.69 - +0.88] for the H-T model (see Table 1, column "Cooperative") confirmed the assumption that the distribution of achieved wine prices within the group of winegrowers' cooperatives is so large that no statistically significant influence can be identified. It was concluded that wine producers listed in German wine guides are similar in terms of the price and quality strategies they pursue, despite their different forms of enterprises, and are comparable in terms of their competitiveness and positioning in the market.

Nevertheless, the interaction term of a positive quality rating and the positioning of a wine in the high-price segment is statistically significant for the ratings of the *Gault&Millau* wine guide. This implies that a positive rating in the high-price segment (price > € 25.00) has a 1 % higher price effect than the equivalent quality rating for a wine sold at lower prices (price <= € 10.00) (Table 1, row "QGM high price segment"). Thus, high-price wines in particular benefit from having a quality evaluation in the *Gault&Millau* wine guide. It can be concluded that consumers are more likely to consult the ratings in wine guides when deciding to buy more expensive wines.

The model comparison between the H-T and RE models showed that the alternative estimates provided comparable results. Therefore, it was concluded that both models were robust. It should be noted that the RE model generally had smaller confidence intervals (see Table 1). The following section compares the findings of the analysis of the high-price segment with the price segments included in the FWA evaluation, examining several price quantiles in order to investigate i) if product attributes affect the wine price in the considered price segments differently and ii) how cooperative wines are positioned in the price segments in comparison to wines offered by other forms of enterprises.

5.3 Quantile Regression Models

The price ranges assigned to the estimated quantiles can be taken from the top row of Table 2. An examination of the residuals of the model indicated a predominant

Table 1. Estimation results of the panel regression models based on the wine guide data set.

Variable n_t = 264, t = 1-5, $N_{t=1-5}$ = 1320	Estimates HT Model (std. error)	CI 2.5 %	 97.5 %	Estimates RE Model (std. error)	CI 2.5 %	 97.5 %
Dependent variable = log(wine price in € per bottle)						
(Intercept)	-3.04*** (0.40)	-3.82	-2.25	-3.47*** (0.36)	-4.17	-2.77
Quality rating Gault&Millau (QGM)	0.02*** (0.00)	0.01	0.03	0.02*** (0.00)	0.01	0.03
Quality rating Eichelmann (QE)	0.05*** (0.00)	0.04	0.06	0.05*** (0.00)	0.04	0.06
Reputation rating Gault&Millau (RGM)	0.01 (0.01)	-0.02	0.03	0.00 (0.01)	-0.02	0.02
Reputation rating Eichelmann (RE)	0.01 (0.02)	-0.02	0.05	0.01 (0.01)	-0.02	0.03
Cooperative	0.09 (0.40)	-0.69	0.88	0.13 (0.08)	-0.04	0.29
Size of growing region (ha)	0.00 (0.00)	0.00	0.00	0.00. (0.00)	0.00	0.00
Organic wine	-0.01 (0.02)	-0.05	0.03	0.00 (0.02)	-0.04	0.04
Number of coop members	0.00. (0.00)	0.00	0.00	0.00 (0.00)	0.00	0.00
Vintage 2 years before rating	0.12*** (0.02)	0.08	0.16	0.12*** (0.02)	0.08	0.16
Vintage 3 years before rating	0.15*** (0.03)	0.09	0.20	0.16*** (0.03)	0.10	0.21
Vintage 4 years before rating	0.14** (0.05)	0.06	0.20	0.14** (0.04)	0.05	0.22
Barrique barrel	0.05** (0.02)	0.02	0.23	0.05** (0.02)	0.02	0.09
Red wine	0.01 (0.03)	-0.04	0.06	0.02 (0.02)	-0.03	0.06
Wooden barrel	0.03. (0.02)	0.00	0.06	0.03 (0.02)	-0.01	0.06
lag(RGM)	0.03** (0.01)	0.01	0.05	0.03** (0.01)	0.01	0.05
lag(RE)	-0.02 (0.01)	-0.04	0.01	-0.01 (0.01)	-0.04	0.01
QGM high price segment	0.01* (0.01)	0.00	0.02	0.01* (0.01)	0.00	0.02
QGM low price segment	0.00 (0.01)	-0.01	0.01	0.00 (0.01)	-0.01	0.01
QE low price segment	-0.01 (0.01)	-0.02	0.00	-0.01 (0.01)	-0.02	0.00
QE high price segment	0.0 (0.01)	-0.01	0.01	0.00 (0.01)	-0.01	0.01
Growing regions	Linear hypothesis testing suggests joint significance (p = 0.00)			Linear hypothesis testing suggests joint significance (p = 0.00)		
Adjusted R^2:	0.821			0.868		

heteroscedasticity (Breusch-Pagan test's p-value < 0.05). Therefore, robust standard errors according to White [49] were used to estimate the OLS model. Testing for multicollinearity of the explanatory variables using the variation inflation factor (VIF) showed a tolerable level of correlation with values < 10 for all of the variables included. Comparing the pseudo R^2 as a local measure for goodness of fit of the particular quantile regression models shows that the models are able to represent the particular price quantiles with a relatively high explanatory power [47].

However, potential endogeneity of some regressors cannot be ruled out completely. With regard to potential endogeneity of the *quality evaluation* and the *cooperative* variable an instrumental variable (IV) quantile regression model as suggested by Chernozhukov and Hansen [50] was estimated. However, a Kolmogorov-Smirnov post estimation test value turned out to be 1.012, which was less than the critical value of 2.722 (under 95% confidence interval). This finding failed to reject the hypothesis of exogeneity of the variables and we therefore present the quantile regression results without IV in Table 2.

Even though various independent product attributes are included in the analysis, information regarding the objective characteristics, i.e. the design of the bottle that potentially influences the hedonic price, could not be taken into consideration in the analysis. Therefore, the results need to be considered with caution with regard to potential occurring omitted variable bias.

In line with the results from the wine guide data described above, all the models showed that the ageing of wine in barriques or wooden barrels has a positive influence on the wine price. The effect amounts to a price increase of 42.2 % for a wine aged in wooden barrels in the price range of the 75th quantile (see Table 2). Barrique barrel ageing leads to price increases of 60-71 % compared with wine stored in steel tanks. In contrast to the wine guide dataset, the red wines in this sample achieve a price advantage compared with the reference category of rosé wines. White wines can also benefit from a relative price premium, where the effects vary with respect to the considered quantile. This showed that the price segment influences the effect of price-

Table 2. Estimation results of the quantile regression models based on the FWA data.

Variable	OLS N = 18740 (robust std. error)	25th-quantile N = 5037 (robust std. error) P ≤ 5.50 €	50th-quantile N = 9685 (robust std. error) P ≤ 7.00 €	75th-quantile N = 14131 (robust std. error) P ≤ 9.80 €	90th-quantile N = 16868 (robust std. error) P ≤ 14.90 €
Dependent variable: log(wine price in € per bottle)					
Wooden barrel	0.314*** (0.015)	0.305*** (0.020)	0.333*** (0.011)	0.362*** (0.022)	0.422*** (0.033)
Barrique barrel	0.612*** (0.017)	0.637*** (0.014)	0.719*** (0.019)	0.688*** (0.011)	0.602*** (0.032)
White wine	0.132*** (0.008)	0.065*** (0.004)	0.086*** (0.007)	0.128*** (0.008)	0.186*** (0.009)
Red wine	0.089*** (0.011)	0.045*** (0.006)	0.029*** (0.010)	0.060*** (0.010)	0.127*** (0.012)
Vintage 2 years before tasting	0.168*** (0.012)	0.081*** (0.006)	0.140*** (0.011)	0.208*** (0.014)	0.266*** (0.019)
Vintage 3 years before tasting	0.293*** (0.026)	0.213*** (0.031)	0.267*** (0.019)	0.321*** (0.030)	0.483*** (0.061)
Vintage 4 years before tasting	0.542*** (0.083)	0.173** (0.080)	0.445** (0.181)	0.866*** (0.088)	0.946*** (0.060)
Gold Extra Award	0.197*** (0.024)	0.168*** (0.010)	0.161*** (0.027)	0.209*** (0.014)	0.201*** (0.033)
Gold Award	0.061*** (0.009)	0.037*** (0.008)	0.041*** (0.009)	0.052*** (0.009)	0.055*** (0.011)
Silver Award	0.032*** (0.006)	0.018*** (0.003)	0.026*** (0.005)	0.032*** (0.006)	0.035*** (0.009)
Tasting year 2016	0.028*** (0.007)	0.028*** (0.005)	0.022*** (0.006)	0.020** (0.008)	0.034*** (0.012)
Tasting year 2017	0.059*** (0.007)	0.053*** (0.004)	0.040*** (0.007)	0.043*** (0.008)	0.063*** (0.012)
Tasting year 2018	0.036*** (0.007)	0.042*** (0.004)	0.034*** (0.007)	0.023*** (0.008)	0.044*** (0.014)
Tasting year 2019	0.061*** (0.008)	0.056*** (0.005)	0.059*** (0.007)	0.050*** (0.008)	0.068*** (0.010)
Size coop 100 - 199 ha	-0.152*** (0.008)	-0.076*** (0.005)	-0.136*** (0.007)	-0.197*** (0.008)	-0.192*** (0.013)
Size coop 200 - 499 ha	-0.105*** (0.008)	-0.031*** (0.006)	-0.098*** (0.008)	-0.158*** (0.010)	-0.146*** (0.011)
Size coop 500 - 999 ha	-0.211*** (0.014)	-0.136*** (0.008)	-0.211*** (0.015)	-0.242*** (0.015)	-0.263*** (0.018)
Size coop 1000 ha	-0.336*** (0.012)	-0.221*** (0.006)	-0.340*** (0.008)	-0.384*** (0.014)	-0.379*** (0.017)
Coop. size*Gold Award	0.007 (0.008)	-0.010*** (0.003)	0.012* (0.007)	0.007 (0.007)	0.012 (0.011)
Coop. size*barrique barrel	0.012 (0.009)	-0.021*** (0.007)	-0.003 (0.015)	0.011 (0.008)	0.009 (0.013)
Coop. size*wooden barrel	-0.007 (0.010)	-0.032*** (0.010)	-0.006 (0.010)	-0.004 (0.012)	-0.036 (0.031)
Coop. size*red wine	-0.006 (0.005)	0.011*** (0.002)	0.007 (0.004)	-0.007 (0.004)	-0.017*** (0.006)
Coop*Gold Award	0.008 (0.019)	0.032*** (0.011)	-0.010 (0.018)	0.019 (0.023)	-0.010 (0.026)
Intercept	1.557*** (0.015)	1.406*** (0.014)	1.566*** (0.014)	1.720*** (0.011)	1.827*** (0.026)
Growing region	Linear hypothesis testing suggests joint significance (p=0.00)				
Adjusted (Pseudo) R^2	0.642	0.5538	0.5868	0.5868	0.6026

. $P \leq 0.1$, *$P \leq 0.05$, **$P \leq 0.01$, ***$P = 0$.

determining product attributes. The greatest effects are achieved in the 90 % quantile (18.6 % price increase for white wine and 12.7 % for red wine). The longer a wine is stored, the higher the price achieved. Especially in the price range up to € 14.90 per sold bottle of wine, a considerable price increase was found (see Table 2, column 5). For wines that are stored for four years, this results in a 94.6 % price premium compared with wines that are marketed without storage. Wine storage therefore plays a central role in the profitable marketing of wine.

As with the wine guide ratings, a positive quality rating also has a price-increasing effect for wines in the FWA sample. The higher the award, the greater the effect. A *Gold Extra* award increases the wine price by 16.1-20.9 % compared with the reference category of the lowest (*Bronze*) award, depending on the price segment. Compared with the *Bronze* award, the silver medal award only has an increasing price effect of 1.6-3.5 %, whereas the *Gold* award leads to an increase in the wine price of 3.7-6.1 %. As the quality rating has a positive effect in all price segments, H3 was not rejected for the models of the FWA.

A test for the joint significance of the regional dummies demonstrates that overall the cultivation area has a statistically significant effect on the wine price, in line with the H-T model results. The results of the estimated models showed that, compared with the Pfalz reference category, higher wine prices are achieved in all growing regions except for the Rheinhessen growing region. This also supported the hypotheses and results of Schäufele et al. [7], who also examined data from the FWA. Regional effects will therefore not be discussed further here. In

the article by Schäufele et al. [7], however, organisational form was not the central focus of the investigations. The findings in relation to organisational effects will therefore be discussed in more detail below.

The quantile regression models revealed that winegrowers' cooperatives achieve statistically significantly lower prices for the wines evaluated at the FWA than comparable wines produced by vintners of other organisational forms. However, there are differences in the extent of the price reduction, depending on the size of the cooperative. Furthermore, the price differences vary across price segments. Thus, cooperatively marketed wines in the price segment up to € 9.80 (75th quantile) are affected most by a price reduction (prices 15.8 to 38.4 % lower than in other forms of enterprises). Wines that are marketed at higher or lower prices experience smaller price reductions with respect to the producer's organisational form. Considering the size of the respective winegrowers' cooperatives, it is apparent that the largest wine cooperatives in Germany are exposed to the greatest price reductions (maximum -38.4 % in the price segment up to € 7.00). One possible reason for this is economies of scale, which enable the produced wines to be sold at lower unit prices [7].

Furthermore, it can be assumed that cooperatives with a comparably high sales volume consciously opt for volume sales at lower prices in order not to be exposed to intensive price competition with other winegrowers in higher price segments. In the lowest price segment (wines priced up to € 5.50) cooperatives experience the smallest price discount. In particular, cooperatives that were 200-499 ha in size only experience a price discount of about 3 % compared with other types of enterprises, which seems small given the limited coverage of the present data with respect to sales channels, advertising campaigns, rebates etc. Overall, the smallest price reductions are revealed for cooperatives of this size. Smaller wine cooperatives in turn achieve lower prices. The reason for this may be increased dependence on the satisfaction and preferences of their individual members. Due to the structural inertia in cooperatives' decision-making processes, it is possible that a focus on high-quality wines increasingly demanded by consumers has not yet been integrated into the management of these winegrowers' cooperatives and that the strategy of quantity-oriented production at lower prices is still being pursued.

Looking at the interaction of the effects (Table 2, independent variable A*independent variable B) between individual product characteristics and the organisational form and size of the winegrowers' cooperatives, the positive effect of achieving a *Gold* award is also boosted within the group of cooperatives marketing wines in the price segment up to € 5.50 (972 observations i.e. 19.3 % of N in the 25th quantile) (see Table 2; 25th quantile, column "Coop.*Gold"). Cooperative wines of above-average quality are able to achieve an additional price advantage of 3.2 % compared with other vineyards and winegrowers' cooperatives. If the size of the cooperative is considered, the positive effect is reduced as the size of the winegrowers' cooperatives increases (-1.0 % per increased size category, Table 2 "Coop. size*Gold" in the 25th quantile). Hence, smaller winegrowers' cooperatives with special quality strategies can position themselves competitively, but mostly in the lower price segment. Nevertheless, larger cooperatives that position their wines in the lowest price segment achieve a positive price effect by ageing their wines in wooden or barrique barrels. However, the overall positive effect of the storage type on price is reduced for the cooperative form of enterprise (negative interaction term "Coop. size*barrique barrel").

The statistically significant influence of storage type and duration was confirmed by the second part of the analysis. Nevertheless, the effect size varies between the models, especially for the storage in barrique barrels. Furthermore, the storage in wooden barrels and the type of wine (red or white wine) only affects the price in the FWA sample.

H1 was not rejected for two reasons: On the one hand, the analysis reveals that there are different rating systems for the German wine market which apparently consider different price segments. On the other hand, it becomes clear that the effects of wine attributes on price vary between the two datasets: the wine guide data and the FWA data. We found that overall, the impact of quality signals—such as positive ratings on the respective platform, storage type, and vintage—is more pronounced in the lower price segments, as indicated by the FWA ratings. Therefore, wines in the lower price segments appear more sensitive to quality signals (or the mentioning of certain attributes) when it comes to achieving price premiums.

The different effects for the estimated price quantile regressions show that winegrowers' cooperatives are not disadvantaged *per se*. Even though the results reveal the consumers seem value cooperative wines lower (see Table 2, negative coefficients for all sizes of cooperatives), depending on the structure of the cooperative and the design of the respective product attributes, the results indicated that certain groups of cooperatives are able to compensate structural disadvantages and can take pace with other forms of enterprises if they serve certain product attributes or market segments.

Compared with the results of the models based on wine guide data, the scattering of the effects of the coop-

erative form of enterprise on the observed wine price was explained more profoundly with this sample. As the effect differed between the estimated models of the wine guide and the FWA sample, and also in the different price segments (see Tables 1 and 2, columns "Coop"), H2 was not rejected. The effect of the form of enterprise on competitiveness depends on the price segment in which a cooperative markets their wines.

Nevertheless, with respect to the marketing of red wine in the lower price segment, larger winegrowers' cooperatives achieve a price premium compared to cooperatives of other sizes (positive interaction term "Coop. size*red wine" for the 25th quantile). To sum up these findings, H4 was not rejected as the size mainly determines the price segment in which a cooperative can position its wines successfully.

Even though the effect size of the quality ratings was not directly comparable because the wine guides' ratings are on a wider (100-point) scale than the medal-award system of the FWA, the tendencies are comparable overall and become especially visible for the numerous price segments in the FWA sample. The results presented in this chapter underline the assumed heterogeneity, structural differences and individuality of German winegrowers' cooperatives that pursue different market strategies. The present analysis of the FWA only included cooperatives with 100 ha or more. Smaller cooperatives were not represented in the dataset. Therefore, only tendencies and no absolute statements can be derived with regard to the effects of size of cooperative.

6. DISCUSSION OF IMPLICATIONS

These results confirm that the wine market in Germany is heterogeneous in terms of price segments and product attributes that determine the wine prices in the respective price segments [51].

With regard to the questions stated in the introduction we conclude that the variation of results in the existing literature regarding the competitiveness of cooperatives depends on i) the data used for the comparison of cooperatives and non-cooperatives and ii) the price segment in the scope of the analysis. It is concluded that the cooperative form of enterprise faces challenges in competing against other forms of enterprises on the wine market, but that the competitiveness depends on the size of the cooperative, the price level at which a cooperative sells its wines, the product attributes that characterise the produced wine, and the interaction between these determinants. The way in which structural differences between cooperatives are taken into account determines which conclusions on the competitiveness of cooperatives can be drawn.

Results show that wine guide ratings can be seen as an indicator of quality for consumers and lead to price premiums, in particular in the high-price segment (wine price ≥ € 25.00 per bottle). Cooperatives that are listed in wine guides and sell their wines in this price segment do not appear to be at a disadvantage compared with other forms of enterprises. Cooperatives that market their wines on the broader market and are evaluated by the FWA face tougher challenges competing with other forms of enterprises and achieving c.p. lower prices. The price disadvantage is the highest for large cooperatives ≥ 500 ha. It is likely that the large cooperatives tend to follow quantity rather that quality strategies to offset price disadvantages. However, cooperatives in the broader market can mitigate these price disadvantages, particularly in the segment of ≤ €5.50, if their wines receive a Gold Award from the FWA. Additionally, larger cooperatives in the price segment of ≤ € 7.00 can achieve a price premium and overcome competitive disadvantages if their wines receive a Gold Award. This suggests that, especially in low-price segments, consumers value quality attributes, as evidenced by the potential for achieving price premiums.

Therefore, based on this analysis, the following recommendations are presented for cooperatives in the wine sector:

Cooperatives that are producing wines that meet the requirements for a listing in wine guides can benefit from a high quality-evaluation and therefore may consider to apply for a listing in order to achieve the price premium. They should not feel discouraged by the competition of wine producers of other organisational forms but rather focus on the continuous provision of high-quality wines. To promote their wines, they could benefit from the use of marketing measures that underline the quality of the offered wines and make use of the positive ratings they achieve. This information needs to be promoted to the consumers.

Also, for cooperatives operating in the broader market quality attributes are essential and cannot be overlooked. As consumers' willingness to pay and therefore the wine price is increased by product characteristics such as storage in wooden and barrique barrels, the production of red and white wines, duration of storage and the award of FWA medals, cooperatives in this market segment could benefit from the development of strategies to produce wines that carry the named characteristics and winning awards at the FWA. Strategies to enhance the quality of wine production among cooperative members may include incentives that encourage

a consistent high-quality output. Additionally, effective mechanisms such as ongoing quality control on all farms by cooperative management throughout the growing season can help to reduce free-riding behaviour and may increase the average the quality of grapes delivered to the cooperative. Furthermore, the production and marketing processes could greatly benefit from aligning with the criteria set forth by the wine rating system of the FWAs. By implementing these strategies, it remains feasible to address the structural disadvantages inherent in the cooperative organizational model and to increase the average price of cooperative wines within this segment. Nevertheless, to successfully counteract these disadvantages, it is essential to maintain a market-oriented approach focused on quality attributes and quality signals.

Large cooperatives (≥ 500 ha) seem to face the biggest price disadvantages on the market. Often the way to compensate this disadvantage is to follow a quantity maximising strategy. Quality attributes, then play a minor role. However, with regard to the growing global competition and the fact that certain quality attributes can provide a price premium, choosing instead a diversification strategy might be an option for this group of cooperatives. As revealed by the results, even in the lowest price segments the provision of quality attributes lead to price premiums which are attractive for large cooperatives that mainly focus on serving quantities to the market. Large cooperatives should therefore feel encouraged to develop product lines that emphasize quality attributes, in order to benefit from the existing price advantages associated with quality-wines. From a managerial perspective, this necessitates that the prices paid to cooperative members are differentiated based on the quality of the grapes provided. This approach could incentivize the delivery of high-quality grapes.

In summary, cooperatives in the German wine market need to be sensitive to the demand for a wine's product attributes and overall quality preferences among consumers and in the marketplace. In line with the findings of Troiano et al. [3], the results show that the adoption of marketing strategies that relay relevant product characteristics and the listing of high-price and high-quality wines in well-known wine guides provide an opportunity to overcome potential disadvantages of the form of enterprise and strengthen their market position. Diversification towards producing high-price and high-quality wines and strategic positioning in the retail market therefore seem promising strategies and potential business models for competitive winegrowers' cooperatives.

7. CONCLUSIONS

This investigation into the competitiveness of German winegrowers' cooperatives shows that the business form of *cooperatives* cannot be seen *per se* as a disadvantage compared with other business forms when comparing the wine prices achieved for a given wine quality. Instead, the results show that cooperatives operate in different price segments depending on their structure and therefore pursue differentiated business strategies. Furthermore, it can be deduced that the c.p. wine price achieved depends on the cooperative's size, its positioning in the price segments of the wine market and its quality strategy. For future research in the field of the competitiveness of cooperatives, it would therefore be relevant to explore possible managerial and strategic success parameters as well as the market positioning strategies of cooperatives and to evaluate and compare them with strategies adopted by other forms of enterprises. As the hedonic pricing framework is a concept that is based on consumer demand and producers' response to this, the production side of wine cooperatives is not considered in this article explicitly. Further investigations may therefore take into consideration the competitiveness of cooperative production processes and their cost structure. The limitations of this research can be summarized as follows: Cooperative and non-cooperative wine producers that are not listed in either wine guides or the FWA data are not considered. An analysis incorporating these producers and their market positions is therefore absent from this study. Moreover, the data utilized in this study do not encompass information regarding how wine producers market the quality ratings they receive for their wines, nor does it address the potential effects of such marketing on consumer perceptions and purchasing behaviour.

REFERENCES

[1] J.H. Hanf, E. Schweickert, Cooperatives in the balance between retail and member interests: the challenges of the German cooperative sector, Journal of Wine Research 25 (2014) 32–44. https://doi.org/10.1080/09571264.2014.871122.

[2] M. Härle, J.H. Hanf, Wirkung von Einflussstrategien auf das Verhalten von Mitgliedern am Beispiel von Winzergenossenschaften, Mainz, Germany, 2015.

[3] S. Troiano, L. Rizzi, F. Marangon, Social or environmental consciousness? Exploring the consumption of cooperative wines among Euro-

pean citizens, WEP 12 (2023) 69–84. https://doi.org/10.36253/wep-14241.

[4] B. Frick, Does Ownership Matter? Empirical Evidence from the German Wine Industry, Kyklos 57 (2004) 357–386. https://doi.org/10.1111/j.0023-5962.2004.00258.x.

[5] A. Dilger, Prinzipal-Agenten-Probleme im deutschen Weinbau, Zeitschrift für das gesamte Genossenschaftswesen 55 (2005) 179–189. https://doi.org/10.1515/zfgg-2005-0126.

[6] G. Schamel, Can German Wine Cooperatives Compete on Quality?, Mainz, Germany, 2015.

[7] I. Schäufele, R. Herrmann, G. Szolnoki, Erzielen Weine mit höherer Qualität höhere Preise? Eine hedonische Preisanalyse zur DLG-Bundesweinprämierung, German Journal of Agricultural Economics 65 (2016) 132–150. https://doi.org/10.22004/ag.econ.284975.

[8] M. Dressler, Strategic winery reputation management – exploring German wine guides, International Journal of Wine Business Research 28 (2016) 4–21. https://doi.org/10.1108/IJWBR-10-2014-0046.

[9] G.H. Schamel, Structure, organization and a vision: Reasons for the success of wine cooperatives?, Punta del Este, Uruguay, 2019.

[10] D. Pennerstorfer, C.R. Weiss, Product quality in the agri-food chain: do cooperatives offer high-quality wine?, European Review of Agricultural Economics 40 (2012) 143–162. https://doi.org/10.1093/erae/jbs008.

[11] B. Richter, J. Hanf, Competitive Strategies for Wine Cooperatives in the German Wine Industry, WEP 9 (2020) 83–98. https://doi: 10.36253/web-8872.

[12] Deutsches Weininstitut, Wines of Germany: Statistics '22 / '23, Bodenheim, 2022.

[13] G. Szolnoki, D. Hoffmann, Consumer segmentation based on usage of sales channels in the German wine market, International Journal of Wine Business Research 26 (2014) 27–44. https://doi.org/10.1108/IJWBR-10-2012-0028.

[14] M. Minnici, Multidimensionale Erfolgsbewertung fusionierter Winzergenossenschaften in Deutschland. Dissertation, 2019.

[15] S. Castriota, D. Curzi, M. Delmastro, Tasters' bias in wine guides' quality evaluations, Applied Economics Letters 20 (2013) 1174–1177. https://doi.org/10.1080/13504851.2013.797552.

[16] G. Schamel, A. Ros, Indicators of Individual Wine Reputation for Friuli Venezia Giulia, Italian Economic Journal 7 (2021) 323–339. https://doi.org/10.1007/s40797-020-00138-9.

[17] D. Kaimann, Spiess Bru, Clarissa Laura Maria, B. Frick, Ratings meet prices: The dynamic relationship of quality signals, Journal of Wine Economics (2023) 1–19. https://doi.org/10.1017/jwe.2023.14.

[18] D. Marks, Seeking the Veritas about the Vino: fine wine ratings as wine knowledge, Journal of Wine Research 26 (2015) 319–335. https://doi.org/10.1080/09571264.2015.1083953.

[19] S. Landon, C.E. Smith, Quality Expectations, Reputation, and Price, Southern Economic Journal 3 (1998) 628–647. https://doi.org/10.1142/9789813232754_0001.

[20] C. Krieger, J.H. Hanf, V. Belaya, Markenbildung und -führung bei Winzergenossenschaften: Ergebnisse einer Unternehmensbefragung, Berichte über Landwirtschaft - Zeitschrift für Agrarpolitik und Landwirtschaft 92 (2014). https://doi.org/10.12767/buel.v92i3.56.

[21] J. Höhler, R. Kühl, Dimensions of member heterogeneity in cooperatives and their impact on organization - a literature review, Annals of Public and Cooperative Economics 89 (2018) 697–712. https://doi.org/10.1111/apce.12177.

[22] J.-P. Couderc, A. Marchini, Governance, commercial strategies and performances of wine cooperatives: An analysis of Italian and French wine producing regions, International Journal of Wine Business Research 23 (2011) 235–257. https://doi.org/10.1108/17511061111163069.

[23] G. Schamel, Coordinating for Quality: How Cooperatives can beat Private Wineries on Quality and Reputation, St. Catherines, 2013.

[24] J. Valette, P. Amadieu, P. Sentis, Cooperatives versus Corporations: Survival in the French Wine Industry, Journal of Wine Economics 13 (2018) 328–354. https://doi.org/10.1017/jwe.2017.1.

[25] B. Frick, Some Cooperatives Produce Great Wines but the Majority Does Not: Complementary Institutional Mechanisms to Improve the Performance of an Indispensable Organizational Form, J Wine Econ 12 (2017) 386–394. https://doi.org/10.1017/jwe.2017.33.

[26] R. Soboh, A. Oude Lansink, G. van Dijk, Efficiency of Cooperatives and Investor Owned Firms Revisited, Journal of Agricultural Economics 63 (2012) 142–157. https://doi.org/10.1111/j.1477-9552.2011.00324.x.

[27] M. Costanigro, J.J. McCluskey, Hedonic price analysis in food markets, in: J.L. Lusk, J. Roosen, J.F. Shogren (Eds.), The Oxford Handbook of the economics of food consumption and policy, Oxford University Press, Oxford, 2011, pp. 152–180.

[28] S. Rosen, Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition, Journal of Political Economy 82 (1974) 34–55. https://doi.org/10.1086/260169.

[29] S. Lecocq, M. Visser, What Determines Wine Prices: Objective vs. Sensory Characteristics, Journal of Wine Economics 1 (2006) 42–56. https://doi.org/10.1017/S1931436100000080.

[30] F. Livat, N.G. Vaillant, Expert opinion and brand reputation: an analysis from a French Cuban cigars guidebook, Applied Economics Letters 13 (2006) 97–100. https://doi.org/10.1080/13504850500390564.

[31] E. Oczkowski, Hedonic Wine Price Functions and Measurement Error, Economic Record 77 (2001) 374–382. https://doi.org/10.1111/1475-4932.00030.

[32] M. Algner, A. Fritsch, R. Reichel, Winzergenossenschaften im Wettbewerb, Zeitschrift für das gesamte Genossenschaftswesen 57 (2007) 167–177. https://doi.org/10.1515/zfgg-2007-0302.

[33] Gault&Millau, Gault&Millau Weinguide Deutschland 2020, ZS Verlag, 2019.

[34] G. Eichelmann, Eichelmann 2020 Deutschlands Weine, MONDO Heidelberg, Heidelberg, Neckar, 2019.

[35] Weinwirtschaft, LEH verkauft erneut weniger Wein, 2024. https://www.meininger.de/wein/handel/leh-verkauft-erneut-weniger-wein (accessed 29 October 2024).

[36] FWA, Bundesweinprämierung. https://www.dlg-bwp.de/de/, 2024 (accessed 15 April 2024).

[37] G. Schamel, German Wine: Measurement and Evaluation of Product Quality, in: K. Hagedorn (Ed.), Umwelt- und Produktqualität im Agrarbereich, Landwirtschaftsverl., Münster-Hiltrup, 2005, pp. 143–151.

[38] P. Fanasch, B. Frick, What Makes Cooperatives Successful? Identifying the Determinants of Their Organizational Performance, Journal of Wine Economics 13 (2018) 282–308. https://doi.org/10.1017/jwe.2018.28.

[39] J.A. Hausman, W.E. Taylor, Panel Data and Unobservable Individual Effects, Econometrica 49 (1981) 1377. https://doi.org/10.2307/1911406.

[40] B.H. Baltagi, Essays in Honor of Jerry Hausman, Emerald Publishing Limited, Bingley, 2012.

[41] C. Cornwell, P. Schmidt, D. Wyhowski, Simultaneous equations and panel data, Journal of Econometrics 51 (1992) 151–181. https://doi.org/10.1016/0304-4076(92)90033-N.

[42] B.H. Baltagi, Econometric Analysis of Panel Data, sixth ed., Springer, Cham, 2021.

[43] B.H. Baltagi, G. Bresson, A. Pirotte, Fixed effects, random effects or Hausman–Taylor?: A pretest estimator, Economics Letters 79 (2003) 361–369. https://doi.org/10.1016/S0165-1765(03)00007-7.

[44] B.H. Baltagi, Simultaneous equations with error components, Journal of Econometrics 17 (1981) 189–200. https://doi.org/10.1016/0304-4076(81)90026-9.

[45] R Core Team, R: A Language and Environment for Statistical Computing, Vienna, Austria, 2021. https://www.R-project.org/.

[46] R. Koenker, G. Bassett, Regression Quantiles, Econometrica 46 (1978) 33–50. https://doi.org/10.2307/1913643.

[47] R. Koenker, J.A.F. Machado, Goodness of Fit and Related Inference Processes for Quantile Regression, Journal of the American Statistical Association 94 (1999) 1296–1310. https://doi.org/10.1080/01621459.1999.10473882.

[48] J. Rebelo, L. Lourenço-Gomes, T. Gonçalves, J. Caldas, A hedonic price analysis for the Portuguese wine market: Does the distribution channel matter?, Journal of Applied Economics 22 (2019) 40–59. https://doi.org/10.1080/15140326.2018.1550596.

[49] H. White, A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, Econometrica 48 (1980) 817–838. https://doi.org/10.2307/1912934.

[50] V. Chernozhukov, C. Hansen, The Effects of 401(K) Participation on the Wealth Distribution: An Instrumental Quantile Regression Analysis, Review of Economics and Statistics 86 (2004) 735–751. https://doi.org/10.1162/0034653041811734.

[51] R. Del Rey, S. Loose, State of the International Wine Market in 2022: New market trends for wines require new strategies, WEP 12 (2023) 3–18. https://doi.org/10.36253/wep-14758.

APPENDIX

Table A1. Descriptive statistics of the variables in the wine guide sample.

Dependent variable	Vector symbol	H-T variables	Mean (max.; min.; std. dev.) non-coops	Mean (max.; min.; std. dev.) coops
n_t = 264, t = 1-5, $N_{t=1-5}$ = 1320				
Wine price per bottle (0.75 l)	P	Y	16.8 (85.0; 4.9; 10.3)	14.5 (49.3; 4.1; 7.8)
Independent variables				
Quality ratings (Overlap* of the two wine guides: 75.76 %)				
Quality rating Gault&Millau (QGM)	Q	X2	86.8 (100.0; 79.0; 2.7)	85.8 (96.0; 75.0; 1.9)
Quality rating Eichelmann (QE)	Q	X2	86.6 (98.0; 80.0; 2.7)	83.9 (89.0; 79.0; 2.4)
Reputation rating Gault&Millau (RGM)	R	X2	2.4 (5.0; 1.0; 1.1)	1.6 (4.0; 1.0; 0.6)
Reputation rating Eichelmann (RE)	R	X2	3.1 (5.0; 1.0; 1.0)	1.5 (2.5; 1.0; 0.5)
Number of members cooperative	F	Z2	1 (1; 1; 0)	385 (1325; 45; 327)
Acreage (ha)	F	X1	18.3 (104; 0.7; 20)	288.0 (1231; 85; 302)
Dummy-Variables			Share in %	
			non-coops	coops
Dummy cooperative	F	Z2	18.18	
Dummy red wine	W	X1	28.0	42.2
Dummy organic agriculture	F	X1	27.1	6.25
Dummy storage wooden barrel	W	X1	12.8	16.2
Dummy storage barrique barrel	W	X1	15.3	13.5
Dummy vintage 2 years before rating(V2)	W	X1	18.9	34.4
Dummy vintage 3 years before rating (V3)	W	X1	11.2	15.6
Dummy vintage 4 years before rating (V4)	W	X1	2.1	5.2
Dummy variables for growing regions (13)	A	Z1	Mean share of each growing region: 7.7 %	
Dummy high price segment (> € 25 per bottle)	W	X1	17.5	11.5
Dummy low price segment (≤ € 10 per bottle)	W	X1	32.4	44.3

*Overlap is defined as the amount of wines that are identically listed in both wine guides at the same time period.

Table A2. Descriptive statistics of the variables in the Federal Wine Awards sample.

Dependent variable	Vector symbol	Mean (max.; min; std.dev.) non-coops	Mean (max.; min; std.dev.) coops
Wine price per bottle (0.75 l) (N=18740)	P	9.1 (89.0; 1.9; 5.8)	8.3 (69.5; 1.8; 5.2)
Independent variables Share in %			
		Non-Coops	Coops
Quality ratings	Q		
Gold Extra Award		1.4	1.2
Gold Award		25.1	24.2
Silver Award		47.7	48.5
Bronze Award		26.0	25.9
Cooperatives' characteristics	F		
Dummy cooperatives (coop)		-	43.6
Cooperatives 100-199 ha (1)		-	27.5
Cooperatives 200-499 ha (2)		-	34.1
Cooperatives 500-999 ha (3)		-	15.1
Cooperatives ≥ 1000 ha (4)		-	13.3
Wine characteristics	W		
Dummy red wine (reference = rosé wine)		23.7	39.1
Dummy white wine (reference = rosé wine)		67.2	51.1
Dummy storage wooden barrel		8.2	6.9
Dummy storage barrique barrel		5.9	7.4
Dummy Vintage 2 years before tasting		7.4	12.2
Dummy Vintage 3 years before tasting		2.3	1.7
Dummy Vintage 4 years before tasting		0.6	0.2
Taste	W		
Sweet		0.6	0.8
Mild		3.1	7.7
Dry		19.3	25.9
Semi-dry		3.3	5.2
Not specified		73.8	60.5
Quality designation	W		
Qualitätswein		62.7	63.3
Kabinett		10.7	15.3
Spätlese		19.1	15.2
Auslese		5.3	3.0
Beerenauslese		1.2	1.6
Trockenbeerenauslese		0.5	0.7
Eiswein		0.6	0.9
Growing regions (13)	A	Mean share of each growing region: 7.69 %	
Dummy variable high price segment (> € 25)	W	2.4	1.79
Dummy variable low price segment (≤ € 10)	W	75.62	81.44

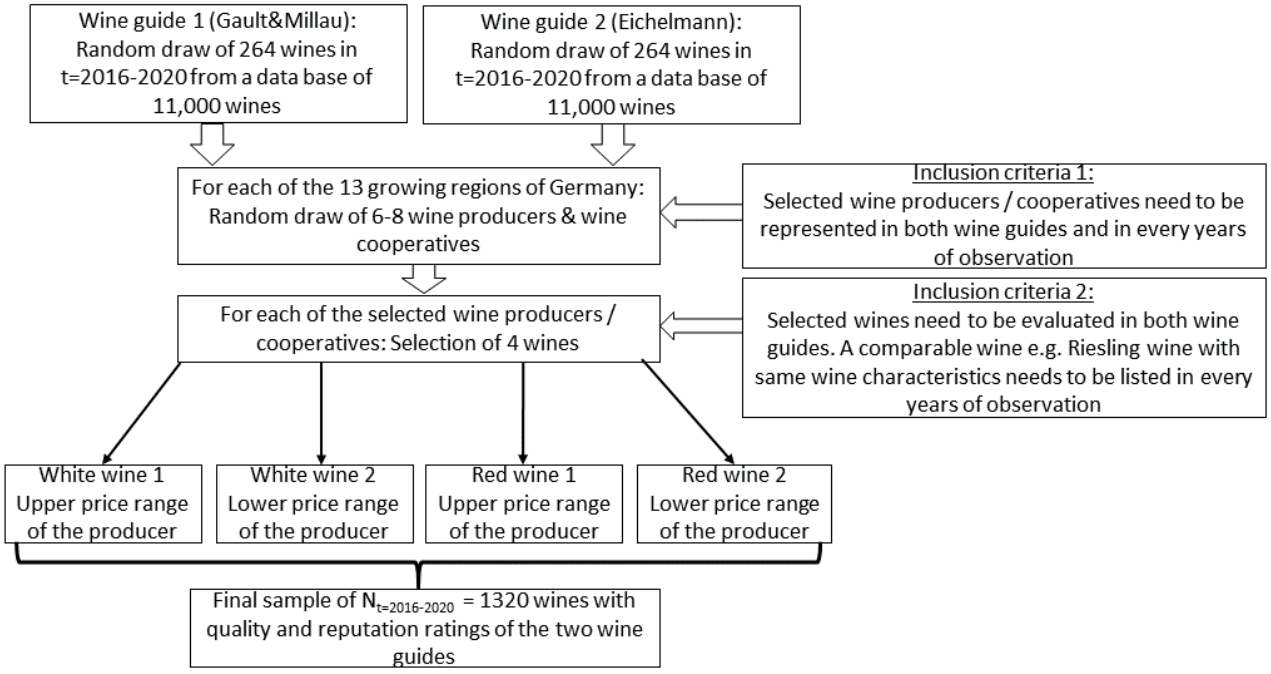


Figure A3. Graphical explanation sample generation.

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

Citation: Perucchini, E., Mazzocchi, C. & Corsi, S. (2025). Uncorking success: exploring the productivity of Italian wine farms. *Wine Economics and Policy* 14(1): 83-96. doi: 10.36253/wep-17000

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Uncorking success: exploring the productivity of Italian wine farms

Elena Perucchini, Chiara Mazzocchi*, Stefano Corsi

Department of Agricultural and Environmental Science (DISAA), University of Milan, Via Celoria 2, 20133, Milan, Italy
*Corresponding author. Email: chiara.mazzocchi1@unimi.it

Abstract. Over the past few decades, Italy's wine industry has shifted from producing low-value, local wines to a modern sector that meets both domestic and international demand. Despite these achievements, the sector faces challenges such as rising production costs, climate change, and a need for enhanced sustainability, particularly affecting small and medium-sized enterprises . This paper investigates the key determinants of productivity across different farm sizes within the Italian wine sector, emphasizing the role of farm size in shaping financial performance. Using data from the Agricultural Accounting Information Network database (2008-2021), the study employs a random-effects regression model to assess the impact of various structural, management, and control variables on wine farm revenues. Findings highlight that large farms benefit more from mechanization, diversification, and the production of processed products, whereas the productivity of smaller farms is driven by organic farming, direct sales, and agritourism. Furthermore, ownership of land has a negative impact on performance across all farm sizes. EU subsidies consistently enhance productivity for all farm sizes, with a stronger effect for smaller farms. The study concludes that tailored management strategies and access to financial support are crucial for enhancing the economic performance and resilience of wine businesses in Italy, particularly small farms.

Keywords: Italian wine farms, productivity drivers, economic size, random-effect regression model.

1. INTRODUCTION

Over the last decades, the Italian wine industry has transformed from a focus on low-value, local wines to a modern industry meeting both domestic and international demands: moreover, a notable shift from lower to higher quality wine, evidenced by an increase in the proportion of Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs) in total output [1], has occurred. Alongside this, Italy has made significant strides in the wine export market, reaching 8 billion euros in 2023, positioning itself second only to France, which boasts 14 billion euros in wine exports [2]. Furthermore, Italy accounts for 9% of the global vineyard area, ranking third worldwide after Spain and France [1]. This widespread pres-

ence of vineyards across Italy's diverse regions, various altitudinal zones, mountainous areas, differentiates Italian viticulture from other traditional wine-producing countries and especially from newer wine-producing nations, where viticulture tends to be concentrated in more limited regions.

Despite these positive trends, the performance of the Italian wine industry is not uniform across the board. While most large companies report positive results, the performance of small farms is more inconsistent, influenced by geographical location, production specialization, and the fluctuating balances of intermediate markets that change annually with harvest sizes [1]. This is further confirmed by data showing that, while overall revenues for wine companies grew during the 2019-2021 period, small businesses saw a decline in their revenue [3]. This volatility is further compounded by inherent complexity of improving productivity within the wine sector, a challenge that is particular evident form small and medium-sized enterprises (SMEs), which dominate the Italian market [4]. For these SMEs, operational efficiencies – such as advanced vineyard management techniques – are crucial for mitigating the disadvantages they face compared to larger firms [5,6]. In this context, high labor costs and fragmented farm structures significantly contribute to the negative returns on investment experienced by many grape wine farms, particularly in quality wine districts [7]. The reliance on labor-intensive technologies and limited economies of scale further undermine profitability, underscoring the urgent need for structural reforms in specific areas. Although some smaller wineries have succeeded in reducing costs, their limited capacity for innovation and collaboration adversely affects their financial performance [8]. Compounding these challenges are external factors, such as rising production costs, potential grape shortages, climate change, and the increasing need for environmental sustainability [9]. In light of these challenges, there is a pressing need for more accessible financial resources and supportive frameworks to bolster farm resilience. Strengthening government policies to improve market regulation, particularly through initiatives that enhance access to information, is essential [10]. This analysis of the Italian wine sector highlights the importance of understanding the determinants of economic performance to help the industry tackle both existing and emerging challenges, especially for small wine companies. While numerous studies have explored the relationship between farm size and economic performance, this paper aims to delve deeper into how various drivers influence the productivity of Italian wine companies, with a specific focus on the economic size of the farms. By examining productivity drivers across different economic sizes, this paper seeks to identify the factors that play a key role in determining productivity within varying operational scales. The objective is to identify potential heterogeneities in the factors influencing productivity based on the firm's operational scale. The findings could also offer valuable insights on how firms of different economic sizes can improve their resilience and competitive advantage in the broader market, inform policy interventions, improving the understanding of the interplay between economic farm size, efficiency, and competitiveness in the wine sector, ultimately guiding the future growth and sustainability of Italy's wine industry.

2. LITERATURE REVIEW

The relationship between profitability and farm size in the wine industry is a complex and multifaced issue, with various studies offering both supporting and contrasting perspectives. A general consensus suggests that larger farms tend to achieve higher profitability and productivity, largely due to economies of scale [11]. This is supported by findings that show technical efficiency and net farm income improve with greater economic size, further indicating that larger operations are often more financially successful [12,13]. Furthermore, larger and medium-sized farms often exhibit higher marginal productivity, highlighting a positive relationship between farm size and land productivity [14]. However, this relationship is not always straightforward, as external factors, such as market conditions, can also play a crucial role in determining success [15]. Interestingly, it has been observed that technical efficiency increases with the expansion of farm size up to a certain point. However, beyond a specific threshold, efficiency can actually decline due to the greater labor demands associated with larger operations. This underscores the importance of promoting balanced management and investing in technologies that reduce labor requirements to ensure more sustainable agricultural production [16,17]. In some cases, research has shown that smaller farms may actually be more efficient than larger ones, due to their ability to operate with fewer resources [18]. Additionally, smaller firms can still achieve strong economic performance by leveraging strategic flexibility and innovative competitive behaviors, rather than relying solely on scale [19,7].This suggests that smaller wineries can thrive through unique marketing strategies and nimble operational models, rather than simply attempting to scale up. Similarly, the economic performance of grape-growing farms is often

more influenced by wine selling prices than by farm size, with even larger farms sometimes experiencing low profitability due to unfavorable market conditions [20]. Moreover, improving product quality, adopting advanced production technologies, and refining marketing efforts can often result in better performance than simply increasing farm size [5]. Further exploring the determinants of wine firms' performance, Neves et al. [21] present a paradox wherein larger firms exhibit a negative correlation with Return on Assets (ROA) but show positive sales growth. This indicates that while larger size may not guarantee better efficiency metrics, it does enhance market visibility and attractiveness to investors, suggesting that market recognition could be an essential driver of profitability, regardless of operational efficiency. Sellers and Alampi-Sottini [22] reinforce this view, finding a positive correlation between firm size and all performance indicators (profit, productivity, and efficiency), attributing it to larger firms' ability to leverage both real and financial economies of scale. They argue that these firms also benefit from enhanced bargaining power with customers, suppliers, and financial institutions, facilitating easier access to international markets. Such advantages may further entrench the competitive divide between larger and smaller wineries. Furthermore, Urso et al. [23] found that larger companies, particularly those that process grapes, tend to perform better in terms of efficiency. Additionally, companies focused on quality production tend to exhibit higher efficiency compared to those that target mass-market wines. This suggests that efficiency is not solely determined by farm size but is also influenced by the degree of specialization and the nature of the production process.

In summary, the literature presents a nuanced view of the relationship between farm size and economic performance in the wine industry. While larger farms typically benefit from economies of scale and enhanced market recognition, smaller farms can achieve competitive profitability through strategic innovation and niche marketing. Nevertheless, external economic pressures, structural inefficiencies, and the need for effective policy support continue to be critical factors shaping profitability in the wine industry. Consequently, the comparative analysis of farm size remains significant for both research and agricultural policy [24]. The literature presents various methodologies for measuring economic performance, particularly in agriculture. Traditional indices for assessing profitability include return on assets (ROA), which is often viewed from a managerial perspective, along with return on equity (ROE), return on investment (ROI), and return on sales (ROS). Additionally, specific ratios, such as sales per employee, are utilized to evaluate labor productivity, while the ratio of total costs to total revenue provides further insights into economic efficiency [25,26]. In the context of wine production, Figurek et al. [27] identify several key indicators of economic performance, including farm net value added (FNVA), FNVA per annually working unit (AWU), farm net income (FNI), and family farm income (FFI/FWU). Additionally, gross value-added indicators have been widely used to assess farm economic performance, providing a broader understanding of value creation within the sector [28].

In our examination of the economic performance of wineries, we have selected productivity, defined as total farm revenue per hours worked, as the dependent variable. This indicator provides a clear view of operational efficiency, as it relates the ability to generate economic value to the labor input. Furthermore, choosing to examine productivity through this indicator enables a more precise understanding of how effectively farms convert their resources into financial output. In an industry like wine production, where variability in resources, technologies, and production methods is significant, analyzing productivity per hours worked provides valuable insights into labor efficiency and optimization across different farm sizes. As discussed in the literature review, several studies have explored the relationship between farm size and economic performance in the wine industry, with varying conclusions. Our study provides a novel contribution by not only investigating whether a relationship exists between economic farm size and economic performance, but also, more importantly, identifying the key factors that significantly influence wine farm performance based on its economic size. To the best of our knowledge, no existing research has specifically addressed this aspect, making our study both innovative and highly relevant.

3. METHODOLOGY

3.1 Conceptual framework

Building on existing literature that establishes a relationship between farm economic size and performance, this study seeks to evaluate the drivers of wine farm productivity in Italy, with farm economic size as a key explanatory factor. We sought to identify and differentiate the factors affecting the productivity of smaller wine farms compared to medium and large enterprises. To this end, we used data from the RICA (Rete di Informazione Contabile Agricola, or Agricultural Accounting Information Network) database, a sample survey conducted across all EU Member States and

serves as the sole harmonized European source for farm management data. RICA database provides an unbalanced panel dataset covering the period from 2008 to 2021, encompassing nearly 18,000 observations, each corresponding to a wine farm in a given year. Our analysis employed a random-effects regression model, with Total Farm Revenues per Hours Worked as the dependent variable. Total Farm Revenues includes revenue from both core agricultural activities and supplementary activities, while Hours Worked represents the total labor hours (excluding subcontracted services). The dependent can ensure comparability across farms of different sizes. The explanatory variables include structural characteristics, management factors, and control variables (Table 1).

Based on the existing literature (see par. 2), we decided to choose a set of explanatory factors, divided into three distinct groups: structural, management and control variables. Structural variables refer to the characteristics based on the farm structure that are related to its organization and resources. Key structural variables include:

- Age and gender of the farm manager: the demographic characteristics of the farm manager play a crucial role in shaping management styles, risk preferences, and decision-making processes. Research indicates that younger farmers are generally more open to adopting innovative practices and science-based research, essential for ensuring long-term viability and profitability. They require access to robust decision-making tools and high-quality information to effectively implement risk management strategies [29]. Additionally, the gender of the farm manager has been shown to impact farm performance [30].
- Utilized agricultural area (UAA) property index: this index reflects the balance between owned and rented land, indicating whether ownership contributes to technical efficiency or if rented land offers flexibility and access to resources [31].
- EU Subsidies: EU subsidies can constitute a substantial portion of farms' revenues. These subsidies may have both positive and negative effects on efficiency and productivity, particularly in light of policy changes [32].
- Level of mechanization: this variable reflects the extent of machinery and technology use on a farm. Higher mechanization enhances efficiency, lowers labor costs, and boosts productivity. In viticulture,

Table 1. List of explanatory variables included in the econometric model.

Variables	Group	Definition	Unit of measure
Manager gender	structural	Indicates the gender of the farmer	0-1 (0 = Male; 1 = Female)
Young manager	structural	Indicates if the farm is managed by a farmer under 40 years old	0-1 (0 = Farmer > 40; 1 = Farmer < 40)
UAA property index	structural	Indicates the proportion of owned on total UAA in the farm	Absolute value between 0 and 1 (0=farm UAA is totally rented)
EU subsidies	structural	Defines the amount of EU subsidies received by farm	€/YEAR
Mechanization	structural	Defines the KW used in farms/year	KW/YEAR
Diversified production	management	Indicates the presence of supplementary activities in addition to primary production activities in the farm	0-1 (0 = No supplementary activities; 1 = Supplementary activities present)
Organic farming	management	Defines if the farm produces organic products	0-1 (0 = Not organic, 1 = Organic farm)
Agritourism revenues	management	Indicates the amount of revenues derived from agritourism activity	€/YEAR
Subcontracting	management	Indicates the amount of revenues derived subcontracting activity	€/YEAR
Current liabilities	management	Indicates the amount of current liabilities by farm	€/YEAR
Consolidated liabilities	management	Indicates the amount of consolidated liabilities by farm	€/YEAR
Direct sale	management	Defines if the farm has direct sale	0-1 (0 = No direct sale; 1 = Direct sale)
Processed products	management	Defines if the farm processes its products	0-1 (0 = No processed products sold; 1 = Processed products sold)
Altitudinal zone	control	Indicates if the farm is located in mountain-hill-plain	0-1 (0 = the farm is located in the altitudinal zone considered)
Regions	control	Indicates in which Italian region is placed a farm	0-1 (1= the farm is located in the Region considered)
Farm size	control	Indicates the economic farm size (UDE classification): small (revenues ≤ €25,000); medium (revenues €25,000 - € 100,000); large (revenues > €100,000)	0-1(1= the farm belongs to the group considered)

increased mechanization can improve economic sustainability, significantly reducing costs in both flat and steep terrains. Ultimately, enhancing vineyard mechanization can lead to greater economic performance for wine producers [33].

Management variables relate to strategic choices made by each single entrepreneur; they are:

- Diversification: this involves incorporating complementary activities beyond traditional wine production. Diversification not only enhances revenue stability but also fosters resilience in a competitive landscape, ultimately influencing a winery's overall economic success [8].
- Organic farming: the inclusion of a dummy variable for organic farming - indicating either a fully organic winery or the presence of at least one organic product or process - serves as a relevant independent variable for analyzing economic performance. Given the recent challenges faced by wine growers, organic wine represents a promising alternative, often commanding higher market prices [34,35].
- Agritourism revenues: agritourism emerges as a significant factor influencing the economic performance of wine farms, offering opportunities for diversification into high-value activities. Moreover, agritourism plays a vital role in engaging the next generation of potential farmers, increasing the likelihood of attracting successors and employing family members, thereby supporting the economic health of the farm [36].
- Subcontracting: leading Italian agro-mechanical associations emphasize the critical importance of subcontracting in modern agriculture. It consistently accounts for a significant share among various support activities and is essential for the survival of small wineries in marginal areas, enabling them to operate more efficiently and sustainably [37].
- Current and consolidated liabilities: they are key factors in ensuring financial stability and facilitating future growth and investment opportunities. Current liabilities can impact cash flow, potentially restricting investments in marketing or product development, which directly affects revenue generation. Conversely, consolidated liabilities often represent long-term investments that can enhance production capacity and expand market reach, ultimately leading to increased revenues.
- Direct sales and processed products: we selected dummy variables for direct sales and processed products to differentiate wineries based on their managerial decisions.

Finally, to increase the precision and enhance the validity of our analysis, we selected geographical variables as control factors. This choice is particularly relevant given that the Italian wine sector is highly regionalized and significantly influenced by altitude. These geographical variables help ensure that our analysis accounts for the unique characteristics of different wine-producing regions, leading to more reliable results. According to [38, 39, 40], including regional fixed effects allows us to neutralize unobserved heterogeneity arising from systematic differences across regions, such as climate, infrastructure, and market access [1, 41, 42].

3.2 Case study and data

Italy has a deep-rooted tradition in viticulture, showcasing a high and diverse production landscape. This includes a wide selection of native grape varieties, advancements in nursery practices, and competitive pricing that strengthens its position in the market. However, over the past 40 years (1982 to 2020), the number of wine-producing farms in Italy has significantly declined, decreasing from over 1.6 million to just 255,000. The decline in the number of wine-producing farms is more pronounced among smaller farms, with the rate of reduction diminishing as the size of the utilized agricultural area (SAU) increases. For instance, according to the most recent ISTAT (National Institute of Statistics) data [43], between 1982 and 2010, farms with less than one hectare decreased by 84%, whereas those with 30 to 50 hectares experienced a smaller decline of 44%. This reduction has been accompanied by a decrease in the total vineyard area, though at a slightly slower pace. Consequently, the average vineyard size has increased from 0.70 hectares in 1982 to 2.46 hectares in 2020, according to the Seventh general agricultural census [44]. Despite this growth, the average size remains relatively small, which continues to be a defining feature of the structure of Italian wine-producing farms. This average size varies regionally, decreasing from north to south: vineyards in the Northwest average 3.19 hectares, those in the Northeast average 3.42 hectares, while in the central regions the average size is 2.25 hectares. In the South, the average vineyard size drops to 1.74 hectares, with vineyards in the islands averaging 2.54 hectares [44]. Building on this observation about the relatively small size of vineyards, another relevant ISTAT statistic highlights that small-scale wine farms, with an economic size of 0-25,000 euros, account for 53% of all wine-producing farms. Medium-sized farms, with an economic range of 25,000-100,000 euros, account for 32%, while the remaining 14% consists of large-scale farms with an economic size exceeding 100,000 euros [44].

3.3 Econometric model

To determine the most appropriate model, we used a stepwise approach and ultimately selected the Random Effects (RE) model. This choice was driven by the unbalanced nature of our panel dataset and the assumption that unobserved differences between units are not correlated with the independent variables. The Random Effects model is particularly beneficial because it allows for the estimation of effects for time-invariant variables, such as control variables, which are excluded in Fixed Effects models. Additionally, we conducted statistical testing and error correction as follows: first, the Breusch-Pagan test confirmed the presence of significant random effects, validating the use of the Random Effects model for managing the panel data structure. The results demonstrated that the variance between units is significantly different from zero, thereby supporting the superiority of the Random Effects model over a pooled OLS (Ordinary Least Squares) model. To address potential heteroscedasticity, we applied robust standard errors. This correction accounts for possible heteroskedasticity and/or correlation within clusters defined by the same farm identifier. As a result, Stata, the software used for this calculation, adjusted the standard errors to account for the cluster structure, thereby enhancing the precision of our statistical estimates.

We analyzed four distinct models based on farm size classifications: small, medium, and large farms; the first model includes all the farms of our database. We estimate Equation (1) first for the entire dataset and then separately for three distinct groups of representative wine farms based on their economic size. The productivity function for the full model takes the following form:

$$\begin{aligned}\text{Log (Prod)} = {} & \beta_0 + \beta_1(\text{Gen}) + \beta_2(\text{Young}) + \\ & \beta_3(\text{UAA Property Index}) + \beta_4(\text{EU Subsidies}) + \\ & \beta_5(\text{Mechanization}) + \beta_6(\text{Diversified}) + \beta_7(\text{Organic}) \\ & + \beta_8(\text{Agritourism Revenues}) + \beta_9(\text{Subcontracting}) + \\ & \beta_{10}(\text{Current Liabilities}) + \beta_{11}(\text{Consolidated Liabilities}) + \beta_{12}(\text{Direct Sale}) + \beta_{13}(\text{Processed Products}) + \\ & \beta_{14}(\text{Mountain}) + \beta_{15}(\text{Plain}) + \beta_{16}(\text{Medium}) + \\ & \beta_{17}(\text{Small}) + j\Sigma\beta_j(\text{Regions}) + u_i + \varepsilon_{it}\end{aligned} \quad (1)$$

where: Log(Prod) is the dependent variable, representing the logarithm of total farm revenues per hour worked; β_0 is the intercept (or constant term); β_1 to β_{17} are the coefficients corresponding to the independent variables; u_i represents the random effect associated with the *i*-th wine farm; and ε_{it} is the idiosyncratic error term. The categories "Hill" and "Large" are omitted from the equation as they serve as the reference groups for the altitudinal zone and economic dimension, respectively. The use of the natural logarithm of the dependent variable (Log(Prod)) is applied to normalize the distribution of farm revenue per hour worked. This transformation helps to linearize the relationships between the dependent and independent variables and to mitigate any potential skewness in the data. Additionally, taking the logarithm allows for the interpretation of coefficients in terms of percentage changes, making the results easier to interpret in economic terms, especially when considering elasticities of production and scale.

4. RESULTS

After outlining the general structure of the Italian wine sector and describing the conceptual framework and econometric model we will proceed by presenting the descriptive statistics of the specific variables chosen for analyzing the economic performance of Italian wine farms. This analysis will provide a more comprehensive view of the sector's structure based on the economic size of the businesses. Table 2 presents the complete descriptive statistics for the explanatory variables.

The table provides a comprehensive overview of variables related to farm size (All farms, Large, Medium, Small). Small farms have a higher proportion of female managers, with 32% of small farm managers being women, compared to 24% in medium-sized farms and 16% in large farms. The proportion of managers under 40 years old is relatively similar across large and medium-sized farms but is notably lower in small farms. The index of UAA property ownership in small firms is the highest (mean = 0.72), suggesting they own a larger portion of utilized agricultural area. Large firms benefit from significantly higher EU subsidies compared to medium and small firms. The highest mechanization level is evident in large firms and the lowest is found in small firms. Diversification and organic farming are more prevalent in large firms, while small firms exhibit limited diversification and a lower adoption of organic practices. Large firms also generate higher agritourism revenues, engage more in subcontracting, and bear significantly higher current and consolidated liabilities, indicating greater financial exposure. The presence of direct sales and processed products on the farm is more common in larger firms. In mountainous areas, the prevalence of small firms is significant with respect to other altitudinal zones. Overall, large firms exhibit greater resources, diversification, and mechanization, while small firms remain more constrained in economic and diversification capacities. The descriptive statistics

Table 2. Descriptive statistics of explanatory variables used in the regression model.

Variable	All		Large		Medium		Small	
	mean	SD	mean	SD	mean	SD	mean	SD
Manager gender	0.23	0.42	0.16	0.37	0.24	0.43	0.31	0.46
Young manager	0.12	0.33	0.13	0.34	0.13	0.33	0.09	0.29
UAA property index	0.66	0.41	0.63	0.40	0.66	0.41	0.72	0.41
EU subsidies	3212.33	9033.60	7012.12	14620.62	1733.60	3717.90	636.93	1423.03
Mechanization	142.13	216.51	230.39	196.55	109.40	73.43	77.30	410.15
Diversified production	0.10	0.30	0.16	0.36	0.09	0.28	0.05	0.21
Organic farming	0.12	0.33	0.17	0.37	0.11	0.31	0.07	0.26
Agritourism revenues	2878.64	28170.25	5960.67	47326.89	1705.98	12208.86	707.24	6241.70
Subcontracting	427.43	6090.31	1081.30	10554.64	148.30	1754.39	60.33	1136.75
Current liabilities	16720.25	124953.00	40952.00	214163.90	6665.66	41181.35	2222.69	10355.12
Consolidated liabilities	14971.69	176200.60	36943.43	306251.30	5968.99	46460.98	1474.25	31507.79
Direct sale	0.16	0.37	0.22	0.41	0.14	0.35	0.12	0.33
Processed products	0.51	0.50	0.59	0.49	0.49	0.50	0.45	0.50
Altitudinal zone								
Plain	0.28	0.45	0.31	0.46	0.26	0.44	0.28	0.45
Hill	0.59	0.49	0.64	0.48	0.59	0.49	0.51	0.50
Mountain	0.13	0.33	0.05	0.22	0.15	0.35	0.21	0.41

outlined above provide an initial understanding of the explanatory variables; however, to gain deeper insights, we now turn to the results of the econometric model, which will help explain and interpret these statistics more effectively.

The general model clearly shows that the control variables associated with the economic size of the companies yield significant results. This supports our decision to further investigate each specific category of farms in detail.

Several key findings emerge from the results: concerning structural variables, the UAA property index shows a significant negative relationship with productivity, particularly for small and medium farms, with the strongest effect observed on small farms (-0.146) and medium farms (-0.103), while it is not significant for large farms. EU subsidies are positively associated with revenues per hour worked across all firm sizes, with the effect being more pronounced for small firms. Mechanization is positively associated with revenues for large and medium firms but shows a negative relationship with productivity on small firms, which may lack the resources or capacity to implement it efficiently.

Regarding the second category, specifically the management variables, it can be observed that both diversification and organic farming are positively related to productivity. Larger and medium-sized firms see notable benefits from diversification strategies. In contrast, medium-sized and particularly small firms exhibit more substantial productivity improvements through the adoption of organic farming practices. Agritourism shows a positive relationship with total revenue per hours worked for farms of all sizes, with small ones experiencing the largest gains. Subcontracting is positively associated with the productivity of medium and small farms, with current liabilities also having a modest impact on the productivity of medium-sized farms. In contrast, consolidated liabilities do not exhibit any significant effect in our regression analysis. Additionally, both direct sales and processed products exhibit a positive relationship with productivity across farms, with varying impacts depending on farm size. Direct sales are significantly associated with higher productivity for medium and small farms but have no significant effect on larger farms. In contrast, processed products have a strong, positive relationship on productivity across all farm sizes, regardless of economic scale.

As anticipated in Section 3.1, the variable Regions was included in the model to account for territorial heterogeneity. The coefficients associated with the regional dummies are mostly positive, with the exception of Calabria for large farms and Piedmont for small ones. However, these results should be interpreted with caution, as they are strongly influenced by the sample composition. The sampling design of the RICA survey relies on a stratified random procedure, which results in an unbalanced distribution of observations across regions. Consequently, directly interpreting the coefficients of the

Table 3. Regression of productivity (Total farm revenues/Hours worked) of Italian wine farms regarding economic size – random-effects modelling.

Variable	All	Large	Medium	Small
Manger Gender	-0.098*** (0.22)	-0.047 (0.041)	-0.064** (0.025)	-0.054 (0.036)
Young manager	-0.027 (0.024)	-0.047 (0.038)	0.003 (0.027)	0.096 (0.070)
UAA property index	-0.154*** (0.023)	-0.063 (0.039)	-0.103*** (0.029)	-0.146** (0.051)
EU subsidies	8.69E-06*** (0,000)	5.20E-06*** (0.000)	2e-05*** (0.000)	6.49E-05*** (0.000)
Mechanization	8.06E-05 (0.000)	3.954E-04*** (0.000)	0.001*** (0.000)	-7.46E-05*** (0.000)
Diversified production	0.189*** (0.034)	0.110** (0.043)	0.095* (0.044)	0.037 (0.098)
Organic farming	0.117*** (0.024)	0.053 (0.034)	0.123*** (0.033)	0.154* (0.062)
Agritourism revenues	1.55E-06*** (0.000)	1.03E-06** (0.000)	4.53E-06*** (0.000)	1.57E−05*** (0.000)
Subcontracting	-9.96E-07 (0.000)	-1.46E-06 (0.000)	1.24E-05*** (0.000)	2.82E-05*** (0.000)
Current liabilities	2.61E-07* (0.000)	1.85E-07 (0.000)	3.00E-07* (0.000)	2.22E-06. (0.000)
Consolidated liabilities	3.78E-09 (0.000)	-1.22E-09 (0.000)	6.48E-08 (0.000)	-1.32E-07 (0.000)
Direct sale	0.027* (0.013)	-0.014 (0.019)	0.041* (0.018)	0.095** (0.037)
Processed products	0.169*** (0.018)	0.178*** 0.030	0.135*** (0.025)	0.163*** (0.036)
Altitudinal zone				
Hill	0	0	0	0
Mountain	0.062 (0.060)	-0.106 (0.130)	0.11 (0.071)	0.137 (0.104)
Plain	0.047 (0.025)	0.038 (0.041)	0.047 (0.031)	0.111* (0.055)
Regions	X	X	X	X
Economic dimension				
Large	0	-	-	-
Medium	-0.313*** (0.022)	-	-	-
Small	-0.676*** (0.030)	-	-	-
Observation	17976	5666	92959	30156
Groups	4308	1519	2477	957
R-squared in between	0.4288	0.2140	0.2076	0.3460

Note: Standard errors in parentheses. The "Regions" variable was introduced as a control variable to verify the stability of the regression in the four different models. The goal is not to explain regional differences: Regions are included to ensure that the estimates of the other explanatory variables are more precise and robust by accounting for unobserved territorial heterogeneity.
*p<0.05; **p<0.01; ***p<0.001.

Regions variable may lead to biased conclusions, as these estimates may reflect sampling disparities rather than genuine territorial effects.

5. DISCUSSION

The findings from the random effects regression model provide valuable insights into the productiv-

ity of Italian wine companies. The results reveal several nuanced factors that show a positive or negative relationship with productivity across different types of farms, highlighting the importance of tailored strategies for each business. First, the negative relation between property ownership and productivity growth highlights the potential inefficiencies in land management, encouraging wine farms to reevaluate their real estate strategies. In fact, as demonstrated by Bojnec and Latruffe [31], renting land can be more efficient, as it allows farms to focus on improving technical efficiency without being burdened by the costs and inflexibilities associated with property ownership. This reinforces the need for wineries to consider alternative land arrangements, especially as renting can often lead to better resource allocation and operational flexibility. The significant advantages of EU subsidies for smaller firms underscore the crucial role of external financial support in improving their competitiveness in the market. This trend is also noted by Kryszak et al. [25], who found that the proportion of subsidies relative to farm revenue is greater among small and medium-sized farms, gradually decreasing for larger operations. This finding emphasizes the critical role subsidies have in leveling the playing field, particularly for smaller businesses that may otherwise struggle to compete with larger, more capital-intensive enterprises. Mechanization shows a distinct impact based on farm size. The significant positive coefficient for mechanization in large farms, contrasted with the negative coefficient in small farms, highlights how these businesses utilize technology differently. Larger firms can capitalize on advanced machinery to improve operational efficiency and productivity, leading to increased profitability. In contrast, smaller farms frequently face a shortage of suitable equipment, which limits their capacity to mechanize effectively and ultimately reduces their productivity. Thus, mechanization poses a substantial challenge for small farms [45]. This difference with large farms highlights the need for policy interventions or financial support to help small wine farms invest in the necessary technology to remain competitive. The positive effects of diversification and organic farming across all firm sizes underscore the importance of these strategies in adapting to market demands and enhancing financial resilience. Notably, organic viticulture proves to be especially advantageous for small-scale wine farms, highlighting the significant economic benefits that organic practices can offer in this context [46]. This finding suggests that organic farming is not only a sustainable choice but also an economically viable strategy for small-scale wine producers looking to differentiate themselves in a crowded market. Agritourism emerges as a particularly advantageous avenue for small firms, enabling them to diversify income streams and capitalize on their local appeal [47,48]. The role of subcontracting in boosting productivity for smaller companies illustrates the significance of accessing specialized skills without incurring substantial overhead costs. Furthermore, the significant impact of direct sales on small (and, to a lesser extent, medium) farms, contrasted with the lack of significance for large farms, indicates that stronger consumer relationships can result in higher profit margins [49]. This presents an advantage that larger farms may struggle to replicate. Overall, this study, which focused on analyzing productivity within the Italian wine sector, emphasizes the critical importance of strategic management and structural decisions. It underscores how these decisions must be tailored, considering the economic size of the farms. The findings suggest that a one-size-fits-all approach is insufficient. This study provides valuable insights for practitioners within the sector and offers a guide for stakeholders to better understand which strategic decisions may be most effective based on the economic characteristics of each farm. Additionally, it lays the foundation for future research, encouraging further exploration into how tailored management practices can enhance productivity in viticulture more broadly.

6. CONCLUSIONS

6.1 Theoretical implications of the results

This paper aimed to explore the factors that most significantly impact productivity within different farm size categories and to determine the sources of competitive advantage. The findings contribute to the theoretical understanding of productivity drivers in the Italian wine sector by highlighting the distinct roles of farm size and entrepreneurial characteristics. The contrasting impact of younger entrepreneurs on small versus large firms supports existing theories of innovation in viticulture, as they bring creativity and responsiveness to market demands. Additionally, the negative correlation between property ownership and revenues per hour worked suggests inefficiencies in land management, reinforcing the idea that leasing may enhance technical efficiency. Moreover, the significant role of EU subsidies for smaller firms underscores the importance of external financial support in achieving competitive advantage. Finally, the varying impacts of mechanization indicate that while larger firms benefit from advanced technology and mechanization, smaller farms face barriers to effective mechanization. Ultimately, the findings suggest that focusing on improving productivity is not just

about increasing output but about developing more sustainable, efficient, and profitable agricultural practices. This approach enables farms to remain competitive in an increasingly complex market, while also contributing to the broader goal of long-term economic sustainability in the Italian wine sector.

6.2 Practical implications of the results

The findings of this study present significant practical implications for both policymakers and wine makers within the Italian wine sector, providing insights into which factors should be prioritized in strategic planning to enhance firm performance. For policymakers, the crucial role of EU subsidies underscores the importance of ensuring that financial support is effectively directed toward smaller firms, where it can have the most substantial impact on productivity. The Common Agricultural Policy (CAP) 2023-2027 specifically addresses this need by redistributing income support. The EU mandates that at least 10% of direct payments from EU member states must be allocated to the redistributive income support tool, targeting small and medium-sized farms to meet their income needs more effectively. This strategy ensures that the most vulnerable sectors, including smaller wine producers, receive the support necessary for sustainable development and growth. By streamlining application processes and expanding funding opportunities, policymakers can strengthen the competitiveness of these businesses and promote sustainable viticultural practices. Additionally, policies that facilitate land leasing arrangements could enhance operational efficiency and productivity for wine producers, thereby challenging traditional notions of property ownership in agriculture. Moreover, the CAP 2023-2027 includes specific provisions to support the viticulture sector, which are crucial for helping producers meet evolving challenges. For wine makers, particularly those managing smaller farms, the results emphasize the critical importance of innovation and diversification in improving productivity. Adopting organic farming practices and exploring agritourism can provide valuable alternative income streams while aligning with evolving consumer preferences for sustainability. Furthermore, younger entrepreneurs should be encouraged to harness their creativity and responsiveness to market demands by integrating new technologies into their operations. Overall, it is essential for both policymakers and wine makers to recognize the multifaceted nature of productivity enhancement and adapt their strategies accordingly to thrive in an increasingly competitive market.

6.3 Limitations

While this study offers valuable insights, it is not without limitations. The reliance on quantitative data may overlook qualitative factors influencing farm performance. Additionally, the study utilizes an unbalanced panel database, resulting in a relatively limited number of distinct firms, with not all companies providing data for every year included in the panel. Consequently, future research would benefit from a larger and more diverse sample of companies. Furthermore, the analysis is primarily focused on Italian wine companies, which may restrict the generalizability of the findings to other countries or agricultural sectors. Finally, the analysis predominantly captures current conditions; therefore, potential future shifts in market dynamics or policy landscapes may not be fully accounted for.

6.4 Future steps

Addressing these limitations in future research will enhance the understanding of productivity within the wine sector and beyond. Future research should delve deeper into each factor contributing positively to the economic performance of wine farms to understand precisely how they influence productivity. This includes investigating the specific mechanisms by which diversification, organic farming, mechanization, and agritourism enhance efficiency and output. Additionally, examining the interplay between agritourism and productivity would be valuable for understanding how small firms can diversify their income streams. Longitudinal studies could also shed light on how these dynamics evolve over time, especially in light of climate change and its effects on vineyards.

REFERENCES

[1] E. Pomarici, A. Corsi, S. Mazzarino, and R. Sardone, “The Italian Wine Sector: Evolution, Structure, Competitiveness and Future Challenges of an Enduring Leader,” *Italian Economic Journal*, vol. 7, no. 2, pp. 259–295, Jul. 2021, https://doi.org/10.1007/s40797-021-00144-5.

[2] Spanish Observatory of Wine Markets (OeMv), “International wine trade Factors affecting consumption & trade trends,” European Commision, Ed., Apr. 2024.

[3] “Wine businesses: big ones make market, small (big-brand) ones at the top for ‘ebitda,’” *Wine News*, Milan, Oct. 19, 2022.

[4] R. Sellers-Rubio, V. Alampi Sottini, and S. Menghini, "Productivity growth in the winery sector: evidence from Italy and Spain," *International Journal of Wine Business Research*, vol. 28, no. 1, pp. 59–75, Mar. 2016, https://doi.org/10.1108/IJWBR-05-2015-0019.

[5] G. Pappalardo, A. Scienza, G. Vindigni, and M. D'Amico, "Profitability of wine grape growing in the EU member states," *J Wine Res*, vol. 24, no. 1, pp. 59–76, 2013, https://doi.org/10.1080/09571264.2012.724392.

[6] F. Sgroi, A. M. Di Trapani, R. Testa, and S. Tudisca, "Strategy to increase the farm competitiveness," *American Journal of Agricultural and Biological Science*, vol. 9, no. 3, pp. 394–400, Jun. 2014, https://doi.org/10.3844/ajabssp.2014.394.400.

[7] B. Perretti, "Economic sustainability of quality wine districts in the South of Italy. The case of Vulture," *International Journal of Globalisation and Small Business*, vol. 11, no. 4, pp. 356–372, 2020.

[8] J. L. Tingey-Holyoak, S. A. Wheeler, C. Seidl, and A. Zuo, "Understanding viticultural financial returns: A case study from the Riverland, South Australia," *J Rural Stud*, vol. 110, Aug. 2024, https://doi.org/10.1016/j.jrurstud.2024.103334.

[9] N. Marinelli, "Old and new challenges in the wine business: what lies ahead for Wine Economics and Policy," *Wine Economics and Policy*, vol. 11, no. 2, pp. 3–4, Jan. 2022, https://doi.org/10.36253/wep-13987.

[10] G. Di Vita, G. D'Amico, and S. Bracco, "Economic performances of smallholders PDO viticulture in Eastern Sicily," *Quality - Access to Success*, vol. 14, 2013.

[11] A. W. Mugera, M. R. Langemeier, and A. Ojede, "Contributions of Productivity and Relative Price Changes to Farm-level Profitability Change," *Am J Agric Econ*, vol. 98, no. 4, pp. 1210–1229, 2016.

[12] M. L. Carvalho, P. D. Henriques, F. Costa, and R. Pereira, "Characterisation and technical efficiency of Portuguese wine farms," *12 th Congress of the European Association of Agricultural Economists-EAAE*, 2008, Accessed: Dec. 09, 2024. [Online]. Available: https://ideas.repec.org/p/ags/eaae08/44130.html

[13] M. Maciejczak and T. Filipiak, "Family income from vineyards according to their economic size in selected EU countries," *Journal of Central European Agriculture*, vol. 21, no. 2, pp. 452–460, 2020, https://doi.org/10.5513/JCEA01/21.2.2585.

[14] A. Galindro, M. Santos, C. Santos, A. Marta-Costa, J. Matias, and A. Cerveira, "Wine productivity per farm size: A maximum entropy application," *Wine Economics and Policy*, vol. 7, no. 1, pp. 77–84, Jun. 2018, https://doi.org/10.1016/J.WEP.2018.03.001.

[15] R. F. Townsend, J. Kirsten, and N. Vink, "Farm size, productivity and returns to scale in agriculture revisited: A case study of wine producers in South Africa," *Agricultural Economics*, vol. 19, no. 1–2, pp. 175–180, Sep. 1998, https://doi.org/10.1016/S0169-5150(98)00033-4.

[16] F. Song and X. Xu, "How Operation Scale Improve the Production Technical Efficiency of Grape Growers? An Empirical Evidence of Novel Panel Methods for China's Survey Data," *Sustainability (Switzerland)*, vol. 15, no. 4, Feb. 2023, https://doi.org/10.3390/SU15043694.

[17] M. D. P. Ferreira and J. G. Féres, "Farm size and Land use efficiency in the Brazilian Amazon," *Land use policy*, vol. 99, Dec. 2020, https://doi.org/10.1016/J.LANDUSEPOL.2020.104901.

[18] R. R. B. Khataza, A. Hailu, G. J. Doole, M. E. Kragt, and A. D. Alene, "Examining the relationship between farm size and productive efficiency: a Bayesian directional distance function approach," *Agricultural Economics (United Kingdom)*, vol. 50, no. 2, pp. 237–246, Mar. 2019, https://doi.org/10.1111/AGEC.12480.

[19] M.-J. Chen and D. C. Hambrick, "Speed, Stealth, and Selective Attack: How Small Firms Differ from Large Firms in Competitive Behavior," *The Academy of Management Journal*, vol. 38, no. 2, 1995.

[20] B. Delord, É. Montaigne, and A. Coelho, "Vine planting rights, farm size and economic performance: Do economies of scale matter in the French viticulture sector?," *Wine Economics and Policy*, vol. 4, no. 1, pp. 22–34, 2015, https://doi.org/10.1016/j.wep.2015.03.001.

[21] E. Neves, A. Dias, M. Ferreira, and C. Henriques, "Determinants of wine firms' performance: the Iberian case using panel data," *International Journal of Accounting and Information Management*, vol. 30, no. 3, pp. 325–338, Jun. 2022, https://doi.org/10.1108/IJAIM-10-2021-0203.

[22] R. Sellers and V. Alampi-Sottini, "The influence of size on winery performance: Evidence from Italy," *Wine Economics and Policy*, vol. 5, no. 1, pp. 33–41, Jun. 2016, https://doi.org/10.1016/j.wep.2016.03.001.

[23] A. Urso, G. Timpanaro, F. Caracciolo, and L. Cembalo, "Efficiency analysis of Italian wine producers," *Wine Economics and Policy*, vol. 7, no. 1, pp. 3–12, Jun. 2018, https://doi.org/10.1016/J.WEP.2017.11.003.

[24] Š. Bojnec and I. Fertő, "The growth of farms: a Hungarian-Slovenian comparison," *Postcommunist Econ*, vol. 33, no. 1, pp. 79–93, 2021, Accessed: Dec. 09, 2024. [Online]. Available: https://doi.org/10.1080/14631377.2020.1727265

[25] Ł. Kryszak, M. Guth, and B. Czyżewski, "Determinants of farm profitability in the EU regions. Does farm size matter?," *Agricultural Economics (Czech Republic)*, vol. 67, no. 3, pp. 90–100, 2021, https://doi.org/10.17221/415/2020-AGRICECON.

[26] R. Sellers-Rubio, "Evaluating the economic performance of Spanish wineries," *International Journal of Wine Business Research*, vol. 22, no. 1, pp. 73–84, Mar. 2010, https://doi.org/10.1108/17511061011035215.

[27] A. Figurek, A. Thrassou, D. Vrontis, and A. Figurek, "Economic performance of wine production in EU: a multi-indicator comparative analysis," *J. Global Business Advancement*, vol. 16, no. 1, 2023.

[28] E. Giannakis and A. Bruggeman, "The highly variable economic performance of European agriculture," *Land use policy*, vol. 45, pp. 26–35, May 2015, https://doi.org/10.1016/J.LANDUSEPOL.2014.12.009.

[29] A. Figurek, K. Morphi, and A. Thrassou, "A Sustainable Risk Management Model and Instruments for Young Farmers in EU Agriculture," *Sustainability (Switzerland)*, vol. 16, no. 1, Jan. 2024, https://doi.org/10.3390/su16010283.

[30] M. Fisher, P. A. Lewin, and R. Pilgeram, "Gender differences in the financial performance of U.S. farm businesses: A decomposition analysis using the Census of Agriculture.," *Appl Econ Perspect Policy*, vol. 45, no. 2, pp. 1233–1253, 2023.

[31] Š. Bojnec and L. Latruffe, "Determinants of technical efficiency of Slovenian farms," *Postcommunist Econ*, vol. 21, no. 1, pp. 117–124, 2009, https://doi.org/https://doi.org/10.1080/14631370802663737.

[32] X. Zhu and A. Oude Lansink, "Impact of CAP Subsidies on Technical Efficiency of Crop Farms in Germany, the Netherlands and Sweden," *J Agric Econ*, vol. 61, no. 3, pp. 545–564, 2010, [Online]. Available: https://www.researchgate.net/publication/23508990

[33] L. Strub, A. Kurth, and S. M. Loose, "Effects of viticultural mechanization on working time requirements and production costs," *Am J Enol Vitic*, vol. 72, no. 1, pp. 46–55, Jan. 2021, https://doi.org/10.5344/ajev.2020.20027.

[34] M. Brugarolas, L. Martinez-Carrasco, R. Bernabeu, and A. Martinez-Poveda, "A contingent valuation analysis to determine profitability of establishing local organic wine markets in Spain," *Renewable Agriculture and Food Systems*, vol. 25, no. 1, 2009.

[35] G. Maesano, G. Di Vita, G. Chinnici, G. Pappalardo, and M. D'Amico, "What's in organic wine consumer mind? A review on purchasing drivers of organic wines," *Wine Economics and Policy*, vol. 10, no. 1, pp. 3–21, Jul. 2021, https://doi.org/10.36253/WEP-9101.

[36] H. H. Chang, A. K. Mishra, and T. H. Lee, "A supply-side analysis of agritourism: Evidence from farm-level agriculture census data in Taiwan," *Australian Journal of Agricultural and Resource Economics*, vol. 63, no. 3, pp. 521–548, Jul. 2019, https://doi.org/10.1111/1467-8489.12304.

[37] D. Longhitano and R. Sardone, "Le attività in contoterzi nell'agricoltura italiana: dinamiche recenti e ruolo nella gestione aziendale," *Annuario dell'agricoltura italiana 2015, CREA- Centro politiche e bioeconomia*, 2015.

[38] J. M. . Wooldridge, "Econometric analysis of cross section and panel data," p. 1064, 2010.

[39] M. Tessler, "Multivariate Analysis: Causation, Control, and Conditionality," pp. 87–133, 2023, https://doi.org/10.1007/978-3-031-13838-6_4.

[40] B. B. Nielsen and A. Raswant, "The selection, use, and reporting of control variables in international business research: A review and recommendations," *Journal of World Business*, vol. 53, no. 6, pp. 958–968, Dec. 2018, https://doi.org/10.1016/J.JWB.2018.05.003.

[41] A. Stefano and C. Paolo, "Enhancing micro-enterprises performance: The role of the regional environment," *Strategic Change*, vol. 33, no. 6, pp. 445–461, Nov. 2024, https://doi.org/10.1002/JSC.2596.

[42] R. Sardone, S. De Leo, D. Longhitano, and R. Henke, "The The new CAP and the challenge of sustainability: a synthetic indicator for the Italian wine sector," *Wine Economics and Policy*, vol. 12, no. 1, pp. 63–80, Mar. 2023, https://doi.org/10.36253/WEP-13468.

[43] ISTAT, "6° Censimento generale dell'Agricoltura."

[44] ISTAT, "7° Censimento generale dell'Agricoltura."

[45] S. Mirpanahi, M. Almassi, A. Javadi, and H. bakhoda, "Applying multi-criteria decision making method to analyze stability and mechanization patterns in small farms," *Environmental and Sustainability Indicators*, vol. 20, Dec. 2023, https://doi.org/10.1016/j.indic.2023.100295.

[46] Y. Qiao *et al.*, "Certified Organic Agriculture as an Alternative Livelihood Strategy for Small-scale Farmers in China: A Case Study in Wanzai County, Jiangxi Province," *Ecological Economics*, vol.

145, pp. 301–307, 2018.
[47] A. R. Khanal and A. K. Mishra, "Agritourism and off-farm work: Survival strategies for small farms," *Agricultural Economics (United Kingdom)*, vol. 45, no. S1, pp. 65–76, Nov. 2014, https://doi.org/10.1111/agec.12130.
[48] A. Bruce, E. Neidecker, L. Zheng, I. S. Leslie, and A. Wilhelm, "'A farm is viable if it can keep its head above water': defining and measuring farm viability for small and mid-sized farms," *Agric Human Values*, 2025, https://doi.org/10.1007/s10460-024-10687-9.
[49] M. D'Amico, G. Di Vita, and S. Bracco, "Direct sale of agro-food product: The case of wine in Italy," *Quality - Access to Success*, vol. 15, pp. 247–253, Jan. 2014.

APPENDIX

Variable	All	Large	Medium	Small
Manger Gender	-0.098***	-0.047	-0.064**	-0.054
	(0.22)	(0.041)	(0.025)	(0.036)
Young manager	-0.027	-0.047	0.003	0.096
	(0.024)	(0.038)	(0.027)	(0.070)
UAA property index	-0.154***	-0.063	-0.103***	-0.146**
	(0.023)	(0.039)	(0.029)	(0.051)
EU subsidies	8.69E-06***	5.20E-06***	2e-05***	6.49E-05***
	(0.000)	(0.000)	(0.000)	(0.000)
Mechanization	8.06E-05	3.954E-04***	0.001***	-7.46E-05***
	(0.000)	(0.000)	(0.000)	(0.000)
Diversified production	0.189***	0.110**	0.095*	0.037
	(0.034)	(0.043)	(0.044)	(0.098)
Organic farming	0.117***	0.053	0.123***	0.154*
	(0.024)	(0.034)	(0.033)	(0.062)
Agritourism revenues	1.55E-06***	1.03E-06**	4.53E-06***	1.57E−05***
	(0.000)	(0.000)	(0.000)	(0.000)
Subcontracting	-9.96E-07	-1.46E-06	1.24E-05***	2.82E-05***
	(0.000)	(0.000)	(0.000)	(0.000)
Current liabilities	2.61E-07*	1.85E-07	3.00E-07*	2.22E-06.
	(0.000)	(0.000)	(0.000)	(0.000)
Consolidated liabilities	3.78E-09	-1.22E-09	6.48E-08	-1.32E-07
	(0.000)	(0.000)	(0.000)	(0.000)
Direct sale	0.027*	-0.014	0.041*	0.095**
	(0.013)	(0.019)	(0.018)	(0.037)
Processed products	0.169***	0.178***	0.135***	0.163***
	(0.018)	(0.030)	(0.025)	(0.036)
Altitudinal zone				
Hill	0	0	0	0
Mountain	0.062	-0.106	0.11	0.137
	(0.060)	(0.130)	(0.071)	(0.104)
Plain	0.047	0.038	0.047	0.111*
	(0.025)	(0.041)	(0.031)	(0.055)
Regions				
Abruzzo	0	0	0	0
Alto Adige	0.628***	0.485**	0.615***	0.705***
	(0.088)	(0.182)	(0.107)	(0.157)
Basilicata	0.196*	0.340	0.223*	0.046
	(0.095)	(0.272)	(0.106)	(0.105)
Calabria	0.184	-0.683***	0.288**	0.705***
	(0.104)	(0.119)	(0.106)	(0.193)
Campania	0.241***	0.130	0.184**	0.508***
	(0.055)	(0.142)	(0.059)	(0.085)

(Continued)

Appendix. (Continued).

Variable	All	Large	Medium	Small
Emilia Romagna	0.388***	0.381***	0.496***	0.147
	(0.047)	(0.078)	(0.058)	(0.090)
Friuli Venezia Giulia	0.417***	0.235***	0.438***	0.235*
	(0.041)	(0.072)	(0.049)	(0.101)
Lazio	0.172*	0.079	0.212*	-0.039
	(0.068)	(0.108)	(0.086)	(0.142)
Liguria	0.742***	0.460***	0.924***	0.844***
	(0.060)	(0.126)	(0.101)	(0.079)
Lombardia	0.292***	0.009	0.419***	0.273*
	(0.062)	(0.118)	(0.075)	(0.125)
Marche	0.028	-0.144	0.091	-0.079
	(0.053)	(0.085)	(0.072)	(0.090)
Molise	0.206***	-0.111	0.229***	0.263*
	(0.041)	(0.077)	(0.048)	(0.107)
Piemonte	0.166**	0.086	0.174*	-0.237*
	(0.055)	(0.079)	(0.071)	(0.102)
Puglia	0.459***	0.001	0.524***	0.690***
	(0.042)	(0.081)	(0.050)	(0.082)
Sardegna	0.190***	0.047	0.357***	0.007
	(0.054)	(0.099)	(0.062)	(0.096)
Sicilia	0.118**	-0.099	0.149**	0.193**
	(0.040)	(0.075)	(0.048)	(0.074)
Toscana	0.163***	-0.010	0.112*	-0.105
	(0.043)	(0.068)	(0.056)	(0.120)
Trentino	0.528***	0.194	0.592***	0.788***
	(0.071)	(0.151)	(0.084)	(0.135)
Umbria	0.158***	-0.013	0.103	-0.124
	(0.056)	(0.082)	(0.076)	(0.126)
Valle D'Aosta	0.375***	0.729*	0.538***	0.279*
	(0.088)	(0.315)	(0.113)	(0.128)
Veneto	0.419***	0.253***	0.384***	0.343***
	(0.044)	(0.078)	(0.052)	(0.086)
Economic dimension				
Large	0	-	-	-
Medium	-0.313***	-	-	-
	(0.022)			
Small	-0.676***	-	-	-
	(0.030)			
Observation	17976	5666	9295	3015
Groups	4308	1519	2477	957
R-squared in between	0.4288	0.2140	0.2076	0.3460

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Dias Lopes, L. F., Cardoso da Silva, D. J. & Stefani Teixeira, C. (2025). Innovation capacity of Brazilian wineries: an integrated approach using the fuzzy Delphi and random forest methods. *Wine Economics and Policy* 14(1): 97-116. doi: 10.36253/wep-16737

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Innovation capacity of Brazilian wineries: an integrated approach using the fuzzy Delphi and random forest methods

Luis Felipe Dias Lopes[1]*, Deoclécio Junior Cardoso da Silva[2], Clarissa Stefani Teixeira[3]

[1] *Department of Administrative Sciences, Federal University of Santa Maria, Av. Roraima nº 1000, Cidade Universitária, 74C Building, Camobi, Santa Maria – RS, Brazil, CEP: 97105-900*

[2] *Postgraduate Program in Administration, Federal University of Santa Maria, Av. Roraima n. 1000, Cidade Universitária, 74C Building, Camobi, Santa Maria – RS, Brazil, CEP: 97105-900*

[3] *Department of Knowledge Engineering, Federal University of Santa Catarina, R. Eng. Agronômico Andrei Cristian Ferreira nº s/n, Trindade, Florianópolis – SC, Brazil, CEP: 88040-900*

*Corresponding author. Email: lflopes67@yahoo.com.br

Abstract. The innovation capacity of organizations, particularly in the competitive Brazilian wine industry, plays a pivotal role in their performance and competitiveness. This study aimed to identify and validate metrics for assessing the innovation capacity of Brazilian wineries through a two-stage research process. Initially, a systematic literature review was conducted using Scopus and Web of Science databases. This phase was followed by a quantitative analysis involving 44 Brazilian winery managers, utilizing the Fuzzy Delphi and random forest methods to validate and prioritize the dimensions and indicators of innovation capacity. Out of 88 potential indicators spanning eight dimensions, 50 were confirmed as validated through the Fuzzy Delphi method, as their defuzzified values exceeded the predetermined cutoff threshold. Research and development, product and service innovation, and sustainability and environmental initiatives emerged as the most critical dimensions, collectively representing over half of the innovation capacity in the wineries. Additional significant, albeit less dominant, dimensions included customer feedback and relationships, emphasizing the importance of consumer engagement, and process efficiency, highlighting the significance of operational effectiveness. While not as prominently, employee engagement and training, strategic collaboration, and market adaptation and diversification were identified as essential for sustained innovation. This research provides strategic metrics to enhance the competitiveness and sustainability of Brazilian wineries.

Keywords: innovation, competitiveness, sustainability, research and development, viticulture.

1. INTRODUCTION

The concept of innovation has evolved to encompass elements from all stages of the knowledge production chain, promoted as an essential tool for addressing national challenges. This perspective on innovation, bolstered by policies that extend beyond economic viewpoints, emphasizes its significance [1]. Innovation capacity (IC) has risen to prominence for its role in decision-making and strategy implementation, markedly influencing organizational performance [2]. Research conducted by Kamal et al. [3] suggests that IC is vital for harnessing the relationship between radical innovation and performance, highlighting the critical role of IC in facilitating radical innovation. Furthermore, IC is instrumental in sustainable growth as it enables the integration of various organizational components and their linkage to outcomes in product, process, market, and organizational innovations [4–6].

At the organizational level, IC is shaped by strategy, leadership, structure, systems, and culture [7]. It signifies an organization's capability to develop new or enhanced products and knowledge [8]. Thus, evaluating IC is crucial, given the uncertain and complex nature of innovation processes, which necessitates accurate measurement methods to ensure alignment with innovation goals [9]. Studies have developed methods to evaluate IC in industrial clusters, small and medium-sized enterprises (SMEs), and the role of IC in promoting sustainability [10–13].

Nevertheless, metrics specific to certain contexts, such as the winery sector in emerging economies such as Brazil, are limited [14]. However, while the concept of IC has been explored in various industrial contexts, there remains a notable gap in metrics tailored for sector-specific challenges, particularly for industries in emerging economies. The Brazilian wine sector exemplifies this need, as it faces unique barriers related to climate adaptation, resource sustainability, and regional market dynamics that are not fully addressed by existing IC frameworks [15].

As of 2023, Brazil ranks as the 15th largest wine producer globally, with the southernmost state of Rio Grande do Sul accounting for approximately 62.41% of the country's production. This demonstrates its established dominance in the vitiviniculture sector, supported by favorable climatic conditions and advanced production techniques [18,19]. While the southern region leads in production, the southeastern and northeastern regions of Brazil are becoming increasingly prominent, showcasing significant potential for growth.

The southeastern region, particularly in states such as São Paulo and Minas Gerais, has demonstrated potential through the adoption of innovative logistical practices, including postponement strategies that enhance production efficiency and responsiveness to market demands [20,21]. Meanwhile, the northeastern region, characterized by its unique terroir and the capability to produce high-quality wines under tropical conditions, offers opportunities for expanding Brazil's wine diversity and competitiveness in niche markets [22]. These developments underscore the increasing diversification of Brazil's wine production landscape, contributing to its growing prominence on the global stage. The industry faces challenges related to climate change, sustainability, and domestic and international competition [23].

This study explores how to evaluate the innovation capacity of Brazilian wineries to identify and validate metrics for IC assessment, uncover the best practices, challenges, and innovations within the sector [24]. Few studies have focused on IC in the winery context, highlighting the significance of this research [25]. This study is also socially relevant as it supports family farming-based companies, creates employment, and enhances rural product value, contributing to the economic and social resilience of wine-producing areas [26–28]. Furthermore, it enriches the literature on innovation management by offering empirical and theoretical insights into winery innovation dynamics [14,29].

2. THEORETICAL FOUNDATION

2.1 The wine industry and innovation capacity

The wine industry is a significant agricultural sector, contributing to the economy and sustainability, with the global wine market's revenue projected to reach approximately 175.9 billion dollars by 2024 [21,31]. In Brazil, the wine industry is mainly concentrated in the southern region, representing about 73% of the nation's planted area and producing around 951,000 tons of grapes in 2021 [17]. Innovation in wineries transcends internal efforts, stemming from collaborations with stakeholders [31].

Innovation is a multidimensional concept that has been explored through various theoretical frameworks. For instance, Schumpeter (1947) [32] defines innovation as conducting activities in a novel way, while Garcia and Calantone (2002) [33] emphasize that innovation is not solely about the product itself but also about the social context that enables its commercialization. Similarly, Crossan and Apaydim (2010) [34] argue that innovation encompasses how a product is delivered, marketed, and produced. These perspectives provide distinct yet complementary insights into the concept of innovation.

When considering open innovation – defined as the internal and external use of knowledge to accelerate the innovation process [35] – the Triple Helix Model, proposed by Leydesdorff and Etzkowitz [36], emerges as a key theoretical framework. This model highlights the interactions between universities, industries, and governments as central drivers of innovation. It posits that innovation does not result solely from linear processes within a single organization but instead emerges from dynamic, collaborative networks that integrate knowledge creation, technological advancements, and political support.

In the context of wineries, the Triple Helix Model is particularly relevant, as partnerships with research institutions foster technological advancements in viticulture and oenology, thereby enhancing innovation capacity and competitive advantage. Innovation capacity, a critical factor for improving organizational performance [37], is influenced not only by technological progress but also by the ability to adapt to market demands and customer expectations. Engaging in innovative practices and collaborating with complementary entities strengthen wineries' value propositions by addressing technological, environmental, and market challenges [38,39].

Furthermore, the ability to innovate relies on an organization's internal competencies and its capacity to overcome inherent limitations. This includes the development of new products or services, as well as fostering customer readiness to adopt these innovations [40]. The Triple Helix Model also underscores the importance of government policies in establishing an environment conducive to innovation, which is crucial for the growth, sustainability, and global competitiveness of wineries. By applying this model to assess innovation processes, a holistic perspective emerges – aligning organizational practices with systemic drivers of innovation and emphasizing the strategic significance of cross-sector collaboration.

Karagiannis and Metaxas [41] noted the importance of government support and collaboration between wineries and research institutions, including tax incentives, research and development funding, and training programs. Measuring innovation performance in the wine industry is challenging due to its unique attributes, which often result in expensive data collection and analysis [24]. Nevertheless, addressing these challenges is essential, as innovation significantly impacts marketing, sustainability, and product and service offerings [42-44]. It is key to fulfilling consumer demands, achieving competitiveness and sustainability, and ensuring wineries' development and survival, as positive innovation capacity positively influences business performance [41,45-47].

2.2 Dimensions and Indicators of Innovation Capacity

Innovation in the wine industry can be effectively assessed through a structured approach that includes specific dimensions and their corresponding indicators. These dimensions encompass key aspects of innovation, such as Research and Development, Strategic Collaboration, Employee Training and Engagement, Process Efficiency, Product and Service Innovation, Sustainability and Environmental Initiatives and Customer Feedback and Relationship. Each of these dimensions is essential for measuring innovation capacity and reflects the unique challenges and opportunities within the wine industry. This framework of dimensions and indicators provides a comprehensive approach to assessing innovation capacity tailored to the wine industry.

3. MATERIAL AND METHODS

This section outlines the methods and criteria employed to analyze the innovation capacity dimensions of Brazilian wineries. The qualitative and quantitative study is based on a systematic literature review and a scale assessing the importance of various dimensions and indicators according to winery specialists [48-50]. The data collection and analysis were conducted in two stages, as depicted in Figure 1.

The initial stage commenced with a systematic literature review utilizing the Scopus and Web of Science databases, employing the search strings: ((“Innovation capacity” OR “Innovation capability”) AND (“SME*” OR “small* business*” OR “medium company*” OR “small and medium enterprise*” OR “medium business*” OR “small company*”)).This review yielded 3,222 articles, from which 193 were chosen based on their classification in the Q1 and Q2 quartiles, denoting the top 50% of most cited articles from high-impact journals according to the Scimago rankings. Subsequently, 67 articles focusing on small and medium enterprises were selected for further analysis.

This process identified key dimensions and innovation capacity indicators pertinent to wineries, establishing a solid theoretical foundation. Analysis of these articles revealed 88 indicators across nine dimensions: research and development (R&D) with 16 indicators, strategic collaborations (SC) with 6 indicators, employee training and engagement (ETE) with 8 indicators, process efficiency (PE) with 16 indicators, product/service innovation (P/SI) with 16 indicators, sustainability and environmental initiatives (SEI) with 9 indicators, market adaptation and diversification (MAD) with 6 indicators, and customer feedback and relationship (CFR) with 11 indicators.

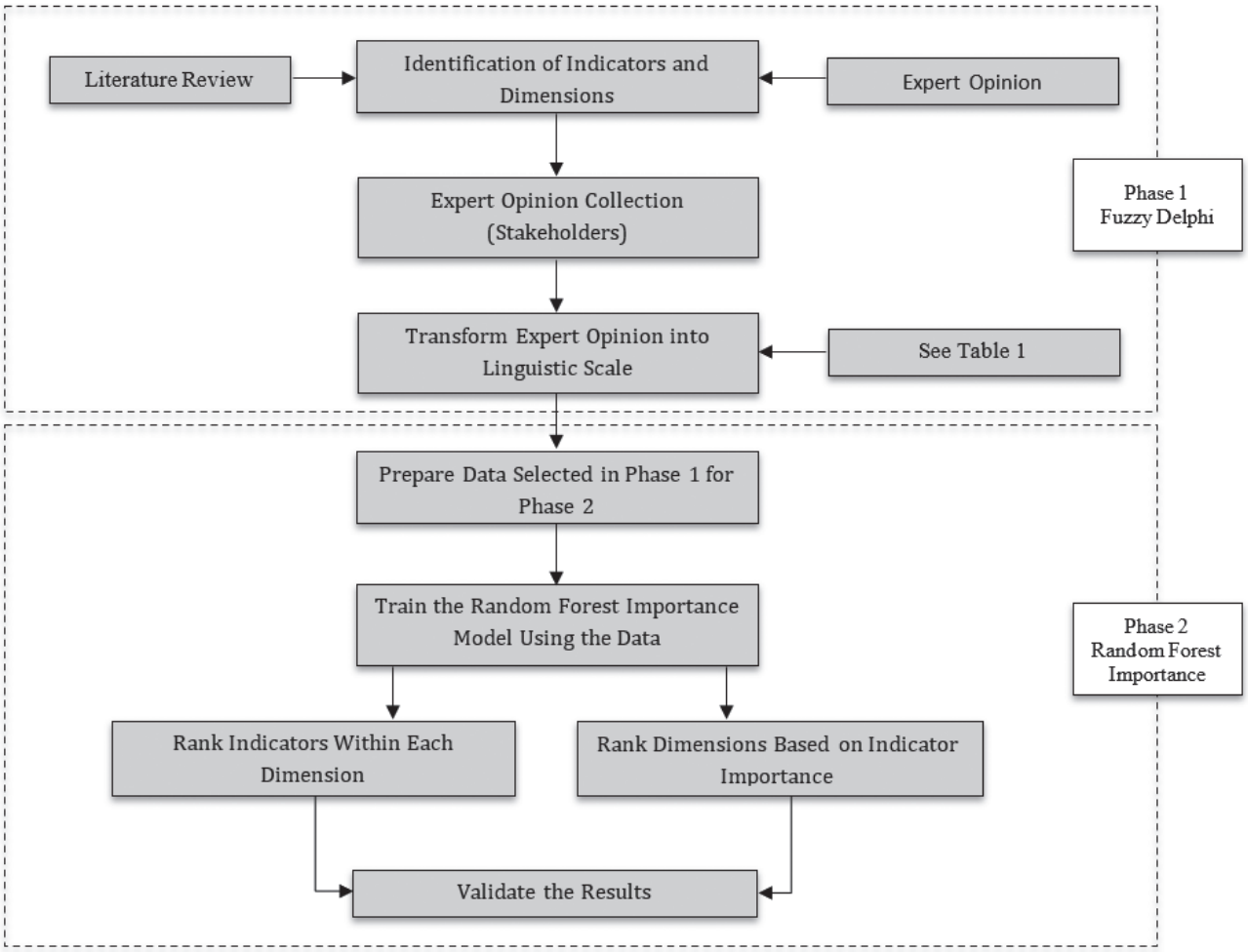


Figure 1. Proposed framework based on Fuzzy Delphi and Random Forest Importance.

The first step's second stage was the validation of these indicators and dimensions using the Fuzzy Delphi method, informed by responses from 44 experts comprising winery managers. Data were collected via in-person and online questionnaires through Google Forms, ensuring participant anonymity to protect privacy. The study adhered to ethical standards, providing a consent form outlining the research objectives and the voluntary nature of participation. An ethical approval certificate was obtained from the Research Ethics Committee (CAAE no. 53139921.0.0000.5346).

3.1 Validation of indicators using the Fuzzy Delphi method

As previously mentioned, to validate the indicators within their respective dimensions, responses from 44 experts were utilized, employing the Fuzzy Delphi method for analysis. The Fuzzy Delphi method is a technique derived from the traditional Delphi method, first developed by Dalkey & Helmer (1963) [51], which has been used to gather information through a systematic feedback process from experts [52].

The Delphi technique is a methodology used to achieve consensus among experts, applied in contexts where specialized knowledge and collective opinion are relevant for decision-making [53]. It should be noted that since its creation, the method's intent is to help establish a consensus among different opinions – in this case, those of winery experts – to define the most accurate decision within a group (dimensions) as decision-makers [54,55].

Ishikawa et al. (1993) [56] proposed the Fuzzy Delphi method to address the uncertainty present in data collection based on human opinion, utilizing Max and Min values. This method resulted in improvements regarding the number of iterations required by the traditional Delphi method, as well as savings in time and

costs. Since its development, the method has been used to define and validate innovation capacity indicators through expert feedback, identifying and prioritizing the most relevant indicators for measuring innovation in different organizational contexts [57].

To apply the Fuzzy Delphi method, specific calculations are required, involving the manipulation of data obtained through the systematic collection of information from experts. These calculations are inherent to the process of aggregating opinions and modeling the uncertainty associated with the subjective evaluations of the experts [58]. Based on the research of Singh & Sarkar (2020) [59] and Mabrouk (2021) [60], the Fuzzy Delphi method includes the following phases:

1. *Development of indicators*: Initially, 88 indicators were identified from the literature, subdivided into 9 dimensions.
2. *Data collection and expert judgments*: The experts, characterized by winery managers, were tasked with evaluating the importance of the indicators related to their respective dimensions. Each respondent used the linguistic scale presented in Table 1.

After collecting the experts' judgments, the linguistic variables are converted into triangular Fuzzy numbers for $\widetilde{a_{ij}} = (a_{ij}, b_{ij}, c_{ij})$ for $i = 1, 2,..., n$ & $j = 1, 2, 3,..., m$, where: $\widetilde{a_{ij}}$ represents the importance of the i-th indicador do j-th expert, n indicates the number of indicators, and mmm denotes the number of experts.

The Fuzzy weights of the barriers ($\tilde{a}_j$) are described as follows:

$$\tilde{a}_j = \left(a_j = \{a_{ij}\}; b_j = (\Pi_i^n b_{ij})^{\frac{1}{n}}; c_j = \max\{c_{ij}\}\right) \quad (1)$$

Next, defuzzification is performed using the center of gravity method proposed by Hsu et al. (2010) [61].

$$D_i = \frac{a_j+b_j+c_j}{3}, j = 1, 2, 3, \ldots, n \quad (2)$$

To determine the cutoff point, the threshold was established by comparing the weight of the indicator with the threshold $\tilde{a}$, where the weight of $\tilde{a}$ is calculated by averaging the weights of all the indicators $\widetilde{a_j}$. This procedure follows the methodology adopted by Bouzon et al. (2016) [62], where the inclusion and exclusion principles are as follows: if $\widetilde{a_j} \geq \tilde{a}$ the indicator j is included, and if $\widetilde{a_j} < \tilde{a}$ the indicator j is excluded.

It is important to note that $\widetilde{a_j}$ and $\tilde{a}$ are combined Fuzzy sets, and therefore it is necessary to transform them into crisp values to make comparisons (equation 3).

$$x_{ij} = \frac{[(u_{ij}-l_{ij})+(m_{ij}-l_{ij})]}{3} + l_{ij} \quad (3)$$

The method presented is appropriate for the data, as it allows for the validation of indicators to compose the model and assess the innovation capacity of Brazilian wineries. This method has proven effective in several studies in the field of innovation, which used the technique to define and validate performance indicators [63-65].

It is worth noting that this method was implemented using a Python algorithm developed by the authors. The result is in the Appendix (supplementary material). Following the validation, the second phase began (Table 4), applying the Random Forest Importance (RFI) technique to generate importance weights for the dimensions and indicators.

Table 1. Linguistic terms and corresponding triangular Fuzzy numbers for the five-point Likert scale.

Linguistic Variable	Value	Corresponding Triangular Fuzzy Numbers
Extremely unimportant	1	(0.1, 0.1, 0.3)
Unimportant	2	(0.1, 0.3, 0.5)
Indifferent	3	(0.3, 0.5, 0.7)
Important	4	(0.5, 0.7, 0.9)
Extremely Important	5	(0.7, 0.9, 0.9)

Source: Singh & Sarkar (2020).

3.2 Ranking of dimensions using the Random Forest Importance (RFI) technique

To create the ranking of dimensions based on the indicators validated by the Fuzzy Delphi method, a Machine Learning algorithm was developed in Python, specifically using the Random Forest Importance (RFI) technique [66]. This technique aims to provide accurate and reliable predictions while robustly calculating the importance of the dimensions. The use of the RFI technique to calculate the degree of importance of dimensions has proven extremely effective in various research areas and practical applications [67-69]. The technique is valued for its ability to provide an interpretable degree of importance for dimensions, which is highly relevant for data-driven analysis and decision-making.

Based on the research of Li (2021) [70] and Mizumoto (2023) [71], the RFI technique follows these procedures: To construct the decision tree, bootstrapping (sampling with replacement) is required, where each tree is trained on a random subset of the training data; node splitting is then applied, where the best split point for each node is selected to minimize impurities [Gini impurity (Equation 4) and impurity reduction (Equation 5)].

$$Gini(t) = 1 - \sum_{i=1}^{D} p_i^2 \quad (4)$$

where:
t: decision tree node containing a subset of winery experts;
D: total number of dimensions;
p_i: proportion of indicators belonging to dimension *i* in node *t*.

$$\Delta I_t = I(t_{parent}) - p_L I(t_L) - p_R I(t_R) \quad (5)$$

meaning:
ΔI_t: Impurity reduction at node *t*;
I(t): Impurity of node t (calculated by Gini);
t_{parent}: Parent node before the split;
t_L: Left child node after the split;
t_R: Right child node after the split;
p_L: Proportion of indicators going to the left child node t_L;
p_R: Proportion of indicators going to the right child node t_R.

The importance of the indicators is calculated by the average impurity reduction, while the importance by dimension is given by the sum of the indicator importance:

$$Import(Ind)_j\% = \frac{Import(Ind)_j}{\sum Import(Ind)_k}; \quad (6)$$

$$Import(Dim)_k = \sum_{j \in Dim_k} Import(Ind)_j; \quad (7)$$

where:
N_{tree}: the number of decisions trees;
T_j: sets of nodes in tree *j*;
p_t: proportion of samples that pass-through node *t*.

Both the importance of the indicators (Equation 8) and the importance of the dimensions (Equation 9) will be evaluated in relation to the total, that is, the relative importance:

$$Import(Ind)_j\% = \frac{Import(Ind)_j}{\sum Import(Ind)_k}; \quad (8)$$

$$Import(Dim)_m\% = \frac{Import(Dim)_m}{\sum Import(Dim)_n} \quad (9)$$

where ***j*** is the indicator, ***k*** is the number of indicators, ***m*** is the dimension, and ***n*** is the number of dimensions.

To ensure the reliability and generalizability of the Random Forest Model in evaluating innovation indicators, a cross-validation process was implemented using 5-fold cross-validation. This method, as noted in the literature [72], mitigates overfitting and assesses performance by dividing the dataset into ***k*** folds, iteratively training on ***k–1*** folds, and testing on the remaining one. For each fold, ***i***, the accuracy was computed as follows:

$$Accuracy_i = \frac{Correct\ Predictions\ in\ Fold_i}{Total\ Predictions\ in\ Fold_i}; \quad (10)$$

The mean accuracy and standard deviation were calculated to assess the overall predictive performance of the model.

$$Mean\ Accuracy = \frac{\sum_{i=1}^{k} Accuracy_i}{k}; \text{ and} \quad (11)$$

$$Standard\ Deviation = \sqrt{\frac{\sum_{i=1}^{k} (Accuracy_i - Mean\ Accuracy)^2}{k-1}} \quad (12)$$

where *k* represents the number of folds.

For a detailed explanation of the data analysis methods, including specific formulas, steps, and their application in this study, please refer to the supplementary material provided in the Appendix. This material encompasses Python algorithms used for implementing the Fuzzy Delphi and Random Forest Importance methods, as well as additional results and sensitivity analyses.

4. RESULTS

4.1 Identification of dimensions and innovation capacity indicators

Table 2, summarizes the dimensions and indicators along with supporting literature.

The detailed presentation of the validated dimensions and indicators establishes both a theoretical and a practical foundation for subsequent analysis. This analysis focuses on the validation and prioritization of these elements through the use of the Fuzzy Delphi and Random Forest methods.

4.2 Data collection and analysis

In this stage, 44 managers/experts contributed to the validation and prioritization of indicators and dimensions, as outlined in Table 3.

4.3 Validation and ranking of the dimensions and indicators using the Fuzzy Delphi method and Random Forest Importance

Stage 1 commenced with the Fuzzy Delphi method to evaluate the relevance of each indicator for measuring

Table 2. Dimensions and key indicators of innovation capacity in the wine industry.

Dimension	Description of Dimension	Key Indicators	Supporting Authors
Research and Development	Research and Development refers to the deliberate efforts of an organization to create new or improved products	Number of R&D projects, partnerships, R&D budget %	Engelmann (2024) [73]; Doloreux & Lord-Tarte (2013) [74]; Alonso & Bressan (2014) [75]
Strategic Collaboration	Ability to form partnerships that enhance innovation and competitiveness	Number of partnerships, partnership satisfaction	Alonso & Bressan (2016) [75]; Corvello et al. (2023) [76]; Presenza et al. (2017) [77]
Employee Training and Engagement	Organizational structure and culture that foster employee participation and motivation	Training hours, promotion rates, job satisfaction	Deci & Ryan (2000) [78]; Rampa & Agogué (2021) [79]; Sánchez-García et al. (2023) [80]
Process Efficiency	Focuses on optimizing processes to reduce waste and improve resource utilization	Production cycle time, waste rate, energy efficiency	Alonso & Bressan (2014) [75]; Awogbemi et al. (2022) [81];
Product and Service Innovation	Creation of new products or enhancement of existing offerings	Number of new products, revenue from new products	Batistella et al. (2023) [82]; Castro et al. (2024) [83]
Sustainability and Environmental Initiatives	Adoption of eco-friendly practices to reduce environmental impact	Renewable energy use, emissions reduction, sustainable practices investment	Alonso & Bressan (2014) [75]; Kelley et al. (2022) [84]; Montalvo-Falcón et al. (2023) [85]
Market Adaptation and Diversification	Expansion into new markets and adaptation to changing consumer demands.	Number of new markets, revenue diversity, wine tourism	Alonso et al. (2023) [86]; Masset & Weisskopt (2024) [87]
Customer Feedback and Relationship	Importance of engaging with customers to inform innovation and foster loyalty	Customer satisfaction, retention rate, number of interactions	Mastroberardino et al. (2022) [88]; Cholez et al. (2023) [89];

Table 3. Absolute and relative frequencies of sociodemographic variables (n = 44).

Variables	Categories	n	%
State	Rio Grande do Sul (RS)	20	45.4
	Santa Catarina (SC)	8	18.2
	Paraná (PR)	8	18.2
	Sergipe (SE)	8	18.2
Level of education	Graduate education	3	6.8
	Higher education	36	81.8
	High school education	5	11.4
Age range (years)	18-35	12	27.3
	36-55	28	63.6
	> 55	4	9.1
Time in the role (years)	≤ 5	24	54.5
	6-10	11	25.0
	> 10	9	20.5

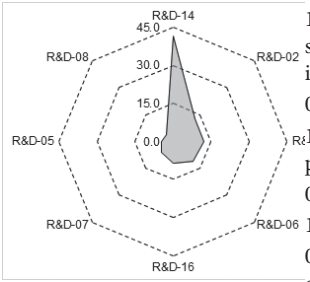
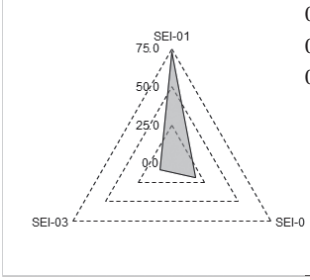
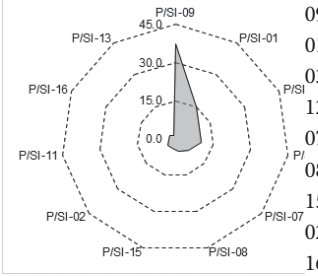
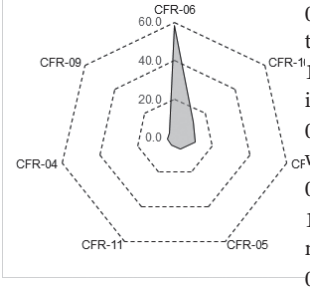
innovation capacity in wineries. This assessment led to the exclusion of 38 indicators from various dimensions due to experts' evaluations: 8 from R&D, 3 from SC), 4 from ETE, 5 from PE, 5 from P/SI, 6 from SEI, 3 from MAD, and 4 from CFR. Consequently, 50 indicators were retained for further analysis in Stage 2, focusing on this capacity.

Details on the elimination of indicators using the Fuzzy Delphi technique can be found in the supplementary material. The validated indicators were then ranked according to the dimensions they belong to, with importance weights assigned using the random forest importance method. The results are depicted in Table 4 and Figure 2.

Analysis of Table 4, as depicted in Figure 2, reveals that the R&D dimension holds the highest significance (22.63%), followed by SEI (15.52%). Conversely, the dimensions deemed least important by experts are SC (4.28%) and MAD (1.60%). The overall mean accuracy of the model is 0.66, with a standard deviation (sd) of 0.173, indicating moderate predictive performance with reasonable consistency across folds in the cross-validation process. A comparative analysis of accuracy between Rio Grande do Sul and other Brazilian states (SC, PR, and SE) was conducted. The mean accuracy for RS was 0.67 (sd = 0.154), compared to 0.64 (sd = 0.172) for the other states.

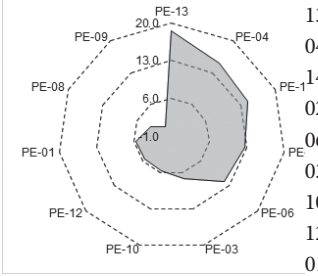
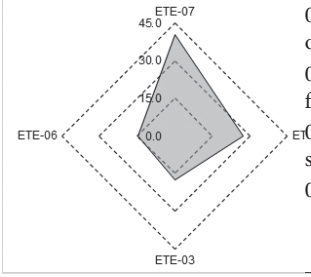
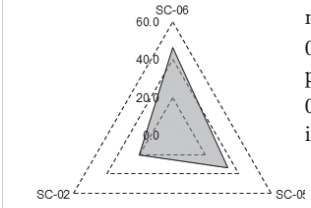
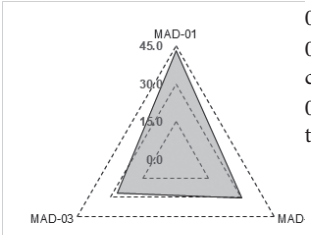
A t-test revealed no significant differences ($p > 0.05$), indicating that both groups have statistically similar accuracies. This demonstrates equivalent sensitivity in evaluating the stability of the rankings, reinforcing the robustness and applicability of the proposed framework across different regional contexts. It is important to rec-

Table 4. Relative importance of dimensions and indicators using the Random Forest Importance Method (Cross-Validation Process).

Dimension	Indicator	Degree of importance (%)		Accuracy	
		Dimension	Indicator	Mean	SD
Research and Development		22.63		0.97	0.174
	14 - Success rate of R&D projects, measured by the number of successfully completed projects relative to the total number of projects initiated		41.51		
	02 - Number of R&D projects executed internally		12.33		
	10 - Number of tests and experiments conducted to validate new ideas or prototypes		12.33		
	06 - Monetary value allocated to internal R&D activities during the year		10.91		
	16 - Number of low-cost innovations implemented (frugal innovations)		8.48		
	07 - Number of funding programs or grants obtained for R&D projects		6.36		
	05 - Number of new products launched		4.55		
	08 - Percentage of the R&D budget in relation to the company's total budget		3.53		
Sustainability and Environmental Initiatives		15.52		0.93	0.177
	01 - Total energy consumption from renewable sources		72.77		
	04 - Percentage of total waste generated that is recycled or reused		18.33		
	03 - Total water consumption per unit of product produced		8.90		
Product and Service Innovation		15.35		0.69	0.175
	09 - Success rate of new products or services based on market acceptance		38,27		
	01 - Number of new services launched		15.50		
	03 - Revenue generated from new products or services		10.81		
	12 - Number of ongoing innovation projects		10.65		
	07 - Cost of developing new products or services		7.28		
	08 - Development time from conception to launch		5.37		
	15 - Number of products or services that meet new consumer needs		4.21		
	02 - Number of significantly improved products or services		3.90		
	16 - Environmental impact of new products or services (sustainability)		2.67		
	13 - Customer feedback on innovations (satisfaction and acceptance)		1.33		
Customer Feedback and Relationship		14.61		0.86	0.240
	06 - Percentage of complaints resolved during the first interaction with the customer		58.44		
	10 - Total number of customer interactions on social media platforms, including comments, likes, and shares		12.48		
	07 - Measure reflecting the likelihood of customers recommending the winery to others		10.66		
	05 - Total number of complaints received within a specific period		6.56		
	11 - Average time the company takes to respond to customer requests, measured in hours or days		4.33		
	04 - Percentage of customers who continue doing business with the winery year after year		3.92		
	09 - Percentage of potential customers (leads) that become buyers		3.61		

(Continued)

Table 4. (Continued).

Dimension	Indicator	Degree of importance (%)		Accuracy	
		Dimension	Indicator	Mean	SD
Process Efficiency		13.75		0.54	0.145
	13 - Number of customer complaints related to product quality		18.45		
	04 - Number of defects or reworks per batch		15.17		
	14 - Percentage of production orders completed without incidents		14.54		
	02 - Production cost per unit		12.75		
	06 - Raw material waste rate		11.80		
	03 - Rate of production capacity utilization		7.11		
	10 - Employee satisfaction index with operational processes		5.73		
	12 - On-time delivery rate		5.44		
	01 - Average production cycle time		4.64		
	08 - Response time to failures or breakdowns		3.33		
	09 - Maintenance cost as a percentage of production cost		1.04		
Employee Training and Engagement		12.26		0.48	0.108
	07 - Percentage of employees participating in engagement activities organized by the company		40.36		
	08 - Frequency and results of performance evaluations that include feedback from peers and supervisors		27.53		
	03 - Percentage of employees who remain with the company for a specified period		17.59		
	06 - Frequency of unexcused absences from work		14.52		
Strategic Collaborations		4.28		0.39	0.145
	06 - Measure of the geographical reach of partnerships, including local, national, and international partners		46.25		
	05 - Analysis of revenue growth directly attributable to established partnerships		33.49		
	02 - Indicators of innovations or process/product improvements introduced in the winery		20.26		
Market Adaptation and Diversification		1.60		0.39	0.194
	01 - Number of new geographic markets or consumer segments reached		43.07		
	05 - Amount invested in research activities to better understand consumer needs and preferences		30.07		
	03 - Total number of different product types or product lines offered by the winery		26.86		

ognize the overlap between certain indicators across different dimensions. For example, Indicator 5 from the R&D dimension and Indicator 1 from the Product and Service Innovation dimension both assess aspects related to the development of new products or services.

Nonetheless, these overlaps were retained based on recommendations from the systematic literature review, ensuring that the dimensions and indicators comprehensively captured the multifaceted nature of innovation capacity. Notably, these indicators were confirmed

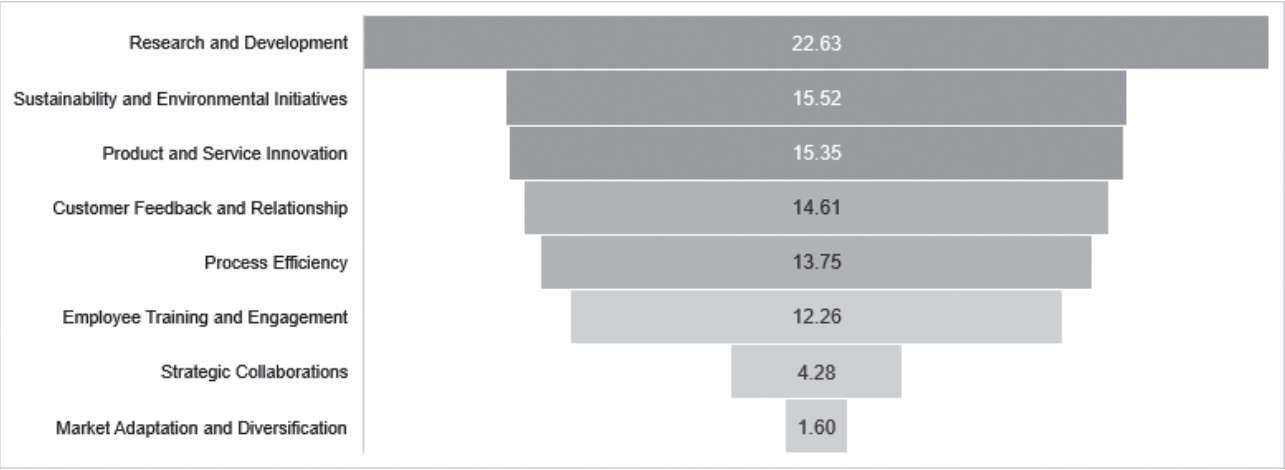


Figure 2. Ranking of the dimensions according to their degree of importance.

during the fuzzy Delphi phase, further validating their relevance within the framework. It is also worth noting that within the R&D dimension, this indicator ranked in position 7 (8.48 degree of importance), while in the Product and Service Innovation dimension, it ranked in position 2 (15.09 degree of importance).

This distinction highlights the perceived greater significance of the indicator for Product and Service Innovation compared to R&D, an observation that should be taken into account when analyzing data and discussing the findings. Such nuances underscore the need for careful interpretation of overlapping indicators to better understand their relative importance within different dimensions and their contribution to the overall framework.

These nuances emphasize the need for a meticulous analysis of the data and findings. Figure 2 illustrates the performance evaluation of the dimensions in assessing innovation capacity, providing a visual representation of their respective roles within the framework.

5. DISCUSSION

The discussion of the results underscores the significance of each dimension in evaluating the innovation capacity of Brazilian wineries. Furthermore, R&D is identified as the most critical factor, accounting for 22.63% of the overall importance. R&D enhances innovation by developing new products, grape varieties, and advanced winemaking techniques. Indicators of R&D capacity include the number of projects, collaborations with research institutions, and budget allocations, which are central to improving product quality and production efficiency, crucial for maintaining competitiveness in the wine sector [73-75,90,91].

Sustainability and environmental initiatives represent 15.35% of the innovation capacity, highlighting the importance of eco-innovation in the industry. Wineries investing in sustainable practices, such as using renewable energy and reducing emissions, appeal to environmentally conscious consumers, thereby enhancing their market image and consumer loyalty. The significance of sustainability in influencing purchasing decisions has already been reported in the literature, making SEI a key factor in innovation [75,88,92].

Product and service innovation accounts for 15.52% importance, emphasizing the adoption of new technologies and procedures to enhance wine quality and production processes, meeting consumer demands and maintaining market differentiation [83,85,93]. As for CFR and PE, they collectively contribute 28.36% to the innovation capacity; CFR constituting 14.61%, highlights the role of strong customer relationships and feedback in guiding innovation and building brand loyalty, with digital tools and wine tourism as strategies for improving customer interactions [88,89,94,95]. PE, constituting 13.75% of the innovation capacity, focuses on operational efficiency through waste reduction and energy efficiency, contributing to sustainability and cost reduction [75,80,96,97].

While EEF, SC, and MAD are considered less critical, with a combined importance of 18.14%, they are essential for sustaining innovation. Hence, EEF boosts employee productivity and creativity [79,98,99], SC enables partnerships that provide new knowledge and markets, and MAD allows for the diversification of offerings and reduces market dependence, ensuring resilience

[76,100]. Overall, this study highlights the interconnectedness of these dimensions in driving the innovation capacity of Brazilian wineries, providing a comprehensive framework for assessing and improving their competitive position in the market.

The integration of emerging technologies, such as artificial intelligence (AI), presents transformative opportunities to enhance wineries' capacity for innovation. AI-driven tools can optimize viticulture processes by analyzing soil conditions, predicting climate impacts, and automating harvest schedules, thereby increasing efficiency and sustainability. For example, predictive analytics can identify optimal planting and harvesting times, reducing waste and improving yield quality. Additionally, AI-powered marketing tools enable wineries to adapt their product offerings based on consumer preferences, leveraging big data to refine strategies and expand market reach.

Beyond operational improvements, these technologies also promote innovation in product development and customer engagement. For instance, machine learning algorithms can analyze global wine trends to identify market gaps, inspiring the creation of unique blends that meet emerging consumer demands. Virtual and augmented reality technologies can enhance wine tourism experiences by providing interactive vineyard tours or immersive narratives about the winemaking process. By adopting these technologies, wineries not only increase their competitive edge but also strengthen their ability to innovate in a rapidly evolving industry landscape.

5.1 Limitations, potential biases in the methodology, and future directions

This study validates metrics for assessing the innovation capacity of Brazilian wineries, emphasizing their relevance for competitiveness and sustainability. Using the Fuzzy Delphi and Random Forest methods, 8 dimensions and 50 key indicators were prioritized, with *R&D*, *Sustainability*, and *Product and Service Innovation* identified as the most influential. Secondary dimensions, such as *Customer Feedback* and *Process Efficiency*, also play significant roles in enhancing operations and fostering customer-centric innovation.

While comprehensive, the study acknowledges certain limitations. First, the regional focus on Rio Grande do Sul may limit the direct applicability of the findings to other regions with differing characteristics. Second, challenges arose during data collection, particularly with managers whose primary focus lies on operational management, potentially constraining the depth of responses. Additionally, despite the robustness of the methodology, potential biases exist, notably the reliance on expert judgments, which may introduce variations influenced by individual experiences and perceptions.

Nevertheless, the findings present a versatile framework that can be adapted to other agricultural and beverage industries, particularly in emerging markets that face similar sustainability and competitiveness challenges. Aligned with global trends, such as sustainable practices, consumer-driven innovation, and digital transformation, this research offers valuable insights to advance innovation strategies across diverse contexts worldwide.

Future research should aim to address these limitations by expanding the scope to include other regions and incorporating a broader range of stakeholders to refine the understanding of innovation dynamics in the wine sector. Employing alternative methods, such as Fuzzy AHP, CRITIC, Shannon Entropy, or Fuzzy DEMATEL, could complement the analysis by assigning importance weights and establishing relationships among dimensions and indicators, thereby providing deeper insights into critical innovation factors.

Furthermore, advanced statistical techniques, such as Principal Component Analysis (PCA) or Factor Analysis, could be applied to validate the proposed dimensions and group indicators. However, these methods would require a larger sample size, enabling broader generalization and applicability of the results to other sectors. Expanding research in this direction would contribute significantly to the evolving discourse on innovation capacity and its role in organizational competitiveness and sustainability.

6. FINAL CONSIDERATIONS

The research aimed to identify and validate metrics for assessing the innovation capacity of Brazilian wineries. It developed a comprehensive framework that includes multiple dimensions vital for the competitiveness and sustainability of the sector. Key dimensions identified were R&D, sustainability and environmental initiatives, and product and service innovation. These dimensions play a crucial role in enhancing product quality and operational efficiency.

Investment in R&D enables wineries to innovate in viticulture and winemaking, leading to new grape varieties, wine types, and more efficient production processes. Consequently, this supports product diversification and differentiation, establishing a unique market identity and boosting competitiveness. Sustainability initiatives, such as using renewable energy and recycling, appeal to envi-

ronmentally conscious consumers, allowing wineries to enhance their public image and attract eco-friendly customers. Incorporating product and service innovation with sustainable practices helps wineries stay competitive and contribute to environmental protection.

Furthermore, our findings also highlight the significance of intermediate dimensions, such as customer feedback and relationships and process efficiency, in driving customer-centric innovation and maintaining operational efficiency. These dimensions facilitate continuous improvement through customer insights, which are essential for retaining loyalty, adapting to evolving consumer preferences, and ensuring cost-efficient production processes. Although receiving less emphasis, dimensions such as employee engagement and training, strategic collaborations, and market adaptation and diversification are equally critical for fostering a robust innovation ecosystem. Neglecting these aspects could compromise wineries' resilience and adaptability to dynamic market conditions.

The methodologies employed in this study – specifically the Fuzzy Delphi and Random Forest Importance techniques – demonstrate significant relevance in assessing innovation capacity. By combining expert validation with machine learning-based prioritization, these methods provide a rigorous and adaptable framework for identifying and evaluating key innovation indicators. Their flexibility enables application across sectors and regions, offering valuable insights into strategic innovation practices beyond the wine industry.

This methodological approach ensures both rigor and practical applicability, contributing to the development of actionable metrics that guide decision-makers in enhancing organizational competitiveness and sustainability. Moreover, these techniques validate dimensions and indicators tailored to the wine industry, establishing a solid foundation for future research. Managers can leverage these insights to refine innovation strategies and enhance competitive performance, while policymakers can utilize the findings to inform innovation policies and foster sustainable development across industries.

Future research should incorporate longitudinal analyses to evaluate the long-term sustainability of innovations. Additionally, exploring the role of emerging technologies, such as artificial intelligence and the Internet of Things (IoT), in driving innovation within the wine sector is recommended. While this study focuses on Rio Grande do Sul, future investigations should extend to other Brazilian states and emerging viticulture regions worldwide to achieve a more comprehensive understanding of innovation challenges and opportunities in the global wine industry.

ACKNOWLEDGMENTS

This study was supported by the National Council for Scientific and Technological Development (CNPq) and the Research Support Foundation of the State of Rio Grande do Sul (FAPERG). We would also like to thank Atlas Assessoria Linguística for language editing.

REFERENCES

[1] D. Meissner, W. Polt, and N. S. Vonortas, "Towards a broad understanding of innovation and its importance for innovation policy," Journal of Technology Transfer, vol. 42, no. 3, pp. 1184-1211, 2017, https://doi.org/10.1007/s10961-016-9485-4.

[2] A. E. Akgün, M. Cemberci, and S. Kircovali, "The relationship between extreme contexts, organizational change capacity, and firm product and process innovation," Management Decision, vol. 61, no. 7, pp. 2140-2172, 2023, https://doi.org/10.1108/MD-06-2022-0856.

[3] E. M. Kamal, E. C. Lou, and A. M. Kamaruddeen, "Effects of innovation capability on radical and incremental innovations and business performance relationships," Journal of Engineering and Technology Management, vol. 67, p. 101726, 2023, https://doi.org/10.1016/j.jengtecman.2022.101726.

[4] M. Z. Arshad, D. Arshad, H. Lamsali, A. S. I. Alshuaibi, M. S. I. Alshuaibi, G. Albashar, A. Shakoor, and L. F. Chuah, "Strategic resources alignment for sustainability: The impact of innovation capability and intellectual capital on SME's performance. Moderating role of external environment," Journal Cleaner Production, vol. 417, 2023, https://doi.org/10.1016/j.jclepro.2023.137884.

[5] S. Yeşil, and I. F. Doğan, "Exploring the relationship between social capital, innovation capability and innovation," Innovation, vol. 21, no. 4, pp. 506-532, 2019, https://doi.org/10.1080/14479338.2019.1585187.

[6] A. Mendoza-Silva, "Innovation capability: a systematic literature review," European Journal of Innovation Management, vol. 24, no. 3, pp. 707-734, 2021, https://doi.org/10.1108/EJIM-09-2019-0263.

[7] E. L. Daronco, D. S. Silva, M. K. Seibel, and M. N. Cortimiglia, "A new framework of firm-level innovation capability: A propensity–ability perspective," European Management Journal, vol. 41, no. 2, pp. 236-250, 2023, https://doi.org/10.1016/j.emj.2022.02.002.

[8] Y. Zheng, J. Liu, and G. George, "The dynamic impact of innovative capability and inter-firm network on firm valuation: A longitudinal study of biotechnology start-ups," Journal of Business Venturing, vol. 25, no. 6, pp. 593-609, 2010, https://doi.org/10.1016/j.jbusvent.2009.02.001.

[9] V. Boly, L. Morel, and M. Camargo, "Evaluating innovative processes in french firms: Methodological proposition for firm innovation capacity evaluation," Research Policy, vol. 43, no. 3, pp. 608-622, 2014, https://doi.org/10.1016/j.respol.2013.09.005.

[10] C. F. Gohr, M. S. A. Tavares, and S. N. Morioka, "Evaluating the innovation capability of cluster-based firms: a graph-theoretic approach," Journal of Business & Industrial Marketing, vol. 37, no. 7, pp. 1402-1421, 2022, https://doi.org/10.38191/iirr-jorr.24.012.

[11] B. M. Castela, F. A. Ferreira, J. J. Ferreira, and C. S. Marques, "Assessing the innovation capability of small-and medium-sized enterprises using a non-parametric and integrative approach," Management Decision, vol. 56, no. 6, pp. 1365-1383, 2018, https://doi.org/10.1108/MD-02-2017-0156.

[12] B. Lianto, "Identifying key assessment factors for a company's innovation capability based on intellectual capital: an application of the Fuzzy Delphi Method," Sustainability, vol. 15, no. 7, pp. 6001, 2023, https://doi.org/10.3390/su15076001.

[13] H. M. J. C. B. Heenkenda, F. Xu, K. M. M. C. B. Kulathunga, and W. A. R. Senevirathne, "The role of innovation capability in enhancing sustainability in SMEs: An emerging economy perspective," Sustainability, vol. 14, no. 17, p. 10832, 2022, https://doi.org/10.3390/su141710832.

[14] A. Amatucci, V. Ventura, and D. Frisio, "Performance and efficiency of national innovation systems: lessons from the wine industry," Wine Economics and Policy, vol. 13, no. 1, pp. 63-80, 2024, https://doi.org/10.36253/wep-14637.

[15] D. Meissner, W. Polt, and N. S. Vonortas, "Towards a broad understanding of innovation and its importance for innovation policy," Journal of Technology Transfer, vol. 42, no. 3, pp. 1184-1211, 2017, https://doi.org/10.1007/s10961-016-9485-4.

[16] V. A. Castro, M. T. D. D. A. Lourenção, J. D. M. E. Giraldi, and J. H. C. Oliveira, "Creation and implementation of collective brands: an analysis of the Brazilian wine sector challenges," Journal of International Food & Agribusiness Marketing, vol. 35, no. 1, pp. 1-19, 2023, https://doi.org/10.1080/08974438.2021.1924334.

[17] J. Salvagni, C. H. Nodari, and V. Valduga, "Cooperation, innovation and tourism in the grape and wine region, Brazil," Cuadernos de Desarrollo Rural, vol. 17, 2020, https://doi.org/10.11144/Javeriana.cdr17.citg.

[18] L. M. R. de Mello, and C. A. E. Machado, "Vitivinicultura brasileira: panorama 2021, EMBRAPA Uva e Vinho," 2022. Available in: https://ainfo.cnptia.embrapa.br/digital/bitstream/doc/1149674/1/Com-Tec-226.pdf.

[19] T. Panizzon, G. Bircke Salton, V. E. Schneider and M. Poletto, "Identifying Hotspots and Most Relevant Flows for Red and White Wine Production in Brazil through Life Cycle Assessment: A Case Study," Resources, vol. 13, no. 7, pp. 88, 2024, https://doi.org/10.3390/resources13070088.

[20] K. A. Ferreira, M. L. Toledo, and L. F. Rodrigues, "Postponement practices in the Brazilian Southeast wine sector," The International Journal of Logistics Management, vol. 32, no. 1, pp. 6-23, 2020, https://doi.org/10.1108/IJLM-10-2019-0292.

[21] C. R. Gualberto, L. F. Rodrigues, and K. A. Ferreira, "Evaluation of postponement strategy in the production of table wine in Brazil: a discrete event simulation approach," International Journal of Wine Business Research, vol. 33, no. 4, pp. 545-560, 2021, https://doi.org/10.1108/IJWBR-08-2020-0042.

[22] H. L. Lucena Filho, and C. H. B. Leite, "The WIETA Code of Conduct: Proposal for a Complementary Regulatory Model for Labor Relations in Brazilian Vitiviniculture," Beijing Law Review, vol. 14, pp. 1394-1417, 2023, doi:10.4236/blr.2023.143076.

[23] M. Wagner, P. Stanbury, T. Dietrich, J. Döring, J. Ewert, C. Foerster, M. Freund, M. Friedel, C. Kamnann, M. Kock, T. Owtram, H. R. Schultz, K. Voss-Fels and J. Hanf, "Developing a sustainability vision for the global wine industry," Sustainability, vol. 15, no. 13, pp. 10487, 2023, https://doi.org/10.3390/su151310487.

[24] E. Pomarici, A. Corsi, S. Mazzarino, and R. Sardone, "The Italian wine sector: Evolution, structure, competitiveness and future challenges of an enduring leader," Italian Economic Journal, vol. 7, no. 2, pp. 259-295, 2021, https://doi.org/10.1007/s40797-021-00144-5.

[25] A. Dogru, and J. Peyrefitte, "Investigation of innovation in wine industry via meta-analysis," Wine Business Journal, vol. 5, no. 1, pp. 44-76, 2022, https://doi.org/10.26813/001c.31627.

[26] L. Bitsch, B. Richter, and J. H. Hanf, "The competitive landscape in transitioning countries: the example of the Armenian wine industry," Wine Econ Policy, vol. 11, no. 1, pp. 31-45, 2022, https://doi.org/10.36253/wep-10657.

[27] O. R. Kompaniets, "Sustainable competitive advantages for a nascent wine country: an example from southern Sweden," Competitiveness Review: An International Business Journal, vol. 32, no. 3, pp.376-390, 2022, https://doi.org/10.1108/CR-04-2021-0063.

[28] K. R. Curtis, and S. L. Slocum, "Rural winery resiliency and sustainability through the COVID-19 pandemic," Sustainability, vol. 13, no. 18, p. 10483, 2021, https://doi.org/10.3390/su131810483.

[29] C. P. Klinger, E. Silveira-Martins, G. J. D. Castro, and C. R. Rossetto, "Strategic positioning, differentiation and performance of Brazilian wineries," International Journal of Wine Business Research, vol. 32, no. 2, pp. 219-246, 2020, https://doi.org/10.1108/IJWBR-11-2018-0068.

[30] Statista, "Wine – Worldwide," 2024. Available in: https://www.statista.com/outlook/cmo/alcoholic-drinks/wine/worldwide.

[31] M. M. Amaral, L. C. Silva Flores, and S. J. Gadotti dos Anjos, "Analysing Coopetition in the Wine Business Ecosystem: A Literature Review," Value Proposition to Tourism Coopetition: Cases and Tools, pp. 155-170, 2024, https://doi.org/10.1108/978-1-83797-827-420241011.

[32] J. A. Schumpeter, "The creative response in economic history," The journal of economic history, vol. 7, no. 2, pp. 149-159, 1947, https://doi.org/10.1017/S0022050700054279.

[33] R. Garcia, and R. Calantone, "A critical look at technological innovation typology and innovativeness terminology: a literature review," Journal of Product Innovation Management: An international publication of the product development & management association, vol. 19, no. 2, pp. 110-132, 2002, https://doi.org/10.1111/1540-5885.1920110.

[34] M. M. Crossan, and M. Apaydin, "A multi-dimensional framework of organizational innovation: A systematic review of the literature," Journal of management studies, vol. 47, no. 6, pp. 1154-1191. 2010, https://doi.org/10.1111/j.1467-6486.2009.00880.x.

[35] H. W. Chesbrough, "Open innovation: The new imperative for creating and profiting from technology", Harvard Business School, 2003.

[36] L. Leydesdorff, and H. Etzkowitz, "Emergence of a triple helix of university – industry – government relations," Science and Public Policy, vol. 23, no. 5, pp. 279-286, 1996, https://doi.org/10.1093/spp/23.5.279.

[37] B. Marco-Lajara, P. C. Zaragoza-Sáez, J. Martínez-Falcó, and E. Sánchez-García, "Does green intellectual capital affect green innovation performance? Evidence from the Spanish wine industry," British Food Journal, vol. 25, no. 4, pp. 1469-1487, 2023, https://doi.org/10.1108/BFJ-03-2022-0298.

[38] R. Adner, "Ecosystem as structure: An actionable construct for strategy," Journal of Management, vol. 43, no. 1, pp. 39-58, 2017, https://doi.org/10.1177/0149206316678451.

[39] B. Walrave, M. Talmar, K. S. Podoynitsyna, A. G. L. Romme, and G. P. J. Verbong, "A multi-level perspective on innovation ecosystems for path-breaking innovation," Technological Forecasting and Social Change, vol. 136, pp. 103-113, 2018, https://doi.org/10.1016/j.techfore.2017.04.011.

[40] A. Menna, and P. R. Walsh, "Assessing environments of commercialization of innovation for SMEs in the global wine industry: A market dynamics approach," Wine Economics and Policy, vol. 8, no. 2, pp.191-202, 2019, https://doi.org/10.14601/web-8211.

[41] D. Karagiannis, and T. Metaxas, "Sustainable wine tourism development: Case studies from the Greek region of Peloponnese," Sustainability, vol. 12, no. 12, p. 5223, 2020, https://doi.org/10.3390/su12125223.

[42] M. Ingrassia, L. Altamore, S. Bacarella, P. Columba, and S. Chironi, "The wine influencers: Exploring a new communication model of open innovation for wine producers – A netnographic, factor and AGIL analysis," Journal of Open Innovation: Technology, Market, and Complexity, vol. 6, no. 4, pp. 165, 2020, https://doi.org/10.3390/joitmc6040165.

[43] A. Rabadán, and R. Bernabéu, "An approach to eco-innovation in wine production from a consumer's perspective," Journal of Cleaner Production, vol. 310, pp. 127479, 2021, https://doi.org/10.1016/j.jclepro.2021.127479.

[44] I. A. Sorcaru, M. C. Muntean, L. D. Manea, and R. Nistor, "Entrepreneurs' perceptions of innovation, wine tourism experience, and sustainable wine tourism development: the case of Romanian wineries," International Entrepreneurship and Management Journal, vol. 20, no. 2, pp. 901-934, 2024, https://doi.org/10.1007/s11365-023-00918-6.

[45] E. Pomarici, and R. Vecchio, "Millennial generation attitudes to sustainable wine: An exploratory study on Italian consumers," Journal of Cleaner Production, vol. 66, pp. 66:537-545, 2014, https://doi.org/10.1016/j.jclepro.2013.10.058.

[46] G. Di Vita, G. Califano, M. Raimondo, D. Spina, M. Hamam, M. D'Amico, and F. Caracciolo, "From Roots to Leaves: Understanding Consumer Accept-

ance in Implementing Climate-Resilient Strategies in Viticulture," Australian Journal of Grape and Wine Research, vol. 2024, no. 1, p. 8118128, 2024, https://doi.org/10.1155/2024/8118128.

[47] R. Sancho-Zamora, S. Gutiérrez-Broncano, F. Hernández-Perlines, and I. Peña-García, "A multidimensional study of absorptive capacity and innovation capacity and their impact on business performance," Frontiers Psychology, vol. 12, pp. 751997, 2021, https://doi.org/10.3389/fpsyg.2021.751997.

[48] G. A. Bowen, "Document analysis as a qualitative research method," Qualitative Research Journal, vol. 9, no. 2, pp. 27-40, 2009, https://doi.org/10.3316/QRJ0902027.

[49] B. F. Crabtree, and W. L. Miller. "Doing Qualitative Research," SAGE Publications, 1999.

[50] J. W. Creswell, and V. L, "Plano Clark, Designing and Conducting Mixed Methods Research," SAGE Publications, 2017.

[51] N. Dalkey, and O. Helmer, "An experimental application of the Delphi method to the use of experts," Management Science, vol. 9, no. 3, pp. 458-467, 1963, https://doi.org/10.1287/mnsc.9.3.458.

[52] H. Guo, X. Wang, L. Wang, and D. Chen, "Delphi method for estimating membership function of uncertain set," Journal of Uncertainty Analysis and Applications, vol. 4, no. 1, p. 3, 2016, https://doi.org/10.1186/s40467-016-0044-1.

[53] V. W. Mitchell, "The Delphi technique: An exposition and application," Technology Analysis & Strategic Management, vol. 3, no. 4, pp. 333-358, 1991, https://doi.org/10.1080/09537329108524065.

[54] H. F. Sulaiman, Z. Z. Abidin, S. Subramaniam, and A. R. Omar, "Validation of occupational zoonotic disease questionnaire using Fuzzy Delphi method," Journal of Agromedicine, vol. 25, no. 2, pp. 166-172, 2020, https://doi.org/10.1080/1059924X.2019.1666763.

[55] Y. K. Al-Rikabi, and G. A. Montazer, "Designing an e-learning readiness assessment model for Iraqi universities employing Fuzzy Delphi Method," Education and Information Technologies, vol. 29, no. 2, pp. 2217-2257, 2024, https://doi.org/10.1007/s10639-023-11889-0.

[56] A. Ishikawa, M. Amagasa, T. Shiga, G. Tomizawa, R. Tatsuta, and H. Mieno, "The max-min Delphi method and Fuzzy Delphi method via fuzzy integration," Fuzzy Sets and Systems, vol. 55, no. 3, pp. 241-253, 1993, https://doi.org/10.1016/0165-0114(93)90251-C.

[57] A. Padilla-Rivera, S. Russo-Garrido, and N. Merveille, "Addressing the social aspects of a circular economy: A systematic literature review," Sustainability, vol. 12, no. 19, p. 7912, 2020, https://doi.org/10.3390/su12197912.

[58] Y. C. Kuo, and P. H. Chen, "Constructing performance appraisal indicators for mobility of the service industries using Fuzzy Delphi Method," Expert Systems with Applications, vol. 35, no. 4, pp. 1930-1939, 2008, https://doi.org/10.1016/j.eswa.2007.08.068.

[59] P. K. Singh, and P. Sarkar, "A framework based on Fuzzy Delphi and DEMATEL for sustainable product development: A case of Indian automotive industry," Journal of Cleaner Production, vol. 246, p. 118991, 2020, https://doi.org/10.1016/j.jclepro.2019.118991.

[60] N. Mabrouk, "Green supplier selection using fuzzy Delphi method for developing sustainable supply chain," Decision Science Letters, vol. 10, no. 1, pp. 63-70, 2021, https://doi.org/10.5267/j.dsl.2020.10.003.

[61] Y. -L. Hsu, C. -H. Lee, and V. B. Kreng, "The application of Fuzzy Delphi Method and Fuzzy AHP in lubricant regenerative technology selection," Expert Systems with Applications, vol. 37, pp. 419e425, 2010, https://doi.org/10.1016/j.eswa.2009.05.068.

[62] M. Bouzon, K. Govindan, and C. M. T. Rodriguez, "Reducing the extraction of minerals: Reverse logistics in the machinery manufacturing industry sector," Journal Cleaner Production, vol. 112, pp. 3720-3733, 2016, https://doi.org/10.1016/j.resourpol.2015.02.001.

[63] Y. C. Kuo, and P. H. Chen, "Constructing performance appraisal indicators for mobility of the service industries using Fuzzy Delphi Method," Expert Systems with Applications, vol. 35, no. 4, pp. 1930-1939, 2008, https://doi.org/10.1016/j.eswa.2007.08.068.

[64] Z. Ma, C. Shao, S. Ma, and Z. Ye, "Constructing road safety performance indicators using fuzzy Delphi method and grey Delphi method," Expert Systems with Applications, vol. 38, no. 3, pp. 1509-1514, 2011., https://doi.org/10.1016/j.eswa.2010.07.062.

[65] M. L. Tseng, S. X. Li, C. W. R. Lin, and A. S. Chiu, "Validating green building social sustainability indicators in China using the fuzzy Delphi method," Journal of Industrial and Production Engineering, vol. 40, no. 1, pp. 35-53, 2023, https://doi.org/10.1080/21681015.2022.2070934.

[66] L. Breiman, "Random Forests," Machine Learning, vol. 45, no. 1, pp. 5-32, 2001, https://doi.org/10.1023/A:1010933404324.

[67] X. Gao, J. Wen, and C. Zhang, "An improved random forest algorithm for predicting employee turnover," Mathematical Problems in Engineering, vol. 2019, pp. 1-12, 2019, https://doi.org/10.1155/2019/4140707.

[68] A. Mizumoto, "Calculating the relative importance of multiple regression predictor variables using dominance analysis and random forests," Language Learning, vol. 73, no. 1, pp. 161-196, 2023, https://doi.org/10.1111/lang.12518.

[69] L. Yin, B. Li, P. Li, and R. Zhang, "Research on stock trend prediction method based on optimized random forest," CAAI Transactions on Intelligence Technology, vol. 8, no. 1, pp. 274-284, 2023, https://doi.org/10.1049/cit2.12067.

[70] L. Li, "Prediction of coal prices based on random forest and lasso regression," International Core Journal of Engineering, vol. 7, pp. 67-73, 2021, https://doi.org/10.6919/ICJE.202109_7(9).0011.

[71] A. Mizumoto, "Calculating the relative importance of multiple regression predictor variables using dominance analysis and random forests," Language Learning, vol. 23, no. 1, pp. 161-196, 2023, https://doi.org/10.1111/lang.12518.

[72] B. F. Huang, and P. C. Boutros, "The parameter sensitivity of random forests," BMC bioinformatics, vol. 17, pp. 1-13, 2016, https://doi.org/https://doi.org/10.1186/s12859-016-1228-x.

[73] A. Engelmann, "A performative perspective on sensing, seizing, and transforming in small-and medium-sized enterprises," Entrepreneurship Regional Development, vol. 36, no. 5-6, pp. 632-658, 2024, https://doi.org/10.1080/08985626.2023.2262430.

[74] D. Doloreux and E. Lord-Tarte, "The organisation of innovation in the wine industry: open innovation, external sources of knowledge and proximity," European Journal of Innovation Management, vol. 16, no. 2, pp. 171-189, 2013, https://doi.org/10.1108/14601061311324520.

[75] A. D. Alonso and A. Bressan, "Innovation in the context of small family businesses involved in a 'niche' market," International Journal of Business Environment, vol. 6, no. 2, pp. 127-145, 2014, https://doi.org/10.1504/IJBE.2014.060235.

[76] V. Corvello, A. Cimino, and A. M. Felicetti, "Building start-up acceleration capability: A dynamic capability framework for collaboration with start-ups," Journal of Open Innovation: Technology, Market, and Complexity, vol. 9, no. 3, p. 100104, 2023, https://doi.org/10.1016/j.joitmc.2023.100104.

[77] A. Presenza, T. Abbate, M. Meleddu, M., and F. Cesaroni, "Small-and medium-scale Italian winemaking companies facing the open innovation challenge," International Small Business Journal, vol. 35, no. 3, pp. 327-348, 2017, https://doi.org/10.1177/0266242616664798.

[78] E. L. Deci, and R. M. Ryan, "The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior," Psychological Inquiry, vol. 11, no. 4, pp. 227-268, 2000, https://doi.org/10.1207/S15327965PLI1104_01.

[79] R. Rampa, and M. Agogué, "Developing radical innovation capabilities: Exploring the effects of training employees for creativity and innovation," Creativity and Innovation Management, vol. 30, no. 1, pp. 211-227, 2021, https://doi.org/10.1111/caim.12423.

[80] E. Sánchez-García, J. Martínez-Falcó, A. Alcon-Vila, and B. Marco-Lajara, "Developing green innovations in the wine industry: an applied analysis," Foods, vol. 12, no. 6, pp. 1157, 2023, https://doi.org/10.3390/foods12061157.

[81] O. Awogbemi, D. V. V. Kallon, and K. A. Bello, "Resource recycling with the aim of achieving zero-waste manufacturing," Sustainability, vol. 14, no. 8, pp. 4503, 2022, https://doi.org/10.3390/su14084503.

[82] C. Battistella, G. Ferraro, and E. Pessot, "Technology transfer services impacts on open innovation capabilities of SMEs," Technological Forecasting and Social Change, vol. 196, pp. 122875, 2023, https://doi.org/10.1016/j.techfore.2023.122875.

[83] M. Castro, J. Baptista, C. Matos, A. Valente, and A. Briga-Sá, "Energy efficiency in winemaking industry: Challenges and opportunities," Science of the Total Environment, 2024, https://doi.org/10.1016/j.scitotenv.2024.172383.

[84] K. Kelley, M. Todd, H. Hopfer, and M. Centinari, "Identifying wine consumers interested in environmentally sustainable production practices," International Journal of Wine Business Research, vol. 34, no. 1, pp. 86-111, 2022, https://doi.org/10.1108/IJWBR-01-2021-0003.

[85] J. V. Montalvo-Falcón, E. Sánchez-García, B. Marco-Lajara, and J. Martínez-Falcó, "Sustainability research in the wine industry: A bibliometric approach," Agronomy, vol. 13, no. 3, pp. 871, 2023, https://doi.org/10.3390/agronomy13030871.

[86] A. D. Alonso, A. Bressan, O. V. T. Kim, S. K. Kok, and E. Atay, "Integrating tradition and innovation within a wine tourism and hospitality experience," International Journal of Tourism Research, vol. 25, no. 1, pp. 169-182, 2023, https://doi.org/10.1002/jtr.2561.

[87] P. Masset, and J. P. Weisskopf, "From risk to reward: the strategic advantages of diversifying grape varietals," International Journal of Contemporary Hospitality Management, 2024, https://doi.org/10.1108/IJCHM-06-2023-0801.

[88] P. Mastroberardino, G. Calabrese, F. Cortese, and M. Petracca, "Social commerce in the wine sector: an exploratory research study of the Italian market," Sustainability, vol. 14, no. 4, 2024, Doi: 0.3390/su14042024.

[89] C. Cholez, O. Pauly, M. Mahdad, S. Mehrabi, C. Giagnocavo, and J. Bijman, "Heterogeneity of inter-organizational collaborations in agrifood chain sustainability-oriented innovations," Agricultural Systems, vol. 212, p. 103774, 2023, https://doi.org/10.1016/j.agsy.2023.103774.

[90] C. Bopp, R. Jara-Rojas, A. Engler, and M. Araya-Alman, "How are vineyards management strategies and climate-related conditions affecting economic performance? A case study of Chilean wine grape growers," Wine Economics and Policy, vol. 11, no. 2, pp. 61-73, 2022, https://doi.org/10.36253/wep-12739.

[91] J. Martínez-Falcó, B. Marco-Lajara, P. Zaragoza-Sáez, and E. Sánchez-García, "The effect of organizational ambidexterity on sustainable performance: a structural equation analysis applied to the Spanish wine industry," Agribusiness, 2023. https://doi.org/10.1002/agr.21846.

[92] N. D. Chauvin and E. C. Villanueva, "The anatomy of exporting wineries of Argentina," International Journal of Wine Business Research, vol. 36, no. 3, pp. 329-350, 2024, https://doi.org/10.1108/IJWBR-08-2023-0049.

[93] C. Battistella, G. Ferraro, and E. Pessot, "Technology transfer services impacts on open innovation capabilities of SMEs," Technological Forecasting and Social Change, vol. 196, pp. 122875, 2023, https://doi.org/10.1016/j.techfore.2023.122875.

[94] M. P. Prodan, A. Č. Tanković, and N. Ritossa, "Image, Satisfaction, and Continued Usage Intention in Wine Tourism through Digital Content Marketing," Wine Economics and Policy, 2024, https://doi.org/10.36253/wep-15447.

[95] A. Dias, B. Sousa, A. Madeira, V. Santos, and P. Ramos, "Determinants of brand love in wine experiences," Wine Economics and Policy, 2024, https://doi.org/10.36253/wep-13855.

[96] V. Lekics, "Sustainable Innovation in Wine Industry: A Systematic Review," Regional and Business Studies, vol. 13, no. 1, pp. 55-73, 2021, https://doi.org/10.33568/rbs.2817.

[97] R. Padoni, M. Nanetti, A. Bondanese, and S. Rivaroli, "Innovative solutions for the wine sector: The role of startups," Wine Economics and Policy, vol. 8, no. 2, pp. 165-170, 2019, https://doi.org/10.1016/j.wep.2019.08.001.

[98] C. Bopp, R. Jara-Rojas, A. Engler, and M. Araya-Alman, How are vineyards management strategies and climate-related conditions affecting economic performance? A case study of Chilean wine grape growers," Wine Economics and Policy, vol. 11, no. 2, pp. 61-73, 2022, https://doi.org/10.36253/wep-12739.

[99] E. Barbierato, I. Bernetti, and I. Capecchi, "What went right and what went wrong in my cellar door visit? A worldwide analysis of TripAdvisor's reviews of Wineries & Vineyards," Wine Economics and Policy, vol. 11, no. 1, pp. 47-72, 2022, https://doi.org/10.36253/wep-10871.

[100] M. Kumar, M. Pullman, T. Bouzdine-Chameeva, and V. Sanchez Rodrigues, "The role of the hub-firm in developing innovation capabilities: considering the French wine industry cluster from a resource orchestration lens," International Journal of Operations & Production Management, vol. 42, no. 2, pp. 526-551, 2022, https://doi.org/10.1108/IJOPM-08-2021-0519.

SUPPLEMENTARY MATERIAL (APPENDIX)

Table 1. Selection of Innovation Capacity Indicators Using the Fuzzy Delphi Technique.

Dimension	Values		
Indicator	Fuzzy Weight	Defuzzification	Decision
1 - Research and Development			
Decision Value		0.593	
1 - Total number of employees dedicated exclusively to R&D	(0.10, 0.60, 0.90)	0.534	Excludes
2 - Number of R&D projects executed internally	(0.30, 0,74, 0,90)	0.648	Includes
3 - Percentage of R&D activities conducted through external sources in relation to total R&D activities	(0,10, 0,56, 0,90)	0.520	Excludes
4 - Number of R&D projects conducted in collaboration with other companies	(0,10, 0,56, 0,90)	0.553	Excludes
5 - Number of new products launched	(0,30, 0,56, 0,90)	0.634	Includes
6 - Monetary value allocated to financing internal R&D activities during the year	(0,30, 0,56, 0,90)	0.648	Includes
7 - Number of funding programs or grants obtained for R&D projects	(0,30, 0,56, 0,90)	0.647	Includes
8 - Percentage that the R&D budget represents in relation to the company's total budget	(0,30, 0,56, 0,90)	0.644	Includes
9 - Number of prototypes developed for market testing	(0,10, 0,56, 0,90)	0.546	Excludes
10 - Number of tests and experiments conducted to validate new ideas or prototypes	(0,30, 0,56, 0,90)	0.639	Includes
11 - Number of market studies conducted to guide R&D activities	(0,10, 0,56, 0,90)	0.572	Excludes
12 - Monthly frequency of systematic brainstorming sessions or other idea generation techniques	(0,10, 0,56, 0,90)	0.523	Excludes
13 - Number of analyses conducted to understand the technological and competitive environment	(0,10, 0,56, 0,90)	0.558	Excludes
14 - R&D project success rate, measured by the number of successfully completed projects in relation to the total number of projects initiated	(0,30, 0,56, 0,90)	0.640	Includes
15 - Number of patents or intellectual property registrations applied for	(0,10, 0,56, 0,90)	0.558	Excludes
16 - Number of low-cost innovations implemented (frugal innovations)	(0,30, 0,56, 0,90)	0.626	Includes
2 - Strategic Collaborations			
Decision Value		0.610	
1 - Number of formal partnerships the winery maintains with other companies, research institutions, distributors, or local producers	(0.10, 0.75, 0.90)	0.583	Excludes
2 - Indicators of innovations or process/product improvements introduced in the winery	(0.30, 0.75, 0.90)	0.651	Includes
3 - Level of satisfaction of the winery with each of its strategic partners, usually through surveys or direct feedback	(0.10, 0.74, 0.90)	0.580	Excludes
4 - Average duration in months that strategic partnerships are maintained	(0.10, 0.67, 0.90)	0.556	Excludes
5 - Analysis of revenue growth directly attributable to established partnerships	(0.30, 0.69, 0.90)	0.632	Includes
6 - Measure of the geographical reach of partnerships, including local, national, and international partners	(0.30, 0.77, 0.90)	0.656	Includes
3 - Employee Training and Engagement			
Decision Value		0.560	
1 - Number of employees participating in training programs relative to the total number of employees	(0.10, 0.62, 0.90)	0.539	Excludes
2 - Results of employee satisfaction surveys conducted periodically	(0.10, 0.58, 0.90)	0.528	Excludes
3 - Percentage of employees who remain with the company for a specified period	(0.10, 0.68, 0.90)	0.560	Includes
4 - Annual average hours of training per employee	(0.10, 0.59, 0.90)	0.531	Excludes
5 - Proportion of employees who received a promotion in the last year	(0.10, 0.46, 0.90)	0.485	Excludes
6 - Frequency of unexcused absences from work	(0.30, 0.73, 0.90)	0.642	Includes
7 - Percentage of employees participating in engagement activities organized by the company	(0.30, 0.70, 0.90)	0.635	Includes
8 - Frequency and results of performance evaluations that include feedback from peers and supervisors	(0.10, 0.68, 0.90)	0.560	Includes

(Continued)

Table 1. (Continued).

Dimension	Values		
Indicator	Fuzzy Weight	Defuzzification	Decision
5 - Process Efficiency			
Decision Value		0.640	
1 - Average production cycle time	(0.3, 0.73, 0.90)	0.645	Includes
2 - Production cost per unit	(0.3, 0.81, 0.90)	0.670	Includes
3 - Rate of production capacity utilization	(0.3, 0.77, 0.90)	0.657	Includes
4 - Number of defects or reworks per batch	(0.3, 0.75, 0.90)	0.650	Includes
5 - Energy efficiency in production	(0.1, 0.73, 0.90)	0.578	Excludes
6 - Raw material waste rate	(0.3, 0.78, 0.90)	0.661	Includes
7 - Percentage of automated processes	(0.1, 0.65, 0.90)	0.551	Excludes
8 - Response time to failures or breakdowns	(0.3, 0.74, 0.90)	0.648	Includes
9 - Maintenance cost as a percentage of production cost	(0.3, 0.77, 0.90)	0.657	Includes
10 - Employee satisfaction index with operational processes	(0.3, 0.72, 0.90)	0.640	Includes
11 - Number of process improvements implemented per year	(0.3, 0.70, 0.90)	0.632	Excludes
12 - On-time delivery rate	(0.5, 0.83, 0.90)	0.742	Includes
13 - Number of customer complaints related to product quality	(0.5, 0.82, 0.90)	0.739	Includes
14 - Percentage of production orders completed without incidents	(0.3, 0.76, 0.90)	0.653	Includes
15 - Average time for production line changeover or equipment adjustment	(0.1, 0.66, 0.90)	0.553	Excludes
16 - Efficiency in the use of water and other critical inputs	(0.1, 0.71, 0.90)	0.571	Excludes
6 - Product/Service Innovation			
Decision Value		0.633	
1 - Number of new services launched	(0.30, 0.73, 0.90)	0.645	Includes
2 - Number of significantly improved products or services	(0.30, 0.75, 0.90)	0.651	Includes
3 - Revenue generated from new products or services	(0.30, 0.77, 0.90)	0.657	Includes
4 - Percentage of revenue from products or services launched in the last 3 years	(0.10, 0.70, 0.90)	0.568	Excludes
5 - Number of disruptive innovations introduced to the market	(0.30, 0.67, 0.90)	0.624	Excludes
6 - Number of patents or intellectual property registrations obtained	(0.10, 0.64, 0.90)	0.548	Excludes
7 - Cost of developing new products or services	(0.30, 0.75, 0.90)	0.650	Includes
8 - Development time from conception to launch	(0.30, 0.71, 0.90)	0.636	Includes
9 - Success rate of new products or services based on market acceptance	(0.30, 0.77, 0.90)	0.656	Includes
10 - Number of strategic partnerships focused on product/service innovation	(0.30, 0.69, 0.90)	0.628	Excludes
11 - Total investment in research and development activities	(0.30, 0.72, 0.90)	0.641	Includes
12 - Number of ongoing innovation projects	(0.30, 0.71, 0.90)	0.636	Includes
13 - Customer feedback on innovations (satisfaction and acceptance)	(0.30, 0.79, 0.90)	0.664	Includes
14 - Adoption rate of emerging technologies in production processes	(0.10, 0.64, 0.90)	0.546	Excludes
15 - Number of products or services that meet new consumer needs	(0.50, 0.78, 0.90)	0.728	Includes
16 - Environmental impact of new products or services (sustainability)	(0.30, 0.74, 0.90)	0.648	Includes
7 - Sustainability and Environmental Initiatives			
Decision Value		0.567	
1 - Total energy consumption from renewable sources	(0.10, 0.72, 0.90)	0.572	Includes
2 - Amount of greenhouse gas (GHG) emissions reduction compared to previous periods	(0.10, 0.68, 0.90)	0.559	Excludes
3 - Total water consumption per unit of product produced	(0.30, 0.76, 0.90)	0.653	Includes
4 - Percentage of total waste generated that is recycled or reused	(0.10, 0.74, 0.90)	0.578	Includes
5 - Total number of ecological or sustainability certifications acquired, such as ISO 14001, LEED certification (Leadership in Energy and Environmental Design), etc.	(0.10, 0.64, 0.90)	0.547	Excludes
6 - Value invested in technologies or practices that promote sustainability	(0.10, 0.68, 0.90)	0.561	Excludes
7 - Total initiatives conducted in partnership with environmental NGOs or other entities for environmental conservation	(0.10, 0.63, 0.90)	0.542	Excludes
8 - Life cycle assessment of new products to determine their environmental impact	(0.10, 0.68, 0.90)	0.559	Excludes
9 - Number of training hours provided to employees on sustainable practices	(0.10, 0.59, 0.90)	0.530	Excludes

(Continued)

Table 1. (Continued).

Dimension	Values		
Indicator	Fuzzy Weight	Defuzzification	Decision
8 - Market Adaptation and Diversification			
Decision Value		0.640	
1 - Number of new geographic markets or consumer segments reached	(0.30, 0.75, 0.90)	0.648	Includes
2 - Proportion of total revenue coming from recently launched products or new markets	(0.30, 0.70, 0.90)	0.633	Excludes
3 - Total number of different product types or product lines offered by the winery	(0.30, 0.76, 0.90)	0.652	Includes
4 - Average time between identifying a new market trend and introducing a corresponding product or service	(0.30, 0.70, 0.90)	0.634	Excludes
5 - Amount invested in research activities to better understand consumer needs and preferences	(0.30, 0.72, 0.90)	0.641	Includes
6 - Proportion of revenue from sales outside the domestic market	(0.30, 0.69, 0.90)	0.630	Excludes
9 - Customer Feedback and Relationship			
Decision Value		0.656	
1 - Average customer satisfaction score received through regular surveys	(0.30, 0.76, 0.90)	0.654	Excludes
2 - Percentage of customer feedback responded to within a specified timeframe	(0.30, 0.77, 0.90)	0.655	Excludes
3 - Monthly number of customer interactions per period	(0.30, 0.76, 0.90)	0.652	Excludes
4 - Percentage of customers who continue doing business with the winery year after year	(0.50, 0.83, 0.90)	0.744	Includes
5 - Total number of complaints received within a specific period	(0.30, 0.77, 0.90)	0.658	Includes
6 - Percentage of complaints resolved during the first interaction with the customer	(0.30, 0.79, 0.90)	0.664	Includes
7 - Measure reflecting the likelihood of customers recommending the winery to others	(0.50, 0.86, 0.90)	0.753	Includes
8 - Count of loyalty programs offered and the number of active customers in those programs	(0.10, 0.69, 0.90)	0.562	Excludes
9 - Percentage of potential customers (leads) that become buyers	(0.30, 0.77, 0.90)	0.658	Includes
10 - Total number of customer interactions on social media platforms, including comments, likes, and shares	(0.10, 0.68, 0.90)	0.560	Includes
11 - Average time the company takes to respond to customer requests, measured in hours or days	(0.30, 0.77, 0.90)	0.658	Includes

Glossary of technical terms used in data analysis

Fuzzy Delphi Method
A refinement of the traditional Delphi method that incorporates fuzzy logic to handle uncertainties in expert opinions. It is widely used for achieving consensus on complex issues by analyzing linguistic variables through triangular fuzzy numbers.

Triangular Fuzzy Numbers
A mathematical representation of uncertainty in the Fuzzy Delphi method, defined by three points: lower limit, most probable value, and upper limit.

Random Forest Importance (RFI)
A machine learning technique that uses multiple decision trees to rank features (dimensions or indicators) based on their importance in predicting outcomes, calculated through measures such as impurity reduction.

Bootstrapping
A statistical technique used in the Random Forest method, involving repeated sampling with replacement to train multiple decision trees, enhancing robustness and accuracy.

Gini Impurity
A metric used in decision trees to measure the impurity or diversity of a node, indicating how well the node splits the data into distinct classes.

Defuzzification
The process of converting fuzzy numbers into crisp values to make them interpretable for decision-making or ranking purposes.

Importance Weights
Quantitative measures assigned to dimensions or indicators based on their relative significance in explaining or predicting outcomes, derived from the Random Forest model.

Cross-Validation
A statistical method for evaluating a model's performance by partitioning the data into multiple subsets (folds). The model is trained on k-1 subsets and tested on the remaining subset, rotating this process through all folds. The results are averaged to estimate the model's generalizability and stability.

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Camino, A. & Vargas, J. P. (2025). Classification of products based on the uncertainty of supply chain demand: a case study of wineries in Chile. *Wine Economics and Policy* 14(1): 117-129. doi: 10.36253/wep-15086

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Classification of products based on the uncertainty of supply chain demand: a case study of wineries in Chile

Armando Camino[1]*, Juan Pablo Vargas[2]

[1] *Universidad de Lleida; Plaça de Víctor Siurana, 1, 25003 Lleida, España*
[2] *Universidad Santiago de Chile, Avenida Libertador Bernardo O'Higgins 3363, Estación Central, Santiago 9160000, Chile*
*Corresponding author. Email: scmchile@gmail.com

Abstract. The wine industry faces distinctive supply chain challenges, including high product variety, export market fragmentation, and seasonal production, all of which contribute to demand uncertainty. Importantly, this uncertainty is not only externally driven but also amplified by tactical and operational decisions – such as labeling, bottling strategies, and product customization – that increase complexity. This study presents a product classification methodology based on demand behavior to improve decision-making in inventory management. Using a case study of three Chilean wineries located in the Central Valley, we compare the traditional ABC classification – commonly used in ERP systems – with a quantitative model that incorporates demand variability. The proposed approach enables segmenting products according to average demand and variability, offering clearer insights for setting differentiated service levels, inventory policies, and forecasting strategies. The findings show that the demand uncertainty-based classification provides more effective support for supply chain decision-making than conventional methods. The model has also demonstrated applicability beyond finished goods, such as in-process wine and critical inputs like corks and bottles. This research contributes empirical evidence to close the gap between theory and practice, providing a replicable tool for product segmentation in wine and other industries facing demand complexity.

Keywords: demand uncertainty, wine supply chain, production and inventory management, product classification, wine industry.

1. INTRODUCTION

The wine industry faces distinctive supply chain challenges that are shaped by factors such as seasonal production, market volatility, export dependency, and regulatory frameworks. These dynamics make inventory planning and demand forecasting particularly complex, especially in export-oriented wine-producing countries like Chile. According to [1], vineyards in Chile's Central Valley exhibit diverse economic performance linked to their operational management and exposure to international markets. Moreover,

[2] show that climate variability adds a further layer of uncertainty to the sector, influencing both production volume and quality.

Despite growing research on supply chain resilience in the wine industry [3], few studies have addressed how demand-side uncertainty impacts inventory classification and decision-making. Most prior work has focused on managing supply-related uncertainty or improving vineyard operations. For instance, [3] explore strategic responses to supply disruptions, while [4] examine the adoption of Lean Six Sigma in Italian wineries to enhance supply chain performance under regulatory and environmental pressure.

Previous studies have raised the need for further research into new approaches to uncertainty modeling, to obtain new approaches to production planning and control to manage uncertainty within each supply chain company, the incorporation of all types of uncertainty in an integrated manner, and the development of empirical work comparing different modeling approaches with real case studies [5]. In addition, [6] emphasizes the need to conduct empirical research on the uncertainties that occur in a particular industrial context and the most effective management actions in reducing one or more of the key uncertainties.

Uncertainty impacts production practices and supply chain performance [7]. Given the potential problems, interest in supply chain decisions that take uncertainty and risk into account has increased [8,9].

However, the application of quantitative classification techniques that explicitly incorporate demand variability - particularly in the context of inventory management - remains limited in wine economics literature. Traditional ABC classification is widely used in Enterprise Resource Planning (ERP) systems, yet it fails to account for volatility in demand patterns. This omission can hinder the efficiency of inventory allocation in wineries that handle a diverse portfolio of products across domestic and export markets.

This paper addresses this gap by proposing a classification approach based on demand uncertainty and comparing it with the traditional ABC method. Using a case study of three Chilean wineries, we assess the effectiveness of a variability-driven model for categorizing products and guiding inventory decisions. Our findings aim to inform winery managers and supply chain practitioners of new tools that support operational efficiency in the face of fluctuating demand. By contextualizing the research within the wine industry and referencing sector-specific studies, we contribute to bridging the theoretical and practical knowledge on inventory management under uncertainty.

Product classification should be part of a comprehensive inventory management system. Figure 1 shows an adaptation of the 4-stage model proposed by [10]. This research focuses on the first stage of product classification.

Our work focuses on showing the contrast of empirical use with theoretical techniques and we seek to contribute to closing the gap between theoretical research on supply chain uncertainty management and practice.

2. LITERATURE REVIEW

In this literature review we go through quantitative methods for classifying products in order to tailor supply chain operational decisions.

A supply chain is composed of all parties involved, directly or indirectly, to satisfy a customer's order. The supply chain includes not only the manufacturer and suppliers, but also transporters, distributors, retailers, and even the customers themselves, as shown in Figure 2. A supply chain is dynamic and involves the constant flow of information, products, and money between different stages. The primary purpose of any supply chain is to satisfy customer needs, and in the process, generate a profit for itself. The success of a supply chain should be measured in terms of its profitability rather than profit at an individual stage [11–13].

All processes in a supply chain fit into two categories in relation to end-customer demand: push or pull. Pull processes produce make to order, while push processes initiate execution in anticipation of customer orders based on a forecast and produce make to stock [14,15]

Global supply chain optimization is difficult because it needs to be designed and operated in which several factors contribute to uncertainty, including: 1. Matching supply and demand is a major challenge because produc-

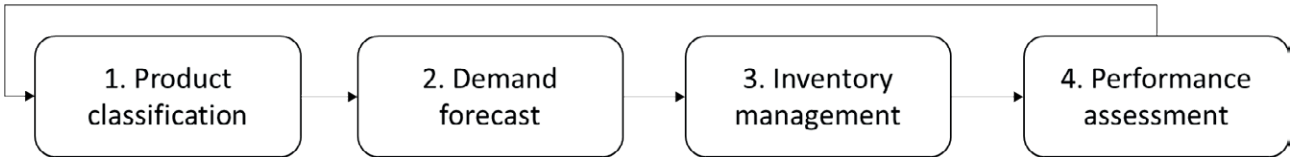


Figure 1. Integrated inventory management model. Source: Adapted from [10].

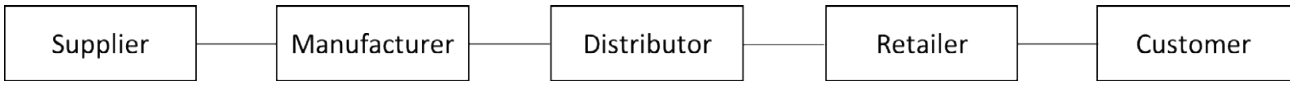


Figure 2. Supply chain. Source: Elaborated by the author.

tion levels need to be committed well before demand is realized. 2. Inventory levels and order backlogs fluctuate considerably throughout the supply chain. 3. Forecasting does not solve the problem. 4. Demand is not the only source of uncertainty; lead times, manufacturing yields, transportation times, and component availability are also sources of uncertainty [16,17].

Supply chain uncertainty refers to decision making in which the decision maker does not know definitively what to decide because he/she is confused about the objectives; lacks information about the supply chain or its environment; lacks information processing capabilities; cannot accurately predict the impact of possible control actions; or lacks effective control actions [18].

It has been suggested that demand uncertainty and implied demand uncertainty represent distinct concepts [11]. Demand uncertainty reflects the uncertainty of customer demand for a product. Implicit demand uncertainty is that resulting from the way the customer orders: if you serve only urgent orders, you will have a higher implicit uncertainty than if you deliver with long lead times. Uncertainty generates complexity in the supply chain, tends to increase inventory and propagates through the supply network [19,20]. Demand uncertainty is particularly important and tends to reduce profits in the supply chain [21].

It is expected that supply chain planning methods that do not include uncertainty will underperform those that do [22]. Both linear and circular supply chains must take uncertainty into account in their management [23].

Recent contributions in the wine industry have highlighted the importance of integrating sector-specific dynamics into supply chain analysis. The value of process improvement methodologies such as Lean Six Sigma in Italian wineries has been demonstrated [4], while preparedness for disruptions – a growing concern under increased climate volatility – has been addressed by [3] and [2]. Additionally, the influence of vineyard management strategies and environmental variability on performance in Chilean wine production has been explored in greater depth [1]. However, most of these studies have emphasized supply-side uncertainties and strategic resilience rather than the operational challenges linked to demand volatility.

Supply chain uncertainty management models are classified into 3: strategic, tactical, and operation [24,25]. The strategy time horizon is several years and decides the configuration of the supply chain, how resources will be allocated, and what processes each stage will perform [26,27]. The planning or tactical horizon is from one quarter to one year and includes demand forecasts, deciding which markets will be supplied from which locations, manufacturing outsourcing, inventory policies, timing, promotions and pricing. Planning also includes decisions regarding demand uncertainty, exchange rate, and competition [28,29]. The time horizon of the operation is daily or weekly, in this phase decisions are made regarding customer orders, allocating inventories or production to orders, setting order delivery dates, defining pick lists for a warehouse, assigning orders to shipments, establishing delivery schedules, etc. [30,31].

Supply chain demand uncertainty models can also be classified into qualitative and quantitative models according to the solution methodology [32]. And they can be classified by source of uncertainty: demand, supply and production processes [22,33].

Supply chain planning models under uncertainty have been studied [23], but they are not commonly related to product classification [22]. Inventory production planning and control systems classify products into those with independent or dependent demand. Finished products have independent demand, that which comes from customers and needs to be forecast. Raw materials and in-process products have dependent demand, and the demand is calculated based on the production of finished products [34,35].

The need to link product classification with inventory management systems in an integrated way has been raised in the literature [10,36].

A literature review of product classification based on various factors is presented in [37]. In particular, classifications can rely on either judgment-based (qualitative) or statistical (quantitative) techniques. The quantitative approaches include ABC classification and two-dimensional graphical matrices (2×2).

Among the quantitative classifications, the ABC classification is the most widespread as it is part of integrated ERP systems. This classification is based on the Pareto Principle, also known as the 80/20 rule, and was originally used to classify goods according to their annual demand. To calculate it, the annual demand is calculated and multiplied by the cost. Class A goods

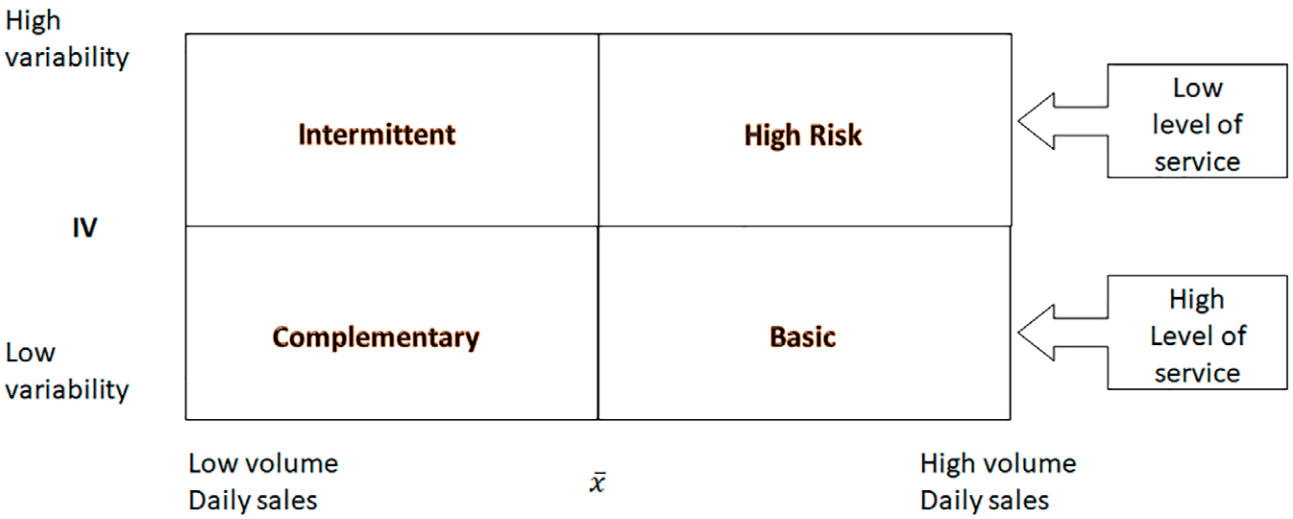


Figure 3. Product categorization by demand uncertainty. Source: [44].

have 80% of the annual volume in money and account for 20% of the goods; Class B goods account for 15% of the annual volume in money and account for 30% of the goods; Class C accounts for 5% of the annual volume in money and comprises about 50% of the goods [38,39]. Multiple factors are considered for using ABC as annual usage value, e.g., average consumption, annual failures, and lead time [40].

The use of two-dimensional graphical matrices (2×2) in product classification is discussed in [37], referencing their application to spare parts [41,42] and to manufactured products [43]. Additionally, a similar matrix-based approach has been identified in the work of another author [44].

A 2×2 matrix-based quantitative classification method grounded in demand uncertainty was applied to a Chilean winery case in [45], demonstrating its superiority over traditional qualitative approaches such as those proposed by [46] and [47]. This study validates the usefulness of variability-based product classification models for supporting different production stages within a winery.

This quantitative method by [43,44] uses a two-dimensional matrix and allows measuring demand uncertainty. The two dimensions are the average daily sale in units and the variability index:

$\bar{x}$ is the average daily sales in logarithmic scale

IV (variability index) = σ / $\bar{x}$ is the standard deviation of the article in demand divided by the average sale.

Four product categories are identified:

- Basic: products with high volume demand and low variability. These are stable, predictable items, and in the case of finished products, they provide the greatest amount of income to the company.
- Complementary: products with low demand volume and low variability. They are also stable items and, in the case of finished products, provide low revenues on a regular basis.
- High risk: products with high volume demand and high variability.
- Intermittent: products with low demand volume but high variability.

The variability index is also known in the literature as coefficient of variability (CV) or (CoV) as an indicator to measure demand uncertainty [48,49].

3. MATERIAL AND METHODS

In this research we use the case study method. [50] has posited that the case method is one of the most powerful methods in operations management research and has contributed from the development of lean manufacturing theory to manufacturing strategy.

We use the structure proposed by [50] to describe the methodology:

1. When to use case study research: the purpose of this research is to contribute to the testing of theory.
2. The research framework: In an inventory management system we focus on the product classification stage. We seek to identify whether the quantitative method of [43,44] which is based on demand uncertainty is better than other quantitative models such as ABC.
3. Choice of case: The case studies three wineries in Chile. The type of case would be retrospective.
4. Development of research instruments and protocols: Semi-structured interviews, meetings, visits to bottling

facilities and wineries, and document analysis were designed for data collection. Also conduct data analysis of product sales transactions to obtain information for the quantitative model. The performance of the methods would be determined by user acceptance.

5. Conducting field research: The primary contact was the operations manager. The main informants were the head of planning, the production planners, and the operations manager.
6. Documentation and data coding: The first step was to identify the methods used by the company. In section 3.2 quantitative method selection, we explained how the quantitative methods were selected and applied to test their performance. We worked on Excel sheets.
7. Analysis. The analysis and its results were validated by the head of planning and the operations manager. In section 5. Discussion we compare the results of the 3 vineyards.

3.1 Case description

The three wineries selected for this study are located in Chile's Central Valley, which is recognized as the country's most important wine-producing region, both in terms of volume and international projection. This area concentrates a significant share of vineyard surface and export-oriented production, making it a strategic reference for understanding the operational and commercial dynamics of the Chilean wine industry [1]. The selected wineries represent diverse business models within this region – ranging from mid-sized exporters to producers with differentiated product portfolios – allowing us to examine how demand uncertainty affects inventory classification across different contexts within a shared geographical and market environment. We will call them wineries V1, V2 and V3 in order of SKU number.

The supply chain of a winery includes different stages: an agricultural stage for grape production, an oenology stage to produce wine from different grape varieties, a production stage for bottling the wine, domestic distribution or export, retail sales and the customer.

The vineyards own part of the grape production, winemaking, bottling production and finished product cellars; they do not own foreign distribution centers or retail sales.

The winemaking follows the production strategy make-to-stock because the wine needs to rest in barrels and because there are relatively few vines. Bottling follows a make-to-stock method for domestic sales and make-to-order for exports. For exports it is not possible to produce make-to-stock because international sales are very fragmented, and the product label is not standardized for the countries due to legal regulations related to the alcohol content allowed by the countries. The bottling and winemaking plants are located near the grape fields south of Santiago. Export shipments are made through the ports of Valparaíso and San Antonio about 115 km west of Santiago.

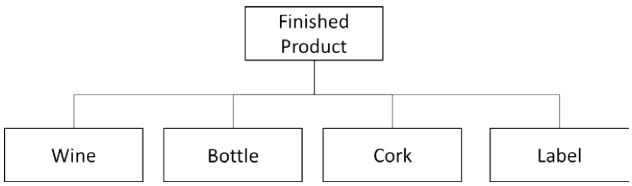


Figure 4. Generic wine bill of materials. Source: Elaborated by the author.

In this case we focus on the production of bottling for export. Supply chain management is concerned with determining the supply and production levels and inventories of raw materials, subassemblies at the different levels of the given bill of materials (BOM) [51]. The finished products use wine, bottle, cork, and label as the main raw materials as shown in Figure 4. All inputs except the label are kept in stock. The label must be printed when the customer's order arrives. Since there are different presentation formats (750 ml, 375 ml bottles, etc.), 9-liter cases are used as the equivalent unit of measure to consolidate production.

There are different types of wineries, some of which are dedicated to the mass market (with varietal and reserve wines) and other boutique wineries dedicated to niche markets (with reserve and icon wines). The companies in this case were dedicated to mass consumption.

The methods are not universally applicable so it is necessary to specify the context of the cases reviewed. The attributes of the specific context of the case are:

- Private organizations
- One stage of the supply chain: manufacturing of finished products.
- Product flows are analyzed (not flows of information or funds).
- Production to order of the finished product with pull strategy.
- Independent demand for the finished product.
- The number of products is not very high.
- Products are functional according to [46] because they are mass market products.
- Efficient supply chain strategy according to [47].

3.2 Selection of quantitative methods

From the 7 quantitative methods established by [37], we selected for this study the ABC classification and the 2×2 graphical matrix.

We selected the ABC classification because it is included in the ERP integrated management systems.

And we selected the 2x2 graphical matrix because it was the only method that included supply chain demand uncertainty. It was applied with one year's data to produce finished products.

Furthermore, the applicability of this classification model based on demand uncertainty extends beyond finished goods. In previous research, we demonstrated how this same approach can be used to categorize in-process items and key inputs such as corks, bottles, and bulk wine [45]. Applying the variability matrix at different stages of the production process enables wineries to make more informed decisions regarding stock levels, bottling schedules, and material procurement. This multi-tier implementation reinforces the model's practical value, not only for finished product planning but also for upstream supply chain coordination.

4. RESULTS AND DATA ANALYSIS

4.1 Quantitative classification

The quantitative matrix model based on demand uncertainty was applied. The centers of gravity were calculated with the averages of the axes.

4.2 Finished product variability Winery V1

The results of the independent demand variability of finished products are shown in Figures 5 and 6.

The company was having difficulty implementing a supply chain efficiency strategy that was reflected in the difficulty of meeting delivery promises, very low customer satisfaction and high inventories. With the graphs, the company's decision makers quickly understood the complexity of the supply chain and the need to reduce it. Several improvement points were recommended.

The company decided to purge products with IV greater than 12 because they increase the complexity of the supply chain; there were 258 SKUs in this condition. Products with IV of 22 were found with one sale in 500 days, with IV of 15 with two sales in 500 days, with IV of 12 with three in 500 days. This low frequency of sales did not make sense for an efficient supply chain strategy oriented to a mass consumer market. Excluding products with IV greater than 12, the new product portfolio had an average variability of 8.

There were 3 high-risk products that in an ABC classification could appear as A products. These are products that will not be sold again and could generate a whip effect in the purchase of raw materials and wine stock. Complementary wines generate complications for

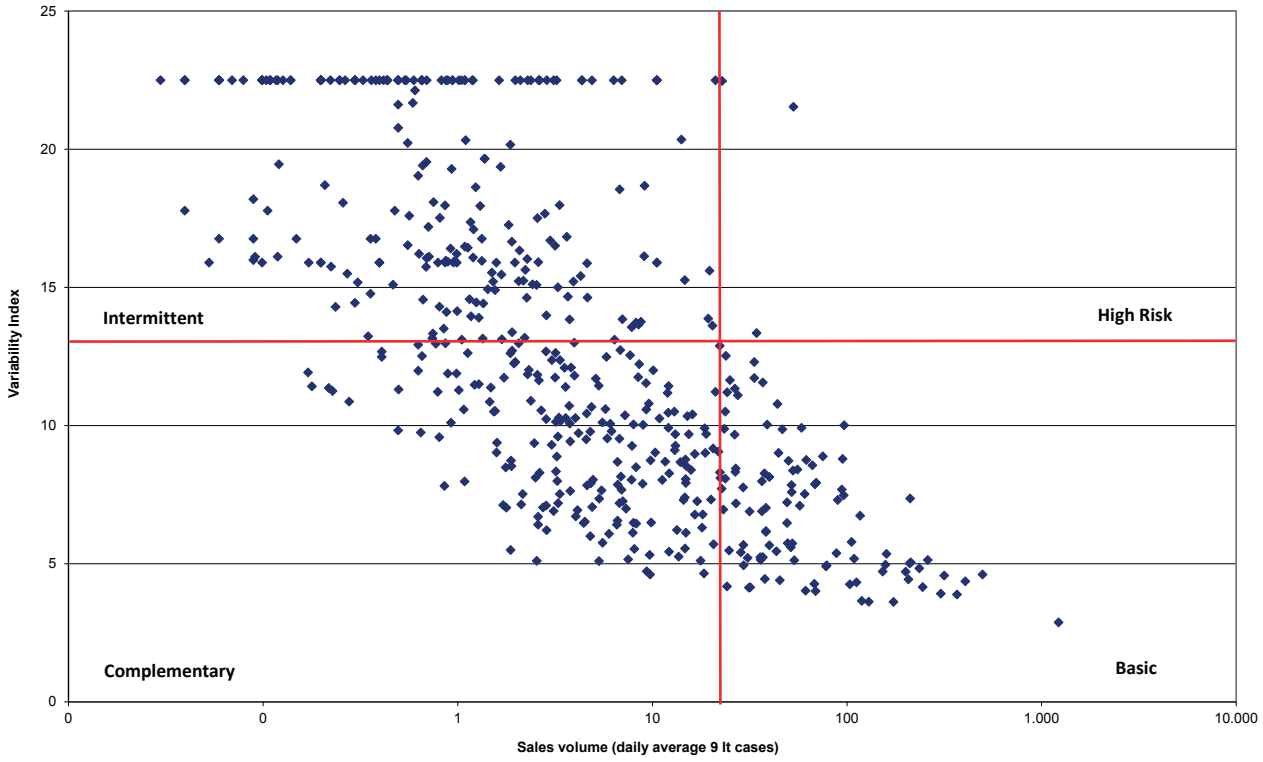


Figure 5. Variability of finished products of Winery V1. Source: Elaborated by the author.

Variability Index

High	Intermittent	High Risk	Lower level of service
	232	3	
	44%	1%	
Low	Complementary	Basic	Higher level of service
	191	103	
	36%	19%	
	Low	High	Volume

Low Rotation

High Rotation

Center of gravity	
Variability Index	12,9
Volume (9LT cases)	22
Total SKU	529

Figure 6. Summary data of the finished products of Winery V1. Source: Elaborated by the author.

the economic bottling lot, and in the case of exports, it is necessary to create stocks of bottled wines without labels.

4.3 Variability of the finished products of Winery V2

The results of the variability of the independent demand for finished products are shown in Figures 7 and 8.

The company was having difficulty implementing the supply chain efficiency strategy which resulted in not being able to make a profit. Despite the fact that this vineyard had better average prices than vineyards A and C.

It had an average IV of 10.94 which is a high IV due to tactical decisions taken from the company with the sale of products with low rotation. It was recommended to purge SKUs with IV > 12 due to low sales frequency and that are contradictory to having an efficient supply chain strategy. The decision makers agreed.

4.4 Variability of the finished products of Winery V3

The results of the variability of independent demand for finished products are shown in Figures 9 and 10.

The company has an IV of 8.03, partly due to the lower number of SKUs and tactical decisions made. SKUs with IV > 12 must be purged due to low sales frequency and because they hinder efficient supply chain strategy.

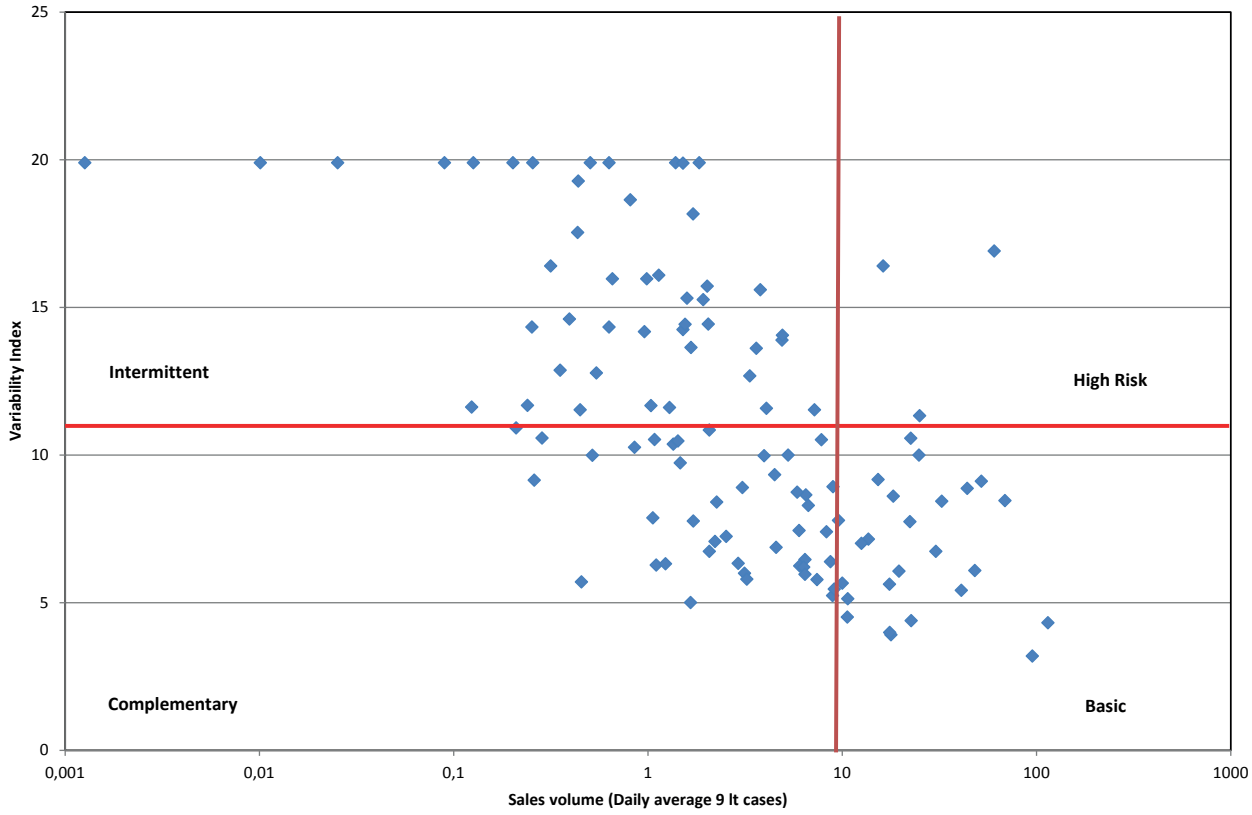


Figure 7. Variability of the finished products of Winery V2. Source: Elaborated by the author.

Variability Index

High	Intermittent	High Risk	← Lower level of service
	45	3	
	39%	3%	
Low	Complementary	Basic	← Higher level of service
	44	24	
	38%	21%	
	Low	High	Volume

Low Rotation

High Rotation

Center of gravity	
Variability Index	10,9
Volume (9LT cases)	10
Total SKU	116

Figure 8. Finished product summary data for Winery V2. Source: Elaborated by the author.

4.5 Variability of finished products ABC of Winery V1

The products with classification A for Vineyard V1 are shown below within the 2x2 matrix format in order to observe the behavior of products that are supposed to have high turnover. The results are shown in figure 11.

Class A products by definition of the ABC classification should have a higher service level due to their combination of high turnover and high value.

By plotting them in the 2x2 matrix with demand uncertainty we can see that there are weaknesses. Infrequently sold intermittent products are not easy to forecast, to plan, so they should have low service level. But if they have a high value they can be classified as A as we see in Figure 11.

We have product A that are basic (low variability, high average sales) and should have the highest level of service. We have product A that are complementary (low variability, low average sales) and should not have the same resources as the basic ones.

In this case there is no high-risk product (high variability and high average sales), but if there were, the A classification would lead us to produce large quantities of products that will be very difficult to sell, which generates the whip effect with wine and wine inputs.

5. DISCUSSION

A comparative summary of the 3 wineries is presented in Table 1.

We can observe that the three wineries have high variability to have an efficiency strategy. Although

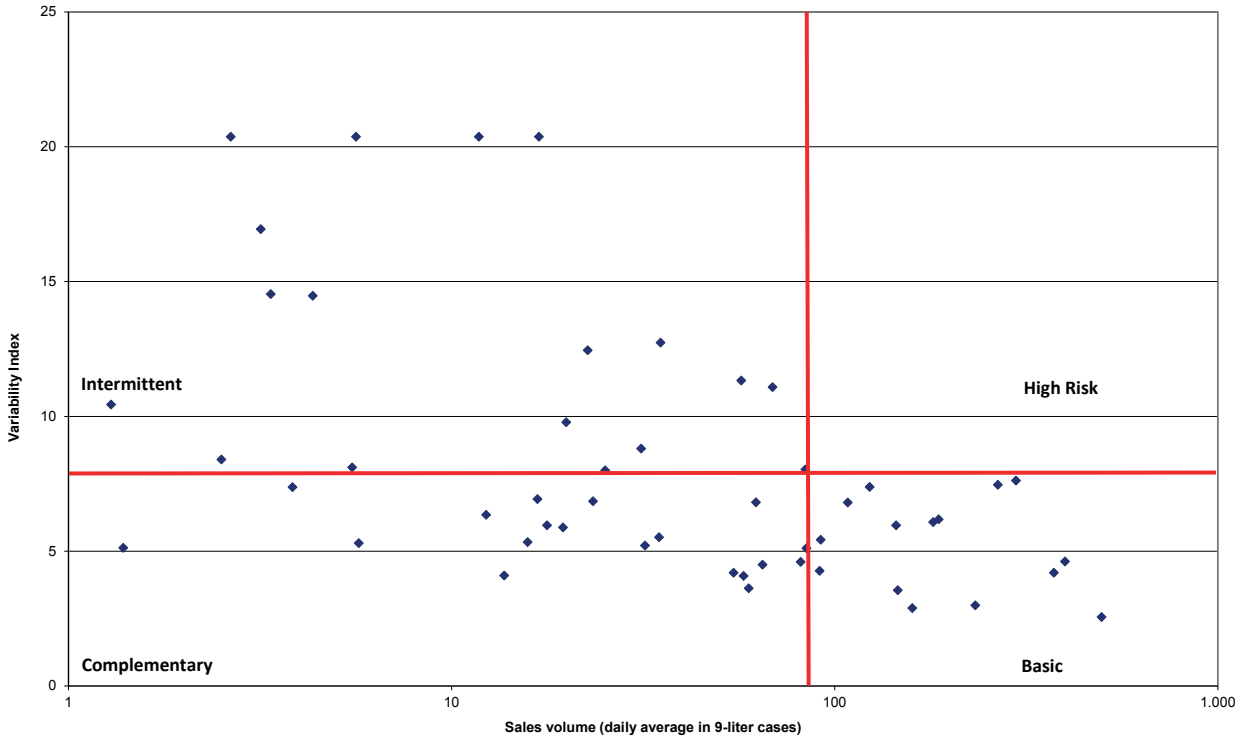


Figure 9. Variability of finished products of Winery V3. Source: Elaborated by the author.

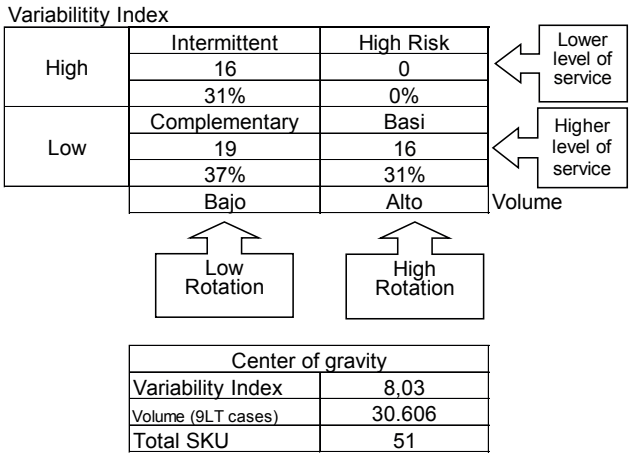


Figure 10. Finished product summary data for Winery V3. Source: Elaborated by the author.

demand uncertainty should be low for mass consumption wines, this uncertainty is amplified by planning or tactical decisions in the supply chain: bottling with country labels increases product uncertainty, there were no restrictions on the number of products that could be requested in an order, the incentives to increase export sales led to accepting customer requirements for blends

Table 1. Summary of vineyard variability.

Winery	SKU Number	Variability Index
V1	529	12.90
V2	116	10.94
V3	51	8.03

Source: Elaborated by the author.

of wines (which were not sold later and whose balances generated problems), requirements for special bottles (which made subsequent supply more complex), decisions on functional silos, etc.

The data collected from the case demonstrate that quantitative theoretical methods are not applied to measure supply chain uncertainty.

The qualitative method by [43,44] is quite reliable and better than the ABC method for tactical decisions. It allows to put a value to the uncertainty by means of the variability index and to be able to compare the complexity with other units. It has a value of variability or uncertainty for each product, which allows to compare it or to know that a product debugging is needed.

The graphical interface has a very high level of user acceptance. In product debugging discussions it was very difficult for anyone to defend products with IV greater

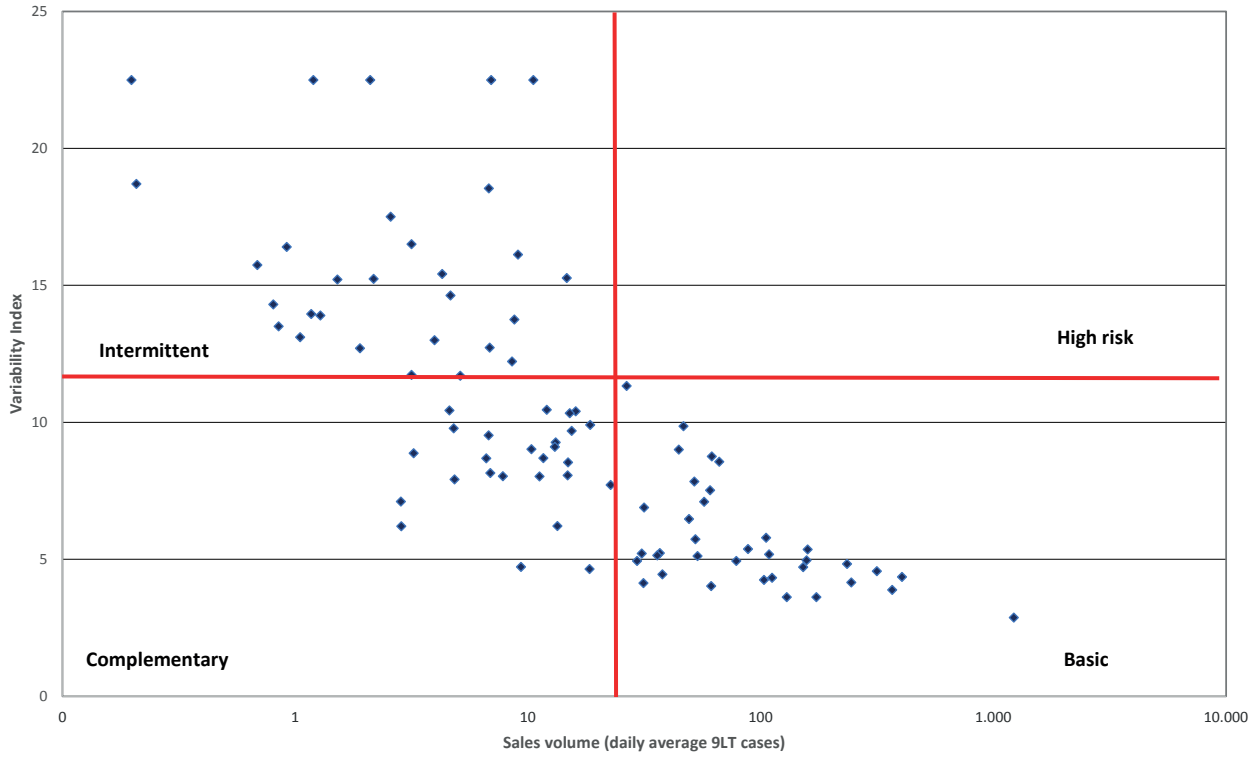


Figure 11. Variability of class A products of Winery V1. Source: Elaborated by the author.

than 12. Displaying the variability graphs showed the damage that was done by making the whole supply chain more complex.

You can compare uncertainty levels of different stages of the supply chain such as bottling and winemaking. In other words, uncertainty can be measured by independent demand (sales dispatches) and by dependent demand (production receipts to in-process warehouses).

This classification by demand uncertainty allows more appropriate production and inventory management decisions to be defined (such as demand forecasting methods, inventory policies, etc.), which are beyond the scope of this study. A better level of service and performance should be expected in commodity and complementary products.

It is necessary to incorporate the measurement of the uncertainty of the demand of the supply chain as an indicator of performance of the wine industry. We did not find it in the reviews at a global level carried out such as the studies of [52]. Nor did we find it in reviews on performance indicators in the wine industry in Chile [53]. In reviews on wine industry risk management in market issues only price volatility is studied [54].

In comparison with previous research that has explored strategic and supply-side responses to uncertainty [2,3], this study adds value by focusing on demand uncertainty at the product level and its operational implications. Unlike general process improvement strategies such as Lean Six Sigma [4], which seek to enhance system efficiency, this classification approach allows for product-specific diagnostics and segmentation. This supports differentiated policies for forecasting methods, service levels, and inventory strategies. Furthermore, as demonstrated in [45], the model is adaptable to multiple stages of the wine production chain, including in-process goods and critical inputs such as corks and bottles. Thus, the tool contributes not only to decision-making on finished goods, but also to reducing supply chain complexity as a whole by enabling better tactical and operational planning across multiple inventory categories.

6. CONCLUSIONS

This study shows that current business practice in the wine industry often lacks quantitative methods for measuring supply chain uncertainty, relying instead on the traditional ABC classification and expert judgment. As such, uncertainty is not systematically measured or used to support tactical and operational decision-making.

Through the case analysis of three wineries in Chile´s Central Valley, we found that the quantitative method based on demand uncertainty [43,44] provides a superior classification of products compared to the ABC method. This classification enables more nuanced and appropriate decisions on inventory policy, demand forecasting, and service level differentiation.

The study contributes to bridging the gap between theory and practice by providing a replicable methodology rooted in demand behavior that can be adapted to different stages of the wine supply chain.

Unlike more generic process optimization frameworks, the demand uncertainty matrix provides product-level insights that allows wineries to reduce complexity, align production and bottling strategies, and implement inventory segmentation. These insights offer direct benefits in supply chain performance, customer service, and operational efficiency.

This research is novel given that, it contributes with empirical information in bridging the gap between theory and practice on product classification by uncertainty and in relieving the need for its use for tactical wine supply chain decisions. At the same time, it opens the door to future research to replicate this methodology in other contexts and to investigate the most appropriate production and inventory management decisions based on this product classification.

REFERENCES

[1] C. Bopp, R. Jara-Rojas, A. Engler, M. Araya-Alman. How are vineyards management strategies and climate-related conditions affecting economic performance? A case study of Chilean wine grape growers. Wine Economics and Policy 2022;11:61–73. https://doi.org/10.36253/wep-12739.

[2] E. Haddad, P. Aroca, P. Jano, A. Rocha, B. Pimenta. A Bad Year? Climate Variability and the Wine Industry in Chile. Wine Economics and Policy 2020;9:23–35. https://doi.org/10.36253/web-7665.

[3] A. Gilinsky, A. Sen, J. Ford, S.C. de la Torre, S.K. Newton. US Wine Industry Preparedness For Unforeseen Crises And Disasters: An Empirical Test. Wine Economics and Policy 2020;9:6–18. https://doi.org/10.14601/web-8054.

[4] A. Zironi, P. Danese, P. Romano, R. Zironi. A Lean Six Sigma, Industry 4.0 and Circular Economy-driven methodology for wine supply chain process improvement. Wine Economics and Policy 2024;13:75–88. https://doi.org/10.36253/wep-15803.

[5] J. Mula, R. Poler, G.S. García-Sabater, F.C. Lario. Models for production planning under uncertain-

ty: A review. Int J Prod Econ 2006;103:271–85. https://doi.org/10.1016/j.ijpe.2005.09.001.

[6] E. Simangunsong, L.C. Hendry, M. Stevenson. Supply-chain uncertainty: A review and theoretical foundation for future research. Int J Prod Res 2012;50:4493–523. https://doi.org/10.1080/00207543.2011.613864.

[7] R. Bhatnagar, A.S. Sohal. Supply chain competitiveness: measuring the impact of location factors, uncertainty and manufacturing practices. Technovation 2005;25:443–56. https://doi.org/10.1016/j.technovation.2003.09.012.

[8] G.T.M. Hult, C.W. Craighead, D.J. Ketchen. Risk Uncertainty and Supply Chain Decisions: A Real Options Perspective. Decision Sciences 2010;41:435–58. https://doi.org/10.1111/j.1540-5915.2010.00276.x.

[9] Z. Sazvar, M. Zokaee, R. Tavakkoli-Moghaddam, S.A. sadat Salari, S. Nayeri. Designing a sustainable closed-loop pharmaceutical supply chain in a competitive market considering demand uncertainty, manufacturer's brand and waste management. Ann Oper Res 2022;315:2057–88. https://doi.org/10.1007/s10479-021-03961-0.

[10] A. Bacchetti, N. Saccani. Spare parts classification and demand forecasting for stock control: Investigating the gap between research and practice. Omega (Westport) 2012;40:722–37. https://doi.org/10.1016/j.omega.2011.06.008.

[11] S. Chopra, P. Meindl. Supply Chain Management 7th edition. Boston: Pearson Education Inc.; 2017.

[12] G. Guillén, F.D. Mele, M.J. Bagajewicz, A. Espuña, L. Puigjaner. Multiobjective supply chain design under uncertainty. Chem Eng Sci 2005;60:1535–53. https://doi.org/10.1016/j.ces.2004.10.023.

[13] H. Min, G. Zhou. Supply chain modeling: past, present and future. Comput Ind Eng 2002;43:231–49. https://doi.org/10.1016/S0360-8352(02)00066-9.

[14] M. Bortolini, M. Faccio, F.G. Galizia, M. Gamberi. Push/pull parts production policy optimization in the ato environment. Applied Sciences (Switzerland) 2021;11:6570. https://doi.org/10.3390/app11146570.

[15] A.P. Velasco Acosta, C. Mascle, P. Baptiste. Applicability of Demand-Driven MRP in a complex manufacturing environment. Int J Prod Res 2020;58:4233–45. https://doi.org/10.1080/00207543.2019.1650978.

[16] D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi. Managing the supply chain the definitive guide for the business professional. New York: McGraw Hill; 2004.

[17] G. Merkuryeva, A. Valberga, A. Smirnov. Demand forecasting in pharmaceutical supply chains: A case study. Procedia Comput Sci, vol. 149, Elsevier B.V.; 2019, p. 3–10. https://doi.org/10.1016/j.procs.2019.01.100.

[18] J.G.A.J. Van Der Vorst, A.J.M. Beulens. Identifying sources of uncertainty to generate supply chain redesign strategies. International Journal of Physical Distribution & Logistics Management 2002;32:409–30. https://doi.org/10.1108/09600030210437951.

[19] M. Babagolzadeh, A. Shrestha, B. Abbasi, Y. Zhang, A. Woodhead, A. Zhang. Sustainable cold supply chain management under carbon tax regulation and demand uncertainty. Transp Res D Transp Environ 2020;80:102245. https://doi.org/10.1016/j.trd.2020.102245.

[20] T. Davis. Effective supply chain management. Sloan Manage Rev 1993;34:35–46.

[21] J.Y. Jung, G. Blau, J.F. Pekny, G.V. Reklaitis, D. Eversdyk. A simulation based optimization approach to supply chain management under demand uncertainty. Comput Chem Eng 2004;28:2087–106. https://doi.org/10.1016/j.compchemeng.2004.06.006.

[22] D. Peidro, J. Mula, R. Poler, F.C. Lario. Quantitative models for supply chain planning under uncertainty. Int J Adv Manuf Technol 2009;43:400–20. https://doi.org/10.1007/s00170-008-1715-y.

[23] F.A. de Lima, S. Seuring, P.C. Sauer. A systematic literature review exploring uncertainty management and sustainability outcomes in circular supply chains. Int J Prod Res 2022;60:6013–46. https://doi.org/10.1080/00207543.2021.1976859.

[24] M. Acuna, J. Sessions, R. Zamora, K. Boston, M. Brown, M.R. Ghaffariyan. Methods to manage and optimize forest biomass supply chains: a review. Current Forestry Reports 2019;5:124–41. https://doi.org/10.1007/s40725-019-00093-4.

[25] A. Gupta, C.D. Maranas. Managing demand uncertainty in supply chain planning. Comput Chem Eng 2003;27:1219–27. https://doi.org/10.1016/S0098-1354(03)00048-6.

[26] B. Bilgen, I. Ozkarahan. Strategic tactical and operational production-distribution models: a review. Int J Technology Management 2004;28:151–71. https://doi.org/10.1504/IJTM.2004.005059.

[27] S. Ghosh, M.C. Mandal, A. Ray. Strategic sourcing model for green supply chain management: an insight into automobile manufacturing units in India. Benchmarking: An International Journal 2021;29:3097–132. https://doi.org/10.1108/BIJ-06-2021-0333.

[28] M.S. Fox, M. Barbuceanu, R. Teigen. Agent-oriented supply-chain management. Int J Flexible Manufacturing Systems 2000:81–104. https://doi.org/10.1023/A:1008195614074.

[29] J. Oh, B. Jeong. Tactical supply planning in smart manufacturing supply chain. Robot Comput Integr Manuf 2019;55:217–33. https://doi.org/10.1016/j.rcim.2018.04.003.

[30] J. Saragih, A. Tarigan, E. Frida, J. Wardati, I. Pratama. Supply chain operational capability and supply chain operational performance: Does the supply chain management and supply chain integration matters? Int J Sup Chain Mgt 2020;9:1222–9.

[31] X. Wen, T.M. Choi, S.H. Chung. Fashion retail supply chain management: A review of operational models. Int J Prod Econ 2019;207:34–55. https://doi.org/10.1016/j.ijpe.2018.10.012.

[32] R. Ganeshan, E. Jack, M.J. Magazine, P. Stephens. A taxonomic review of supply chain management research. Quantitative models for supply chain management, Boston: Kluwer Academic; 1999, p. 840–79. https://doi.org/10.1007/978-1-4615-4949-9_27.

[33] S.Y. Sun, M.H. Hsu, W.J. Hwang. The impact of alignment between supply chain strategy and environmental uncertainty on SCM performance. Supply Chain Management 2009;14:201–12. https://doi.org/10.1108/13598540910954548.

[34] A. Kortabarria, U. Apaolaza, A. Lizarralde, I. Amorrortu. Material management without forecasting: From MRP to demand driven MRP. Journal of Industrial Engineering and Management 2018;11:632–50. https://doi.org/10.3926/jiem.2654.

[35] R. Miclo, M. Lauras, F. Fontanili, J. Lamothe, S. Melnyk, S.A. Melnyk. Demand Driven MRP: assessment of a new approach to materials management. Int J Prod Res 2019;57:166–81. https://doi.org/10.1080/00207543.2018.1464230.

[36] S. Cavalieri, M. Garetti, M. MacChi, R. Pinto. A decision-making framework for managing maintenance spare parts. Production Planning and Control 2008;19:379–96. https://doi.org/10.1080/09537280802034471.

[37] T.J. van Kampen, R. Akkerman, D.P. van Donk. SKU classification: A literature review and conceptual framework. Int J Operations and Production Management 2012;32:850–76. https://doi.org/10.1108/01443571211250112.

[38] J.H. Heizer, B. Render. Principles of operations management. Pearson Education; 2003.

[39] F. Liu, N. Ma. Multicriteria ABC inventory classification using the social choice theory. Sustainability (Switzerland) 2020;12. https://doi.org/10.3390/SU12010182.

[40] V. Lukinskiy, V. Lukinskiy, B. Sokolov. Control of inventory dynamics: A survey of special cases for products with low demand. Annu Rev Control 2020;49:306–20. https://doi.org/10.1016/j.arcontrol.2020.04.005.

[41] A.A. Ghobbar, C.H. Friend. Sources of intermittent demand for aircraft spare parts within airline operations. 2002. https://doi.org/10.1016/S0969-6997(01)00054-0.

[42] A.A. Syntetos, J.E. Boylan, J.D. Croston. On the categorization of demand patterns. Journal of the Operational Research Society 2005;56:495–503. https://doi.org/10.1057/palgrave.jors.2601841.

[43] A.J. D'Alessandro, A. Baveja. Divide and conquer: Rohm and Haas' response to a changing specialty chemicals market. Interfaces (Providence) 2000;30:1–16. https://doi.org/10.1287/inte.30.6.1.11627.

[44] J.H. Chavez. Supply Chain Management. Santiago de Chile: RIL Editores; 2012.

[45] L.A. Camino Cabrejos, J.P. Vargas Norambuena. Medición de Incertidumbre de Demanda de la Cadena de Suministro del Vino. RIVAR 2025;12:154–75. https://doi.org/10.35588/01jbbd18.

[46] M.L. Fisher. What is the Right Supply Chain for Your Product? Harv Bus Rev 1997;75:105–16.

[47] H.L. Lee. Aligning Supply Chain Strategies with Product Uncertainties. 2002. https://doi.org/10.2307/41166135.

[48] M. Abolghasemi, E. Beh, G. Tarr, R. Gerlach. Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion. Comput Ind Eng 2020;142. https://doi.org/10.1016/j.cie.2020.106380.

[49] L. Xie, J. Ma, M. Goh. Supply chain coordination in the presence of uncertain yield and demand. Int J Prod Res 2021;59:4342–58. https://doi.org/10.1080/00207543.2020.1762942.

[50] C. Voss, N. Tsikriktsis, M. Frohlich. Case research in operations management. Int J Operations and Production Management 2002;22:195–219. https://doi.org/10.1108/01443570210414329.

[51] A. Alonso-Ayuso, L.F. Escudero, A. Garín, M.T. Ortuño, G. Pérez, U. Rey, et al. An approach for Strategic Supply Chain Planning under Uncertainty based on Stochastic 0-1 Programming. Journal of Global Optimization 2003;26:97–124. https://doi.org/10.1023/A:1023071216923.

[52] J. Mota, A. Moreira, R. Costa, S. Serrão, V. Pais-Magalhães, C. Costa. Performance indicators to

support firm-level decision-making in the wine industry: a systematic literature review. Int J Wine Business Res 2020;33:217–37. https://doi.org/10.1108/IJWBR-06-2020-0027.

[53] L. Valenzuela, S. Maturana. Designing a three-dimensional performance measurement system (SMD3D) for the wine industry: A Chilean example. Agric Syst 2016;142:112–21. https://doi.org/10.1016/j.agsy.2015.11.011.

[54] A. Seccia, F.G. Santeramo, G. Nardone. Risk management in wine industry: A review of the literature. BIO Web Conf 2016;7:03014. https://doi.org/10.1051/bioconf/20160703014.

Wine Economics and Policy

Firenze University Press
www.fupress.com/wep

OPEN ACCESS

Citation: Dubois, M., Cardebat, J.-M. & Georgantzis, N. (2025). External evaluations under quality uncertainty: the market for wine ratings. *Wine Economics and Policy* 14(1): 131-162. doi: 10.36253/wep-16620

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

External evaluations under quality uncertainty: the market for wine ratings

Magalie Dubois[1], Jean-Marie Cardebat[2], Nikolaos Georgantzis[1]

[1] *School of Wine & Spirits Business, Université Bourgogne Europe, Burgundy School of Business, CEREN EA 7477, F-21000 Dijon, France*
[2] *Université de Bordeaux, INSEEC School of Business and Economics, France*
*Corresponding author. Email: magalie.dubois@bsb-education.com

Abstract. The parallel development of scientific knowledge and technical practices over the last five decades has had a significant impact on sensory wine quality definition and evaluation. We conduct an integrative review of the literature on wine quality evaluation to determine the role of experts in the wine market, considering the recent changes. Following the updated methodology of integrative review proposed by Whittemore & Knafl (2005) [1], we conceptually structure the topic of quality evaluation and valuation in the wine market while critically analyzing the literature. The existence of a market for experts and aggregated peer evaluations is not fully explained by the profitability of the actors involved: wine media and online review aggregators. The residual value necessary for the subsistence of this market seems to be contributed by the wine industry. The present research demonstrates that professional wine evaluation does not meet the demand for quality evaluation and judgment delegation apart from fine wines. Subsequently, with the fall of the search cost for price, information, and expertise, we are witnessing a digital switch toward informal influence. This is to our knowledge the first integrative review spanning the emergence and development of the industry of information and specialized valuation in the major wine markets.

Keywords: information asymmetry, wine ratings, quality evaluation, prescription, digital transformation, online review aggregators, prosumers.

1. INTRODUCTION

The issue of uncertainty concerning a product's quality represents a significant area of focus within the field of economics. In particular, the seminal work of Akerlof (1970) [2] and Spence (1973) [3] have highlighted the association between information asymmetry, a particular type of market inefficiency, and the necessity for quality signaling through product certification. Under information asymmetry, the advice provided to the less informed agents in the market becomes a valuable service for which a market may emerge. Contrary to the predicted consequences of informational asymmetries under quality uncertainty, the spontaneous emergence of an "intermediate market" for quality assessment by independent evaluators has

received scant consideration. In fact, the theoretical foundations for the emergence of such a market without the need for a formal certification-conferring authority are anything but clear.

Compés-López et al. (2018) [4] suggest that an industry of information and specialized valuation has emerged in the major wine markets. Similarly, various papers refer to the existence or the emergence of a wine quality evaluation market, at the crossroads between wine sellers, wine buyers, and wine experts (e.g. [5],[6]). The present research proposes an integrative literature review of 267 papers (including publications from conference proceedings) on wine ratings, reviews and scores published from 1970 onwards retrieved from the Web of Science, Science Direct, Scopus, and Google Scholar databases. The objective of this integrative literature review is to collect and report some features identified so far in the literature, which should be considered in future theoretical and empirical analysis of such spontaneous intermediate quality evaluator markets. More specifically, it aims to provide a comprehensive overview of the existing research on wine ratings.

The review suggests the existence of an expanding two-sided market structure (this can be likened to the case of media, payments systems and matching markets) because the demand for expert opinion from wine consumers does not generate sufficient income to sustain the suppliers. Wine media must therefore subsidize readers (demand side one: customers) and make money out of advertisers or competition entry fees (demand side two: wine trade). Meanwhile, online review aggregators (platforms that gather user-generated reviews on different products into one easy-to-view dashboard, as is the case with Vivino) subsidize the free of charge (zero price) of online prosumer (in this case wine consumers who actively share their product experience participating in the production of wine reviews) reviews by charging commissions on sales (or by selling wine directly to their users) and selling both promotional services and data intelligence to the trade. Our integrative literature review highlights the fact that the survival of both experts and online review aggregators is dependent on the trade.

To the best of our knowledge, our paper represents a pioneering discussion of the complementarity of the two quality signal sources (experts and peers), each associated with a specific demand type. In this respect, it provides useful support for recent developments on (two-step) hedonic functions by type of actor [7]. At a more foundational level, our findings offer a promising avenue for exploring the potential implications of such an information market on the wine market, particularly in terms of marketing, operational and strategic management, and finance.

2. LITERATURE ANALYSIS: INTEGRATIVE REVIEW APPROACH

2.1 Reasons behind the choice of an integrative literature review approach

In contrast to systematic literature reviews, integrative literature reviews are more flexible ways to synthesize existing research. It allows for a diverse range of sources, including theoretical, qualitative, and quantitative, to be incorporated in order to develop new frameworks, identify potential research gaps, and provide a comprehensive understanding of a given topic. Because research on wine evaluation is fragmented, originates from different fields (e.g. economics, marketing, sensory sciences, linguistics) and uses multiple study designs and methodologies (e.g. hedonic price function, experimental economics, content analysis, principal component analysis), the use of an integrative literature review is indicated [8]. Integrative literature review methodology proves particularly useful when studying a recent change in the direction of a phenomenon [8] such as the emergence of peer evaluation as the source of a potential paradigm shift in the wine evaluation market identified by Bazen et al. (2022) [9]. Unlike systematic reviews, integrative literature reviews are versatile, they allow the use of "grey literature" such as conference proceedings [10]. We acknowledge that those publications do not offer sufficient guarantees as validated knowledge, but we consider that the importance of the insight they provide in the study of a recent phenomenon is a sufficient justification for their careful consideration.

Following the integrative literature review methodology revised by Whittemore & Knafl (2005) [1], we structure the topic of quality evaluation and valuation in the wine market. A comprehensive literature search is conducted across multiple databases, including empirical studies (e.g. [11]), theoretical papers (e.g. [12]), and grey literature (e.g. [13]) using specific inclusion and exclusion criteria to ensure relevance. Subsequently, the quality and relevance of the selected studies are subjected to critical assessment using staged review. The data analysis phase entails the identification of themes and patterns through thematic analysis, with the findings subsequently organized into coherent themes. Ultimately, the review synthesizes the findings into a coherent narrative, highlighting research gaps.

2.2 Selection criteria

The vocabulary used to refer to quality evaluation, quality signaling and quality evaluation intermediaries in the wine market is extensive (see Table 1).

Considering this diversity, we have deliberately opted for broad inclusion criteria to capture the evaluative content produced by experts and peers. Using Boolean logic, the search strings in Web of Science, Science Direct, Scopus, and Google Scholar databases consisted of the terms *wine ratings*, *wine review,* and *wine scores*, including synonyms, and abbreviations. Recently published peer-reviewed articles and earlier literature (from 1970 onwards) published in English were searched. We also reviewed the articles citing the articles obtained through this search as well as their references to identify further potentially relevant studies. The record selection process is displayed in Figure 1.

A total of 530 books and papers published prior to July 2023 were identified and 83 duplicate records were removed prior to screening. Subsequently, the remaining records were screened on the basis of content, with 120 papers (in particular, those comparing the sensory performances of experts and consumers) being excluded. Ultimately, 267 papers were selected for the integrative review following detailed analysis using staged review.

Table 1. Topics and keywords.

Themes	Keywords	Examples of references
Experts	expert*, critic*, guru*, connoisseur*, rater*, assessor*, judg*, jur*	Ali et al., 2010 [14] Brien et al., 1987 [15] Gokcekus & Gokcekus, 2019 [16] Honoré-Chedozeau et al. 2015 [17] Parga-Dans et al.,2022 [18]
Peers	peer*, apps, crowd-sourced, pannel*, prosumer*, influenc*, opinion, community	Buonanno et al., 2008 [19] Oczkowski & Pawsey, 2019 [20] Thrane, 2019 [21]
Quality evaluations	quality, competition*, show*, rat*, scor*, review*, award*, medal*, apprais*, evaluat*, valu*, appreciat*, prescri*, advi*, recommend*, apprais*, assess*	Bessy & Chauvin, 2013 [22] Cicchetti, 2009 [23] D'Alessandro & Pecotich, 2013 [24] Dunphy & Lockshin, 1998 [25] Neuninger et al., 2017 [26] Paroissien & Visser, 2020 [27]
Intermediation	intermedia*, mediat*, coordinat*, tier-part*, opinion leader*,	Bessy & Chauvin, 2013 [22] Hsu et al., 2007[28] Karpik, 2007 [29] Sharkey et al. 2022 [30]

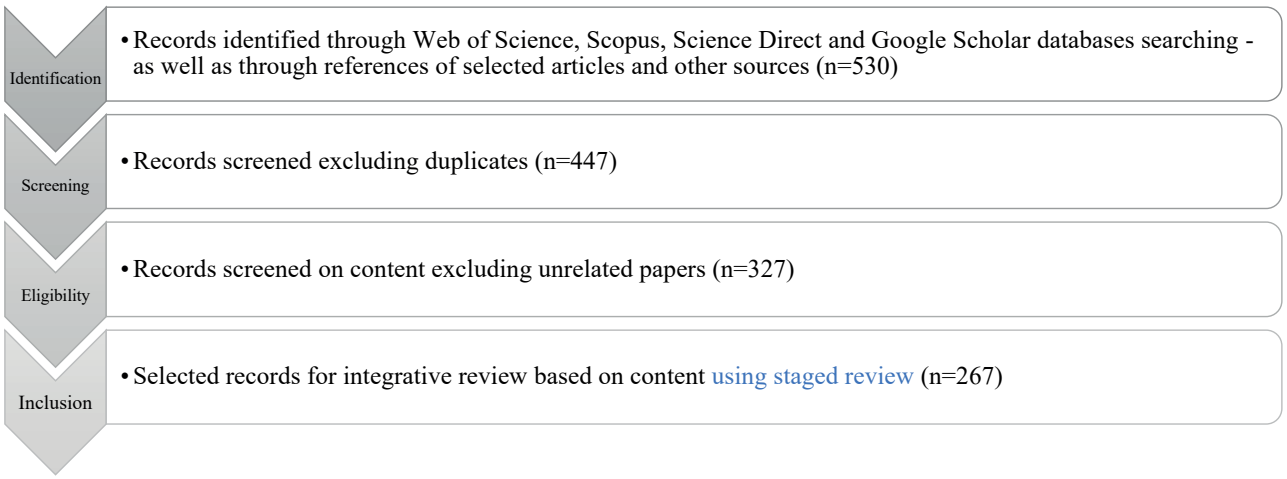


Figure 1. Records selection process for integrative review

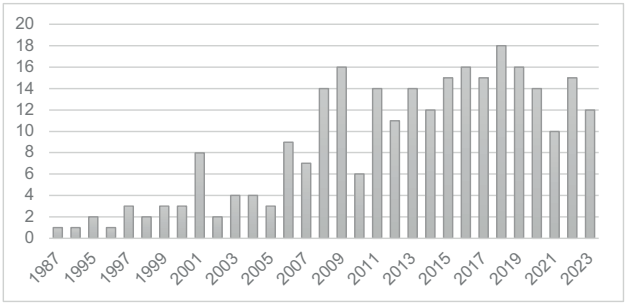


Figure 2. Number of publications per year on wine scores, ratings, and reviews in the final selection

The number of records per year in the final selection appears in Figure 2.

Among the records selected for the integrative review, the Journal of Wine Economics, first published in 2006, is by far the best represented (59), followed by the International Journal of Wine Business Research (16), the Journal of Wine Research (18), and Food Quality and Preference (13). The overview of all final used papers within the scope of the integrative literature review is available in the Appendix.

The analysis of the literature is facilitated by the deconstruction of the topic into the key relationships and interactions between the supply and demand sides of wine quality information.

3. THE MARKET FOR QUALITY EVALUATION

3.1 Analysis of the supply

3.1.1 Wine experts: only the best rated by only the best

Definition

Professional wine experts possess both conceptual knowledge (of terroirs, grape varieties, vintages) and perceptual (sensory) knowledge of wine [31],[32]. While opinion leaders are traditionally difficult to identify, since the 1970s professional wine expert tasters have identified themselves through their public roles [33]. According to Fernandez (2004) [34], in the wine market, the core of wine critics' activity remains the publication of wine reviews and consumer guides: their opinion is their living. The most influential publications in this field include Decanter, The Wine Spectator, the Wine Advocate and a number of prominent individual critics, such as James Suckling, Jancis Robinson and Tim Atkin. Figure 3 presents the main interactions between wine experts and the stakeholders of the primary market.

Rated wines

Given the constraints on the number of bottles that they are able to taste and evaluate on an annual basis, experts tend to prioritise their prescription work on fine wines, which are characterised by higher prices and superior reputations[1]. The *Wine Spectator* tasting team reviews more than 15,000 wines a year, they also exclude thousands of (often non-premium) wines from their selection [35]. The majority of these businesses have come to rely on solicited samples to maintain a sustainable equilibrium within their business models. The reliance on solicited samples might explain the censorship applied to negative reviews by wine experts [36]. A negative rating on one vintage could jeopardize the possibility of receiving samples the following year [34],[37],[38]).

Top critic scores are crucial globally for *en primeur* [14],[39], however, it is a common practice amongst producers of super-premium wines to decline participation in blind reviews; the potential for an unfavourable assessment to generate adverse publicity is a significant concern in this regard. Nevertheless, quality ratings hold little significance beyond the domain of fine wines [40–42].

Audience

The market structure for experts is complex due to the diversity of their publishing channels[2]: they can own publications, wine magazines, specialized and general print press, and online channels [43–44]. According to Storchmann, discussing the US wine market fifteen years ago (2012, p. 22 [45]), "The market for expert opinion on wine is large. The seven major U.S. wine magazines have a combined subscribership of more than 500,000, with 350,000 alone for the Wine Spectator; wine magazine sales total more than $25 million". Today, most of the wine publications mentioned by Storchmann in 2012 (data from 2010) have increased their readership base. The three major U.S wine magazines (*Wine Spectator*, *Wine Enthusiast*, and *Wine & Spirits*) have a combined subscribership of more than 750,000, with 389,000 alone for the Wine Spectator [46]. Online marketplaces also

[1] Although fine wines have no commonly accepted definition in the literature, they are commonly distinguished from so-called "normal wines" by their higher prices and superior reputation (Ben Ameur & Le Fur, 2020; Le Fur & Outreville, 2019).

[2] As a matter of fact: "Robert Parker has been profiled in such major magazines as Time, Newsweek, Atlantic Monthly, People, Money, The Traveler, Changing Times, Esquire, GQ, Business Week, Smart Money, The Robb Report, notable newspapers such as The Los Angeles Times, USA Today, The Boston Globe, The New York Times, The Baltimore Sun, The London Sunday Times, The Sunday Telegraphe, The Independent, The Financial Times, Le Journal du Dimanche, and L'Express, and in virtually all of Europe's leading magazines, including The Economist, Paris Match, and Figaro." https://www.robertparker.com/about (Consulted March 2020).

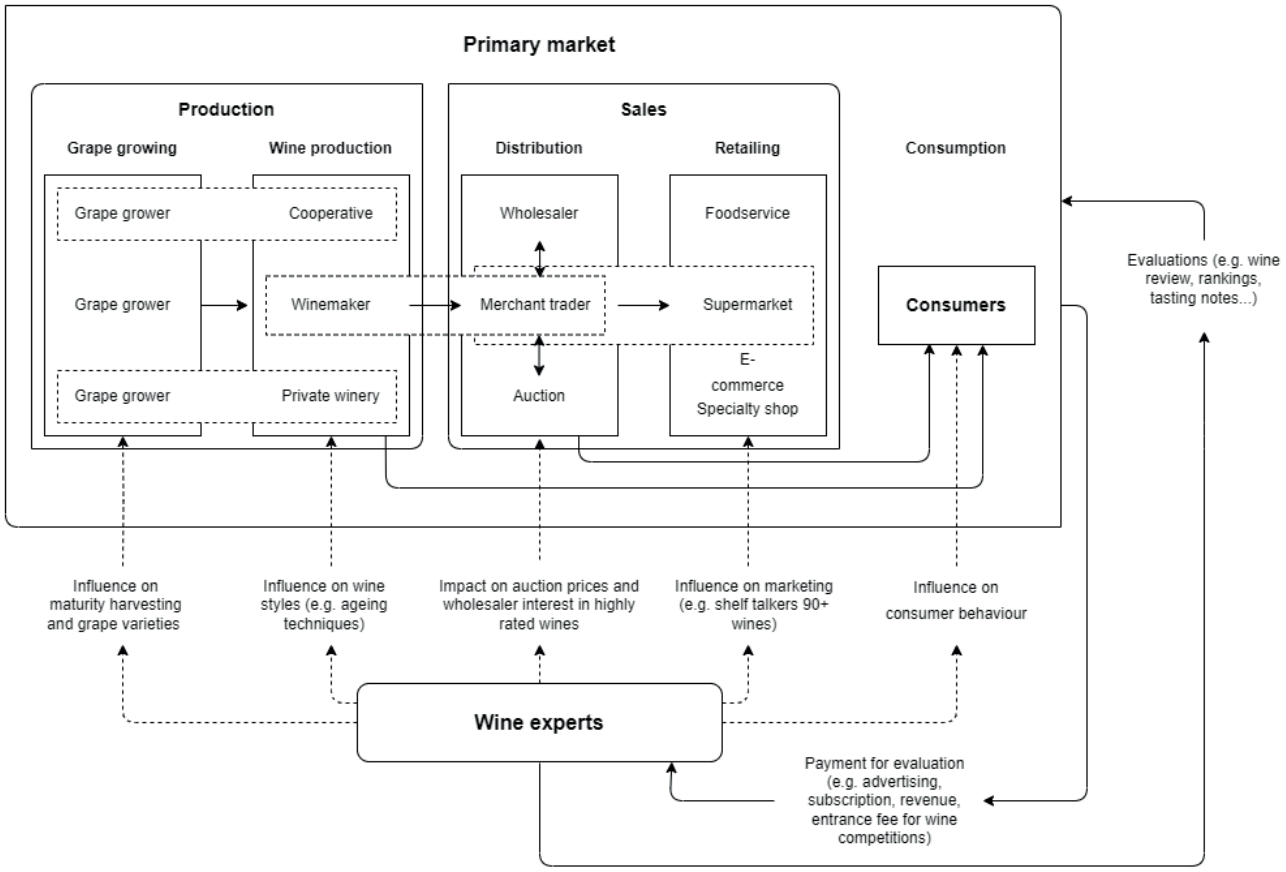


Figure 3. Integration of wine experts in the wine value chain (adapted from Kwon & Easton (2010) and Goncharuk (2017))

supply wine critics (especially English-speaking ones) with a much wider network of prescriptive channels and reach than ever before [47–48].

Still, researchers deplore the difficulty of determining the area of influence beyond publications and subscribers, as well as the scarce availability of figures on publications and sales of magazines and guides dedicated to wine [49]. We know that wineries are important customers for guidebooks, as they tend to share them among themselves [50]. However, there is no mention made in the literature of the proportion of this subscription or of the purchase of guides actually generated by the trade (e.g., wine producers, distributors, retailers) and not by wine consumers[3]. Likewise, the subscriptions figures do not reveal possible overlap (especially among professionals) nor the indirect reach of experts (e.g., one magazine can be read by multiple readers, word of mouth).

Business model

The main source of revenue for wine critics and magazines is circulation and advertising revenue as well as subscriptions to access their ratings: their value for advertising increases with the number of readers. When critic's ratings are not displayed in store or online at zero price, wine consumers are usually charged with positive prices (subscription) to access them.

Criticisms

Wine experts have been found to be less reliable and consistent than experts in fields such as medicine, clinical psychology, business, auditing, personnel management, or meteorology [51]. They have even been charged with opportunistic behavior, grade (rating) inflation, and conflict of interest [22]. The accuracy of wine experts' judgment has been challenged, particularly

[3] *La Revue du vin de France* is one of the most important wine magazines in France, with 40,000 subscribers and 300,000 unique visitors on their website. A recent qualitative survey (n=1736) distributed to their readers gives interesting hints of their profile: from the 87% males and 13% females, 83% are enthusiasts and 17% work in the wine industry (of which 27% are winemakers, 17% sommeliers, 15% wine merchants, 11% salespersons). Their interest goes primarily to tasting notes (source: https://www.larvf.com/qui-sont-les-lecteurs-et-lectrices-de-la-rvf,4667518.asp).

by Ashenfelter & Jones (2013, p. 1[52]): "the expert opinions are not efficient, in the sense that they can be easily improved, and that these opinions must be demanded, at least in part, for some purpose other than their accuracy". In his study of publication bias in *Wine Spectator*, Reuter (2009) [53] suggests that wine consumers may be more tolerant of review bias than consumers of other product categories, due mainly to the subjectivity of wine tasting

The business model of experts is based on two main revenue streams: subscriptions and the sale of advertising space. Although there is no evidence to suggest that advertising spending directly impacts wine scores, it can be posited that companies which invest in advertising within wine publications are more likely to be chosen by wine critics to have their wines tasted. The wine magazines could be suspected of opportunistic behavior to attract more advertisers (wine sellers). However, Reuter (2009) [53] studying Wine Spectator publication bias (product coverage and review) concluded that advertising influences ratings only on the margin, particularly enhancing retasting of wines rated less than 70 during the first single-blind tasting. According to him, wine media's readership is a function of both subscription prices and the publication's reputation for being unbiased [53].

Experts rate, usually blind tasting, both the present and future value of wine, while peers rate it, usually not blind, only through the scope of their current appreciation [54]. This leads Schiefer & Fischer (2008) [55] to question the usefulness of wine experts' ratings as a predictor of wine consumer liking and to infer that most expert ratings do not reflect consumer taste. Even though the prior knowledge of price, brand and reputation may bias their appreciation [56] peers may be more relevant than experts to super-premium available wines for example, because they may taste them more often than critics. More bankers than wine critics can afford drinking/tasting Domaine de la Romanée Conti.

Future perspectives

The evolution of other experience goods markets, such as art or hospitality, foresees the disappearance of experts in favor of peer recommendations [57–58]. Cox & Kaimann (2015) [59] predict that the growing influence of word-of-mouth and consumer-generated content in consumer purchase decision-making could decrease consumers' reliance on the opinions of experts or professional critics. Clauzel et al. (2019) [60] recommend that experts capitalize on the empowerment of consumers by integrating prosumers' reviews into their content, alongside their own ratings. A similar trend (see Figure 4) might be ongoing in the wine industry [61–62].

3.1.2 Online review aggregators: all rated by all

Definition

A participatory culture is emerging among consumers [63]. Unofficial and informal prescription is gaining importance in the wine market; consumers' tastes

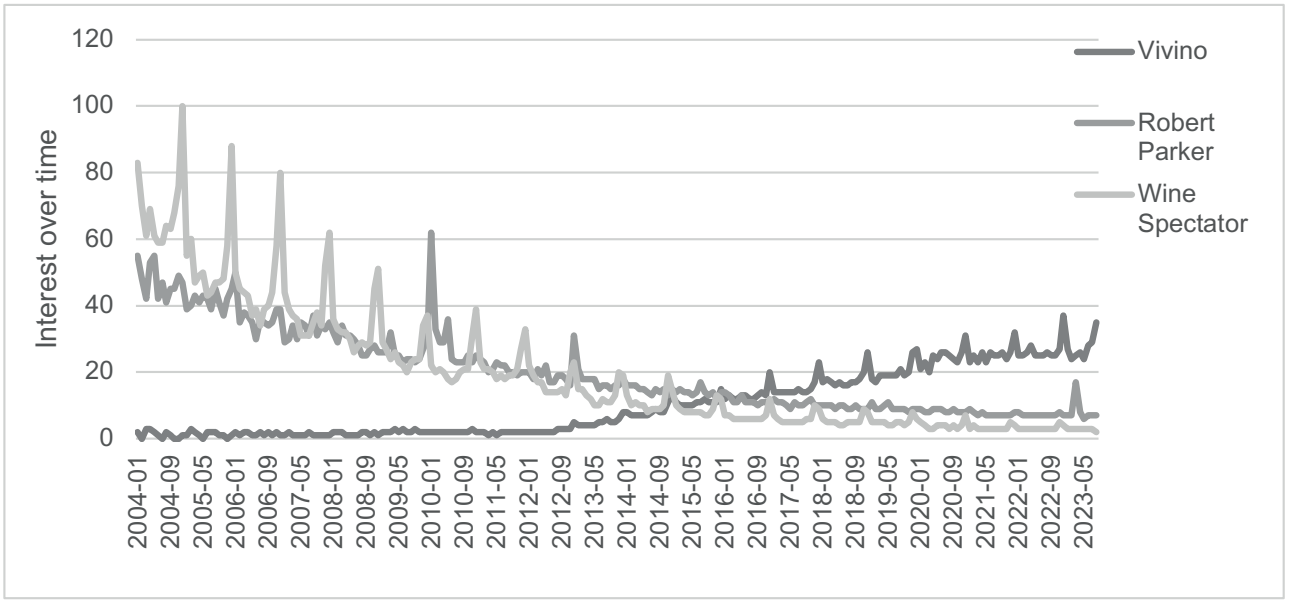


Figure 4. Google trends worldwide (Vivino, Robert Parker, Wine Spectator).

Table 2. Evolution of the number of users, wines, scanned labels, and ratings on Vivino.

Year	Users	Wines	Scanned labels	Ratings	% of wines rated	Reviews	% of wines reviewed
2014	4,762,336	1,298,332	40,322,319	10,496,576	26%	2,329,346	6%
2015	10,332,744	6,826,573	147,057,872	29,878,575	20%	9,794,912	7%
2016	17,055,145	8,983,693	250,731,923	45,999,716	18%	15,890,474	6%
2017	23,012,455	10,573,756	375,347,597	64,499,224	17%	21,731,482	6%
2018	35,464,050	10,573,996	834,357,775	123,819,828	15%	42,025,965	5%
2019	36,911,161	10,868,691	892,534,812	130,613,064	15%	44,550,050	5%
2021	51,880,356	13,625,480	1,629,548,572	207,065,136	13%	73,297,000	4%
2022	57,881,172	15,003,610	1,959,609,646	234,159,998	12%	83,915,528	4%
2023	64,582,058	16,647,522	2,429,210,838	272,963,324	11%	95,343,375	4%

(general hedonic rating) prevail over quality evaluation because the personal taste is simply more relevant than quality when choosing a wine [55]. Experts are no longer the only benchmark for quality, the wisdom of the crowd is gaining prevalence for knowledge construction and evaluation [57]. With the internet and the emergence of online ratings, wine consumers have shifted from passive to active purchase evaluation, and their comments displayed online provide an informative signal of quality [64]. "That is democracy at an organoleptic level; it is subjective individualism raised to a moral principle." (Shapin, 2012, p. 83 [65]). The wine drinkers who share their wine-tasting experience on platforms like Vivino, CellarTracker or Delectable also produce information about wine quality. Online review aggregators bundle this (prosumers) user-generated content (UGC) to provide quality information to other users, creating what Chan et al. (2022) [66] call "prosumers communities".

Rated wines

The remarkable sales figures of The Wine Trials [67] indicated a potential demand for more consistent evaluation of everyday wines. Prosumer communities cover all wine categories without discrimination[4]. Online review aggregators have expanded the market for wine quality evaluation, providing ratings where they were not available before (cheaper wines) and supplying those ratings aggregated at zero price (free of charge).

Audience

The world's largest online wine rating community and marketplace, Vivino, claims no less than 29.9 million users and 89.4 million ratings. The first academic mention of Vivino in a working paper dates back to 2018 [68]. The evolution of the number of users, wines, wineries, scanned labels, and ratings since 2014 is detailed in Table 2.

Vivino's wide adoption has been facilitated by the rise of apps use from more than 2.7 billion users [69]. Comparatively, CellarTracker, another online review aggregator and inventory management tool[5] mostly used by wine collectors, claims 4.3 million wines and 11.8 million community and professional ratings (compared to 7 million in the summer of 2018).[6] Its users (232,000 in 2012[7]) manage more than 164 million bottles in their private cellars and have access to professional experts' ratings, market value, and inventory management [70–71].

Business model

The business model of online review aggregators revolves around user-generated content, monetized through advertising, premium subscriptions, affiliate marketing, and data analytics. These platforms provide a space for users to review, rate, and discover wines while offering targeted advertising opportunities for wineries and retailers. Premium subscriptions unlock advanced features like cellar management tools, expert recommendations, or exclusive content. Revenue is also generated through affiliate partnerships, directing users to purchase options and earning commissions, as well as by licensing anonymized consumer data to industry stakeholders for market insights.

Criticisms

Online review aggregators declare tackling the negative review censorship issue[8]. However, they fail to men-

[4] "There's a problem in wine: Over 75% of wines are never rated by experts. This is where crowdsourced ratings on Vivino become useful" https://www.vivino.com/wine-news/vivino-ratings-explained (consulted November 2019).

[5] Launched in 2003.

[6] https://www.cellartracker.com (consulted January 2023).

[7] To the best of our knowledge, number of users are not available.

[8] https://www.vivino.com/wine-news/vivino-ratings-explained "Another advantage our ratings have is that our community members are honest,

Table 3. Quality evaluation sources in the wine market. Source: authors.

Supplier	Source	Rated wines	Scale	Typology	Main users	Credibility based in	Consumer Price
Content review aggregators	Prosumers	All ranges	Over 5	Inclusion & Algorithmic egalitarianism *(synthesis of the ratings)*	Wine consumers	Number of ratings (aggregation)	Free
Media	Experts	Fine wines	Over 100 (or over 20)	Selection & reviewer's singularity or editorial elitism	Wine consumers, investors & collectors, Producers & organizations, distributors & retailers	Taster's or media's reputation of being unbiased	Free if provided by a seller / positive price in other cases (subscription)

tion three major issues with community ratings. First, the under-reporting bias [72]: prosumers might not be willing to spend (waste) time scanning, rating, or reviewing the wines that they dislike. Under-reporting leads consumers to comment only on the wines they liked or disliked a lot. Second, the acquisition bias [73]: a positive predisposition towards a wine enhances purchase and comment generation likelihood. Ultimately, beyond these two forms of self-selection bias remain the considerable variations in wine knowledge levels of the users, along with the significant problem of fake reviews [74].

Future perspectives

The limitation of expert wine evaluation to fine wine and the complexity of the evocative vocabulary have created an opportunity for peer-reviewing [75]. The importance of crowdsourcing prosumers' opinions is increasing, and so is their impact on the market [36],[76]. More specifically, hedonic price function estimates suggest that wine prices are better explained by online community rating scores than by expert ratings [20],[77].

To sum up, there are two sources of quality ratings in the wine market, offering heterogeneous information products (experts versus community ratings) at different prices (positive versus zero-price i.e. free of charge). Historically dominated by wine experts (reviewing only fine wines), evaluative intermediation now reaches cheaper wines and a wider audience with online review aggregators (see Table 3). This has the effect of complicating the determination of whether they may be considered substitutes or complements.

sometimes brutally so, with their ratings. Many experts opt not to publish poor ratings, assuming that wines that are lacking will eventually take themselves out of the running. But with Vivino, you'll find a wide range of ratings, letting you know what you can buy with confidence and what wine might not be the best fit" https://www.vivino.com/wine-news/vivino-5-star-rating-system (consulted November 2019).

3.2 Analysis of the demand

3.2.1 Wine consumers: lowering search costs effect

Most consumers declare that liking a specific wine they tasted before is the most important reason for their (re)purchase [78],[79]. However, previously purchased wines are not systematically available for purchase (see on-trade for example). Since wine is an experience good, wine quality evaluation only occurs through post-purchase consumption. Wine consumers are subject to information asymmetry. Moreover, unlike in other markets (education, finance), the wine market offers no homogenized institutional quality signaling system at a global level [80]. The high complexity and heterogeneity of existing quality signaling systems (e.g. Geographical Indications in the European Union and the United States) can be perceived as confusing by consumers, who may look for alternative sources of quality information [81–83]. More broadly, the complexity of the wine market is a source of consumer confusion and qualifies wine buying as a risky activity for most wine consumers [84].

When confronted with uncertainty about product quality, consumers often use multiple product quality cues as proxies for quality [85],[86]. Another solution to cope with this confusion is for consumers to rely on better-informed agents when making their decisions [87]. These third parties supply homogenous information mapped on a single rating scale comparable among wines [62]. To reduce perceived risks when selecting a wine and to maximize their satisfaction, wine consumers can delegate quality judgment to others [29]. They seek the advice of wine experts, friends, family members, and clerks who are deemed knowledgeable [88]. There is a wide literature on wine experts focused on perceived risk reduction and subsequent purchase intention stimulation [89],[90],[91]. Although experiential information

has the highest informational content, sources of quality evaluation such as peers have not been extensively investigated [92].

3.2.2 Fine wine investors and collectors: warranty effect

The classification presented here is the result of a balanced structure within the paper itself, rather than the result of the preferences of fine wine investors and collectors being homogeneous. However, Masset (2024) [93] suggests that the preferences of investors and collectors are equally influenced by the reputation of wines. Since professional wine experts work as proxies for rating agencies, wine critics' scores have opened the market for Bordeaux fine wines to investors [94]. The financial indices of Liv-ex.com were built using wines rated 95 and above by Robert Parker [95]. Liv-Ex is nowadays the primary electronic exchange platform for trading fine wine. Merchants, brokers, retailers, and consumers can use the platform to purchase these wine futures in advance of their distribution for retail operations. Along with the process of financialization in the fine wine market, several economic studies have shown the correlation between experts' ratings, *en primeur*, and auction prices (e.g. [11],[22],[96]). Wine is the only agricultural market to have reached such a valorization of variability in the premium part of its market [97]. But there might be an interdependency here since in her attempt to identify the macroeconomic determinants of fine wine prices, Jiao (2017) [98] concluded that the increasing volatility of prices triggers demand for expert appraisal from fine wine investors. The influence of expert information on price is subject to variation over time. In a hedonic analysis of fine wines, Faye & Fur (2019) [99] demonstrated that, in contrast to the Parker score, the Quarin (French critic) score exerts a remarkably stable influence on price. Similarly, it may be posited that the influence of peers on valuation is likely to be contingent on price levels [100].

3.2.3 Wine producers and organizations: signaling quality as marketing strategy

The determination of wine prices is no longer solely contingent upon production costs. Instead, they are also influenced by the collective reputation of the region or geographical indication, as well as the individual reputation of the brand [49],[101],[102],[103],[104]. The marketing of quality, a key element of a differentiation strategy for wine producers, involves close contact with critics as part of their communication and reputational strategy [105]. Evidence abounds that reviews of professional critics enhance commercial success, though consumer sensitivity to reputation is higher for premium, super-premium, and icon wines [59],[106]. Wine reputation is positively correlated with expert ratings [20]. Collective reputation is shown to have an impact on consumers' willingness to pay, which rises in line with the reputation of individual wine producers [102]. The individual reputation of wineries will also enable them to select their retailers and distributors depending on the positioning they wish to reflect: hotels, restaurants, independent wine stores and export for fine wines, and supermarkets for bigger-volume wine producers [107]. This explains why, for high-end wineries, reputation management can become almost as important as revenue management [108]. Organizational reputation has become a strategic intangible asset for firms and is one of the most important drivers of their success [109], which is why some companies place wine critics at the core of their marketing and communication strategy [110].

Wine critics benefit from close contact with wine producers enabling them to publish interesting articles and well-informed reviews. They reciprocate by disseminating products and company messages [111]. "Producers, and intermediaries such as distributors and retailers, often use favorable reviews to promote products, resulting in a multiplier effect for evaluation where the eventual audience can be far broader than the direct audience (e.g., paid subscription)." (Kwon & Easton, 2010, p. 136 [95]).

3.2.4 Wine distributors and retailers: quality signaling as an intermediate product

The academic literature has studied the effect of shelf-talkers (product cards including ratings that appeal in stores) on sales, and shown from early on their positive correlation with sales: scored wines outsell non-scored wines in retail studies (e.g. [112],[113]. Retailers are therefore encouraged to use a wide range of wine experts' references in shelf talkers that will boost their sales. Distribution networks are increasingly important in the wine evaluation market, reflecting the transformation of economic competition into a more vigorous struggle for attention and visibility [50],[95],[114]. Hsu et al. (2012) [115] and Hennion (2015) [116] underline the importance of evaluative schemata (mental representations of evaluative categories) and procedure clarity, to help both consumers and producers cope with uncertainty, and to allow producers to anticipate quality assessment and adequately adjust their production strategy. Even when distributors, retailers, or sommeliers state that they do not pay attention to ratings, their

audience base (customers) might force them to recognize the judgment of critics and to adapt to it, listing iconic 100-point wines, for example [117]. Bazen et al. (2023) [77] additionally highlighted the increasing significance of Vivino ratings for wine importers.

4. DISCUSSION

Even though the empowerment of the vox populi in the wine market has been noticed for almost two decades, the existing literature about online consumer-generated content on wine remains scarce outside of the context of wine tourism [118]. In a recent European survey, more than 30% of the 7,324 respondents stated that they had a wine app on their mobile phone[9] [119]. Nevertheless, only a limited number of papers have integrated prosumers' reviews in their reflection (e.g. [62]) or compared their relative influence with experts' ratings using empirical (e.g. [20],[77]) or experimental methods [19],[21],[120]. Still, part of the literature available on the topic consists of working papers, unpublished in peer-reviewed journals to date [20–21,56,121–123], In 2022 only, more than 10 projects using Vivino data were presented at the three major wine economics and business conferences in 2022 (European Association of Wine Economists, American Association of Wine Economists, Academy of Wine Business Research). The most recent publication available investigates the emotional response to Vivino reviews exposure [124]. As there are to date no published studies that used other methods than hedonic price analysis to compare the influence of peers' and experts' ratings in the wine market. The results reported here should be considered as part of a larger effort to develop more empirical research about the wine evaluation market.

Analyzing both sides of the market, this review highlighted the financial reliance of wine experts and online review aggregators on the wine trade. Both expert and consumer assessments of quality are similarly uncertain and susceptible to various biases. This may provide an explanation for the reluctance of consumers to pay a premium for these services. This review highlighted the fact that only a tiny proportion of the ratings users are willing to pay for a subscription to get access to wine evaluations. While the majority of consumers do not disregard the value of ratings when obtained for free, they are not willing to pay for it[10] [80]. This is why a vast majority of experts rely on free requested samples and advertisement income to carry out their activities. Without the sale of advertisements (and more recently other side activities like competition or events), most wine publications would not be profitable [53]. Nor would the online review aggregators without the sale of wine promotional services and data [126]. The present integrative literature review reveals that both revenue models are based on two-sided strategies (See Figure 5).

According to Evans (2003) [127] in two-sided markets, the intermediaries must (1) select a price and (2) use a differential pricing structure (not only how much they will charge, but to whom). They usually skew the prices on the less price-sensitive side of their two sets of customers. The wine valuation market behaves like a two-sided market when suppliers subsidize one side of the market to earn profit from the other side.

Experts' ratings reach three different categories of stakeholders: industry readers, consumer readers and consumers who see scores in the store or online (not to mention word of mouth from any of those three categories of stakeholders). Wine consumers, investors, and collectors can pay to get access to most of the media through which expert reviews are conveyed: Magazines, guides, and online reviews. But information is also made available at zero price (often in exchange for viewing advertisements on the platforms) to consumers: wine ratings and awards are frequently displayed in both online and brick-and-mortar shops.

Meanwhile, online review aggregators provide free ratings to their users. Those free ratings inform the customers of their marketplace, which positively impacts sales (including commissions or sales margin). Wine producers, distributors, and retailers do not pay to have their wines listed by online review aggregators. Prosumers review wines for free through their smartphones or computers. But producers must pay if they want to correct inaccuracies in the information available about their wines on the platform, advertise their production (enhancing their profile or purchasing triggered email campaigns), or purchase data about specific markets and consumers' preferences (brand awareness, engagement, sales)[11]. Wine producers, distributors, and retailers also pay fees to list their wines in competitions (and potentially receive an award), and to advertise in the wine media. Based on the review of the literature, Table 4 presents the two-sided strategies for experts and online review aggregators.

Online review aggregators in the wine market benefit from both positive same-side and cross-side network effects. The increasing number of Vivino users, for example, feeds the platform and increases its utility

[9] Even though having downloaded an app does not necessarily imply that this is used on a regular basis.

[10] Reminding us of digital journalism, for a systematic review see O'Brien et al. [125].

[11] https://www.vivino.com/partners (consulted October 2023).

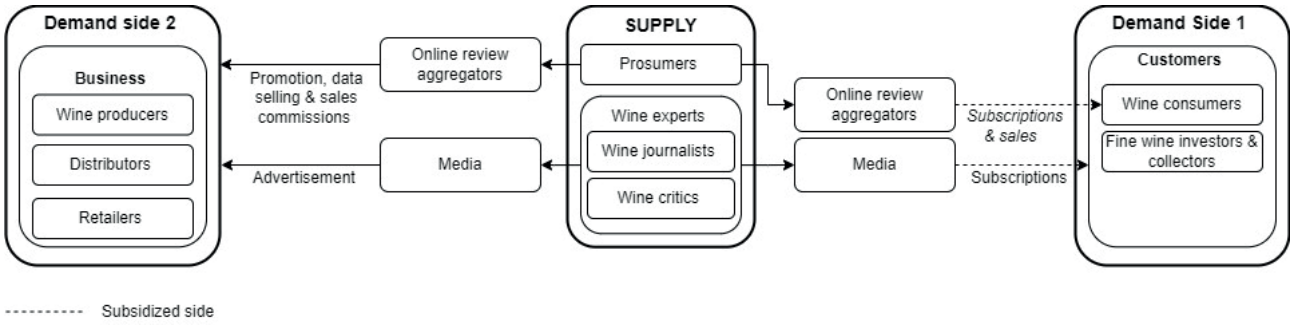


Figure 5. Revenue model of the wine evaluation market: a two-sided strategy

Table 4. Two-sided strategy and prospect. Source: authors.

Two-sided market	Side one	Side two	Subsidized side	Cost structure	Source of revenue	Prospect
Online review aggregators	Wine consumers	Wine producers and business	Wine consumers – zero price for ratings	Platform maintenance, Analytics and Insights, Marketing	Wine consumers through direct wine selling Wine producers and Business through promotional services, data intelligence & sales commission (marketplace)	Growth
Wine media	Readers	Wine producers and business	Readers	Content creation, Publication, Distribution and Marketing	Readers subscriptions Advertisements from wine producers & business	Slow decline

to other users (same side). At the same time its value as a data provider or as a marketplace for wines increases with the number of potential customers (cross-side). It is possible for new players to enter the evaluation market at a limited cost; however, new online review aggregators will suffer from a competitive disadvantage, as the utility they offer both their users and potential customers of data or marketplace solutions depends on their number of users. Conversely, the path to success for new experts lies in building awareness and establishing credibility which typically takes time,

5. CONCLUSION

Two sources of wine ratings coexist on the market: experts and online review aggregators. While the literature on wine experts is extensive, the one on online review aggregators remains scarce. The supply of professional quality evaluation (wine experts) is characterized by its multiplicity and fragmentation over the years whereas online review aggregators offering for-free content are highly concentrated in the market, corroborating the conclusions of Barnett (2018) [128]. In other experience goods markets, such as hospitality, the influence of peer ratings now surpasses the influence of experts' ratings. In the wine market, their coexistence illustrates two different definitions of quality. Professional wine experts focus on fine wines, charge positive prices to access their ratings (subscription) and impact the entire value chain (production, sales, consumption). In the meantime, peers rate all kinds of wines, for free, across a wider price range. While the Wine Spectator experts claim to produce 15,000 wine ratings a year, the Vivino community produces more than 31 million[12]. While the *Wine Advocate* prides itself on the 450,000 ratings housed in their online database, Vivino has 620 times more. If online review aggregators become the dominant evaluation source on the market, they could similarly influence the market and different wines could be favored. Since they rate all wine segments, it may lead to a renewal of the demand for less high-end wines globally.

This integrative literature review of the recent trends underlying the market for wine quality evaluation reveals various interesting patterns. Even though the importance

[12] Source: Vivino internet archive, from September 5, 2021 to September 5, 2022.

of experts is decreasing, the wine market is likely to sustain both peer and expert quality information sources in the long run (they complement rather than substitute for each other). Their coexistence is likely to sustain and stimulate the E-commerce market for wines in the coming years, including direct-to-consumer (DTC) sales. The literature review has revealed that both sources of ratings base their business models on a two-sided strategy and could not be sustainable without the trade. Online review aggregators offer free access to wine drinkers' reviews and use the generated data to source and sell popular and high-rated wines to their users. In the meanwhile, they also act as marketplaces, collect sales commissions, and sell promotional services as well as data intelligence to the industry. Based on this review we do not foresee a disappearance but a decline of wine experts (in the limited perimeter of fine wines), and a rise of the importance of online review aggregators in the wine evaluation market globally. Pure content producers such as *The Wine Advocate*, who employ one-sided structures (subscriptions are their only source of revenue), are likely to remain small[13] and be disfavored by competition against online review aggregators as their consumer base grows older. The predictions identified by this literature review are in line with the conclusions of Kwon & Easton (2010) [95] and suggest that the future lies in hybrid internet-based evaluation aggregators, like Vivino, that combine the functions of review aggregator and marketplace.

This review has important implications for managers. With the expansion of the audience of online review aggregators emerges the possibility that the so-called "wisdom of the crowd" (or "preference of the crowd" [62]) channels attention to a limited number of products already favored by other consumers. The importance of a plurality of supply of wine evaluations is therefore of prime importance for the sustainability of the wine market: online review aggregators inform customers, complementing the work of wine experts that attract attention to producers. Online review aggregators contribute to the stabilization of a hierarchy in which professional experts sustain the variability of an artistic fine wine market where no two wines should be perfectly identical, even to two vintages of the same wine (see [97]).

6. LIMITATIONS OF THE STUDY AND FUTURE RESEARCH DIRECTIONS

This study has integrated fragmented literature in the domain of wine quality information intermediation following the integrative literature review methodology revised by Whittemore & Knafl (2005) [1]. We acknowledge that combining diverse data sources and methodologies can be challenging. Despite the adoption of an exhaustive data collection strategy, the selection of inclusion criteria might have led to the omission of parts of the literature. For example, the Journal of Wine Economics, the leading outlet of articles related to the scope of the thesis, did not require keywords until 2013, which may have resulted in some missing references. An investigation into the ripple effects that the wine evaluation has on the wine market would have provided valuable insight. However, such an estimate is complicated by the opacity of the transactions (e.g., advertisements, price of promotional services or data intelligence) between stakeholders in the market. Seemingly, the value generated by the wine evaluation market cannot be easily measured through price. In the light of our findings, it would also be interesting to tackle the question of the long-term viability of expert ratings in the wine industry.

The disappearance of the border between the marketplace and prescription is also a central question for the wine industry. The acquisition of prosumer data gives online review aggregators access to valuable knowledge about consumer preferences that may provide them a competitive advantage over traditional competitors (experts). Online review aggregators can, as Vivino does, purchase and sell themselves the wines they have identified as being the most popular or the wines with highest potential according to their users and earn a direct sales margin instead of a commission on sales. Artificial intelligence is set to enhance the worth of this category of data, enabling a more precise targeting of consumers and sales of wine. Similarly, finding out how online review aggregators may affect wine producers' marketing strategies would be of utmost interest to the industry.

When wine experts supply information on wine quality, online review aggregators also provide their users with a personalized likelihood of liking based on past evaluations. The consumer purchasing path has been fundamentally transformed by recommendation systems, offering customized choices while obviating the requirement for intensive information search [129]. The rating of a wine does not tell you how it tastes, nor if you will like it. How do consumer past evaluations influence their likelihood to adhere to personalized recommendations generated by algorithms? The exploitation of consumer data by wine sellers (sourced from online review aggregators) to mitigate the information asymmetry prevalent in the wine market (by gaining insight into consumer preferences) is likely to emerge as a key research area in the near future.

[13] 50,000 paid readers for the *Wine Advocate*, against 375,000 for the *Wine Spectator* (Kantar, 2020).

ACKNOWLEDGEMENTS

The authors deeply appreciate the insightful comments provided by Larry Lockshin, Günter Schamel, Robin Goldstein, and Lara Agnoli. Their constructive feedback significantly contributed to the development of this work. We also extend our sincere gratitude to the anonymous reviewers, whose thorough and critical assessment was invaluable in substantially improving the quality of this manuscript.

REFERENCES

[1] R. Whittemore, K. Knafl, The integrative review: Updated methodology, J. Adv. Nurs. 52 (2005) 546–553. https://doi.org/10.1111/j.1365-2648.2005.03621.x.

[2] G.A. Akerlof, The Market for 'Lemons': Quality Uncertainty and the Market Mechanism, Q. J. Econ. 84 (1970) 488–500. https://doi.org/10.2307/1879431.

[3] M. Spence, Job Market Signaling, Q. J. Econ. 87 (1973) 355–374. https://doi.org/10.2307/1882010.

[4] R. Compés-López, C.I. Font-Julian, E. Orduna-Malea, Has Robert Parker lost his hegemony as a prescriptor in the wine World? A preliminar inquiry through Twitter, in: Proc. 2nd Int. Conf. Advanced Research Methods and Analytics (CARMA 2018), 2018. https://doi.org/10.4995/CARMA2018.2018.8320.

[5] P. Barbe, F. Durrieu, Evaluation of the Quality of the Great Bordeaux Wines: Are There Significant Differences Between Critics?, Int. J. Wine Mark. 17 (2005) 55–66. https://doi.org/10.1108/eb008795.

[6] T. Stenger, La prescription dans le commerce en ligne: Proposition d'un cadre conceptuel issu de la vente de vin par Internet, 1 Rev. Fr. Mark. 27 (2017).

[7] B. Faye, E. Le Fur, Heterogeneous buyer preferences behind rejecting the law of one price in the fine wines market, Econ. Lett. 239 (2024). https://doi.org/10.1016/j.econlet.2024.111744.

[8] R.J. Torraco, Writing Integrative Literature Reviews: Guidelines and Examples, Hum. Resour. Dev. Rev. 4 (2005) 356–367. https://doi.org/10.1177/1534484305278283.

[9] S. Bazen, J.M. Cardebat, M. Dubois, From Gurus to Geeks? The Role of Customer and Expert Ratings in a Hedonic Analysis of French Red Wine Prices, 2022.

[10] A. Paez, Grey literature: An important resource in systematic reviews, J. Evid.-Based Med. (2017). https://doi.org/10.1111/jebm.12265.

[11] G. Schamel, An Empirical Analysis of Online Auction Prices for Bordeaux Wine, 2004.

[12] M. Gibbs, M. Tapia, F. Warzynski, Globalization, Superstars, and the Importance of Reputation: Theory & Evidence from the Wine Industry, Chicago Booth School of Business Research Paper No. 09-13, 2009. https://doi.org/10.2139/ssrn.1343732.

[13] O. Gokcekus, D. Nottebaum, The buyer's dilemma – To whose rating should a wine drinker pay attention?, American Association of Wine Economists, 2011. [Online]. Available: https://www.wine-economics.org/dt_catalog/working-paper-no-91/.

[14] H.H. Ali, S. Lecocq, M. Visser, The Impact of Gurus: Parker Grades and en primeur Wine Prices, J. Wine Econ. 5 (2010) 22–39. https://doi.org/10.1017/S1931436100001358.

[15] C.J. Brien, P. May, O. Mayo, Analysis of Judge Performance in Wine-Quality Evaluations, J. Food Sci. 52 (1987) 1273–1279. https://doi.org/10.1111/j.1365-2621.1987.tb14061.x.

[16] O. Gokcekus, S. Gokcekus, Empirical evidence of lumping and splitting: Expert ratings' effect on wine prices, Wine Econ. Policy (2019). https://doi.org/10.1016/j.wep.2019.09.003.

[17] C. Honoré-Chedozeau, J. Ballester, B. Chatelet, V. Lempereur, Wine competition: From between-juries consistency to sensory perception of consumers, BIO Web Conf. 5 (2015). https://doi.org/10.1051/bioconf/20150503009.

[18] E. Parga-Dans, P. Alonso González, R. Otero-Enríquez, The role of expert judgments in wine quality assessment: The mismatch between chemical, sensorial and extrinsic cues, 2 Br. Food J. 124 (2022) 4286–4303. https://doi.org/10.1108/BFJ-04-2021-0373.

[19] P. Buonanno, G. Caggiano, M.M. Galizzi, L. Leonida, P. Vanin, Expert and Peer Pressure in Food and Wine Tasting: Evidence from a Pilot Experiment, 2008.

[20] E. Oczkowski, N. Pawsey, Community and Expert Wine Ratings and Prices, Econ. Pap. 38 (2019) 27–40. https://doi.org/10.1111/1759-3441.12240.

[21] C. Thrane, Expert reviews, peer recommendations and buying red wine: Experimental evidence, J. Wine Res. 30 (2019) 166–177. https://doi.org/10.1080/09571264.2019.1614548.

[22] C. Bessy, P.-M. Chauvin, The Power of Market Intermediaries: From Information to Valuation Processes, Valuat. Stud. 1 (2013) 83–117. https://doi.org/10.3384/vs.2001-5992.131183.

[23] D. Cicchetti, Wine rating scales: Assessing their utility for producers, consumers, and oenologic researchers, Int. J. Wine Res. (2009). https://doi.org/10.2147/IJWR.S4703.

[24] S. D'Alessandro, A. Pecotich, Evaluation of wine by expert and novice consumers in the presence of variations in quality, brand and country of origin cues, Food Qual. 3 Prefer. 28 (2013) 287–303. https://doi.org/10.1016/j.foodqual.2012.10.002.

[25] R. Dunphy, L. Lockshin, A contemporary perspective of the Australian wine show system as a marketing tool, J. Wine Res. 9 (1998) 107–129. https://doi.org/10.1080/09571269808718140.

[26] R. Neuninger, D. Mather, T. Duncan, Consumer's scepticism of wine awards: A study of consumers' use of wine awards, J. Retail. Consum. Serv. 35 (2017) 98–105. https://doi.org/10.1016/j.jretconser.2016.12.003.

[27] E. Paroissien, M. Visser, The Causal Impact of Medals on Wine Producers' Prices and the Gains from Participating in Contests, Am. J. Agric. Econ. 102 (2020) 1135–1153. https://doi.org/10.1002/ajae.12037.

[28] G. Hsu, P.W. Roberts, A. Swaminathan, Standards for quality and the coordinating role of critics, 2007.

[29] L. Karpik, L'économie des singularités, Gallimard, 2007.

[30] A. Sharkey, B. Kovacs, G. Hsu, Expert Critics, Rankings, and Review Aggregators: The Changing Nature of Intermediation and the Rise of Markets with Multiple Intermediaries, 4 Acad. Manage. Ann. (2022). https://doi.org/10.5465/annals.2021.0025.

[31] M.B. Frøst, A.C. Noble, Preliminary Study of the Effect of Knowledge and Sensory Expertise on Liking for Red Wines, 2002.

[32] C. Honoré-Chedozeau, S. Chollet, M. Lelièvre-Desmas, J. Ballester, D. Valentin, From perceptual to conceptual categorization of wines: What is the effect of expertise?, 5 Food Qual. Prefer. 80 (2020). https://doi.org/10.1016/j.foodqual.2019.103806.

[33] F. Edwards, G. Mort, The Expert Wine Taster, Int. Mark. Rev. 8 (1991). https://doi.org/10.1108/EUM0000000001538.

[34] J.-L. Fernandez, La critique vinicole en France: Pouvoir de prescription et construction de la confiance, Harmattan, 2004.

[35] A. Humphreys, G.S. Carpenter, Status Games: Market Driving through Social Influence in the U.S. Wine Industry, J. Mark. 82 (2018) 141–159. https://doi.org/10.1509/jm.16.0179.

[36] M. Steinberger, Every one a critic the future of wine writing, World Fine Wine 18 (2008) 130–135.

[37] J. Gans, S. Kaplan, Survive and Thrive: Winning Against Strategic Threats to Your Business, Dog Ear Publishing, 2017.

[38] S.F. Thode, L.W. Taylor, J.M. Maskulka, Information Asymmetries in the Pricing of Fine Wines, Int. J. Wine Mark. 14 (2002) 5–13. https://doi.org/10.1108/eb008731.

[39] D. Cyr, L. Kwong, L. Sun, Who Will Replace Parker? A Copula Function Analysis of Bordeaux En Primeur Wine Raters, J. Wine Econ. 14 (2019) 133–144. https://doi.org/10.1017/jwe.2019.4.

[40] A.M. Angulo, J.M. Gil, A. Gracia, M. Sánchez, Hedonic prices for Spanish red quality wine, Br. Food J. 102 (2000) 481–493. https://doi.org/10.1108/00070700010336445.

[41] R.S. Jackson, Nature and Origins of Wine Quality, in: Academic Press, 2017, pp. 337–370. https://doi.org/10.1016/B978-0-12-801813-2.00008-2.

[42] E. Paroissien, Essays in Empirical Economics on the Formation of Wine Prices, Theses, Université de Bordeaux, 2017. [Online]. Available: https://tel.archives-ouvertes.fr/tel-01701831.

[43] R. Chocarro, M. Cortiñas, The impact of expert opinion in consumer perception of wines, Int. J. Wine Bus. Res. 25 (2013) 227–248. https://doi.org/10.1108/IJWBR-2012-0014.

[44] D. Marks, Seeking the Veritas about the Vino: Fine wine ratings as wine knowledge, J. Wine Res. 26 (2015) 319–335. https://doi.org/10.1080/09571264.2015.1083953.

[45] K. Storchmann, Wine Economics, J. Wine Econ. 7 (2012) 1–33. https://doi.org/10.1017/jwe.2012.8.

[46] Kantar Media, Kantar Media, Kantar Media, 2020. [Online]. Available: https://www.kantarmedia.com/.

[47] P.-J. Benghozi, T. Paris, De l'intermédiation à la prescription: Le cas de la télévision, Rev. Fr. Gest. 142 (2003) 205–227.

[48] C. Lamour, De la Robertie, A Definition of Shopping Prescription and its Integration into the Decision-Making Process, 2015.

[49] S. Olivesi, Des vins et des hommes: Une économie symbolique du goût, Presses universitaires de Grenoble, 2018.

[50] V. Odorici, R. Corrado, Between Supply and Demand: Intermediaries, Social Networks and the Construction of Quality in the Italian Wine Industry, 6 J. Manage. Gov. 8 (2004) 149–171. https://doi.org/10.1023/B:MAGO.0000026542.18647.48.

[51] R.H. Ashton, Reliability and Consensus of Experienced Wine Judges: Expertise Within and Between?, J. Wine Econ. 7 (2012) 70–87. https://doi.org/10.1017/jwe.2012.6.

[52] O. Ashenfelter, G.V. Jones, The Demand for Expert Opinion: Bordeaux Wine, J. Wine Econ. 8 (2013) 285–293. https://doi.org/10.1017/jwe.2013.22.

[53] J. Reuter, Does Advertising Bias Product Reviews? An Analysis of Wine Ratings, J. Wine Econ. 4 (2009) 125–151. https://doi.org/10.1017/S1931436100000766.
[54] A. Corsi, O. Ashenfelter, Wine Quality: Experts' Ratings and Weather Determinants, 2001.
[55] J. Schiefer, C. Fischer, The gap between wine expert ratings and consumer preferences: Measures, determinants and marketing implications, Int. J. Wine Bus. Res. 20 (2008) 335–351. https://doi.org/10.1108/17511060810919443.
[56] G. Schamel, G. Gastaldello, Exploring online community wine ratings: Are more popular wines rated higher?, in: Book of Abstracts of First Conference of the EuAWE - European Association of Wine Economists, Vila Real, Portugal, May 2022, vol. 1, no. 1, pp. 156–158.
[57] P. Arora, F. Vermeylen, The end of the art connoisseur? Experts and knowledge production in the visual arts in the digital age, 7 Inf. Commun. Soc. 16 (2012) 194–214. https://doi.org/10.1080/1369118X.2012.687392.
[58] K. Kiatkawsin, H. Han, What drives customers' willingness to pay price premiums for luxury gastronomic experiences at michelin-starred restaurants?, 8 Int. J. Hosp. Manag. 82 (2019) 209–219. https://doi.org/10.1016/j.ijhm.2019.04.024.
[59] J. Cox, D. Kaimann, How do reviews from professional critics interact with other signals of product quality? Evidence from the video game industry: 9 Interaction of professional critic reviews, J. Consum. Behav. 14 (2015) 366–377. https://doi.org/10.1002/cb.1553.
[60] A. Clauzel, H. Delacour, S. Liarte, When cuisine becomes less haute: The impact of expert ratings on consumers' legitimacy judgments, J. Bus. Res. 105 (2019) 395–404. https://doi.org/10.1016/j.jbusres.2019.03.038.
[61] A. Albright, P. Pedroni, S. Sheppard, Uncorking Expert Reviews with Social Media: A Case Study Served with Wine, 2018.
[62] B.C. Smith, Getting More Out of Wine: Wine experts, wine apps and sensory science, Curr. Opin. Food Sci. (2019). https://doi.org/10.1016/j.cofs.2019.10.007.
[63] H. Choi, B. Burnes, How consumers contribute to the development and continuity of a cultural market, Consum. Mark. Cult. 19 (2016) 576–596. https://doi.org/10.1080/10253866.2016.1172214.
[64] C.M.K. Cheung, M.K.O. Lee, What drives consumers to spread electronic word of mouth in online consumer-opinion platforms, Decis. Support Syst. 10 53 (2012) 218–225. https://doi.org/10.1016/j.dss.2012.01.015.
[65] S. Shapin, The Tastes of Wine: Towards a Cultural History, Riv. Di Estet. 51 (2012). https://doi.org/10.4000/estetica.1395.
[66] H. Chan, K.J. Zeng, M.X. Yang, Review platforms as prosumer communities: Theory, practices and implications, Eur. J. Mark. 56 (2022) 2698–2720. https://doi.org/10.1108/EJM-10-2021-0819.
[67] A. Herschkowitsch, R. Goldstein, The Wine Trials 2010: The World's Bestselling Guide to Inexpensive Wines, with the 150 Winning Wines Under $15 from the Latest Vintages, 11 2nd ed., T. Walters, Ed., Fearless Critic Media, 2009.
[68] N. Kotonya, P. De Cristofaro, E. De Cristofaro, Of Wines and Reviews: Measuring and Modeling the Vivino Wine Social Network, in: Proc. 2018 IEEE/ACM Int. Conf. Advances in Social Networks Analysis and Mining (ASONAM), 2018, pp. 387–392. https://doi.org/10.1109/ASONAM.2018.8508776.
[69] K. Akdim, L.V. Casaló, C. Flavián, The role of utilitarian and hedonic aspects in the continuance intention to use social mobile apps, 12 J. Retail. Consum. Serv. 13 66 (2022). https://doi.org/10.1016/j.jretconser.2021.102888.
[70] P. Mastroberardino, G. Calabrese, F. Cortese, M. Petracca, The Internationalization of Business and Their Approach to New Markets: A Focus on US Wine Consumer, Int. J. Bus. Manag. 14 (2019) 14. https://doi.org/10.5539/ijbm.v14n12p14.
[71] E.T. Stuen, J.R. Miller, R.W. Stone, An Analysis of Wine Critic Consensus: A Study of Washington and California Wines, J. Wine Econ. 10 (2015) 47–61. https://doi.org/10.1017/jwe.2015.3.
[72] N.S. Koh, N. Hu, E.K. Clemons, Do online reviews reflect a product's true perceived quality? An investigation of online movie reviews across cultures, Electron. 14 Commer. Res. Appl. 9 (2010) 374–385. https://doi.org/10.1016/j.elerap.2010.04.001.
[73] Y. Xie, W. Yeoh, J. Wang, How self-selection Bias in online reviews affects buyer satisfaction: A product type perspective, Decis. Support Syst. 181 (2024). https://doi.org/10.1016/j.dss.2024.114199.
[74] S. He, B. Hollenbeck, D. Proserpio, The Market for Fake Reviews, Mark. Sci. 41 (2022) 896–921. https://doi.org/10.1287/mksc.2022.1353.
[75] G. Teil, La production du jugement esthétique sur les vins par la critique vinicole, Sociol. Trav. 43 (2001) 67–89. https://doi.org/10.1016/S0038-0296(01)01122-0.
[76] Z. Zhang, Q. Ye, R. Law, Y. Li, The impact of e-word-of-mouth on the online popularity of restaurants: A comparison of consumer reviews and edi-

tor 15 reviews, Int. J. Hosp. Manag. 16 29 (2010) 694–700. https://doi.org/10.1016/j.ijhm.2010.02.002.
[77] S. Bazen, J.-M. Cardebat, M. Dubois, The role of customer and expert ratings in a hedonic analysis of French red wine prices: From gurus to geeks?, Appl. Econ. 0 (2023) 1–17. https://doi.org/10.1080/00036846.2023.2257036.
[78] S. Mueller, P. Osidacz, I.L. Francis, L. Lockshin, Combining discrete choice and informed sensory testing in a two-stage process: Can it predict wine market share?, Food Qual. 17 Prefer. 21 (2010) 741–754. https://doi.org/10.1016/j.foodqual.2010.06.008.
[79] K.-S. Song, Effects of Wine Selection Attributes on Satisfaction and Repurchase Intention -Focused on the Moderating Effect of Wine Involvement-, J. Korea Contents Assoc. 12 18 (2012) 431–446. https://doi.org/10.5392/JKCA.2012.12.05.431.
[80] M. Costanigro, M. Dubois, A. Gracia, J.-M. Cardebat, The Information Value of Geographical Indications, Food Policy 130 (2025). https://doi.org/10.1016/j.foodpol.2024.102769.
[81] J. Castillo-Valero, M.C. García-Cortijo, Price adjustment in world wine markets: A cointegration analysis, Wine Econ. Policy 4 (2015) 128–135. https://doi.org/10.1016/j.wep.2015.05.004.
[82] M. Costanigro, G. Scozzafava, L. Casini, Vertical differentiation via multi-tier geographical indications and the consumer perception of quality: The case of Chianti wines, 19 Food Policy 83 (2019) 246–259. https://doi.org/10.1016/j.foodpol.2019.01.008.
[83] G. Malorgio, L. Camanzi, C. Grazia, Effectiveness of European Appellations of Origin on the International wine market, AgEcon Search, 2007. https://doi.org/10.22004/ag.econ.7896.
[84] T. Atkin, R. Johnson, Appellation as an indicator of quality, Int. J. Wine Bus. Res. 22 (2010) 42–61. https://doi.org/10.1108/17511061011035198.
[85] C. Hjorth-Andersen, Quality indicators: In theory and in fact, Eur. Econ. Rev. 35 (1991) 1491–1505. https://doi.org/10.1016/0014-2921(91)90014-A.
[86] P. Narwal, J.K. Nayak, How consumers form product quality perceptions in absence of fixed posted prices: Interaction of product cues with seller reputation and third-party reviews, 20 J. Retail. Consum. Serv. 52 (2020). https://doi.org/10.1016/j.jretconser.2019.101924.
[87] G. Drummond, G. Rule, Consumer confusion in the UK wine industry, J. Wine Res. 16 (2005) 55–64. https://doi.org/10.1080/09571260500236633.
[88] D. Vigar-Ellis, L. Pitt, A. Caruana, Does objective and subjective knowledge vary between opinion leaders and opinion seekers? Implications for wine marketing, 21 J. Wine Res. 26 (2015) 304–318. https://doi.org/10.1080/09571264.2015.1092120.
[89] C. Aqueveque, Extrinsic cues and perceived risk: The influence of consumption situation, J. Consum. Mark. 23 (2006) 237–247. https://doi.org/10.1108/07363760610681646.
[90] M.J. Bauman, N. Velikova, T. Dodd, T. Blankenship, Generational differences in risk perception and situational uses of wine information sources, Int. J. Wine Bus. Res. 32 (2019) 247–265. https://doi.org/10.1108/IJWBR-03-2019-0022.
[91] S. Lacey, J. Bruwer, E. Li, The role of perceived risk in wine purchase decisions in restaurants, Int. J. Wine Bus. Res. 21 (2009) 99–117. https://doi.org/10.1108/17511060910967962.
[92] J. Lallement, S. Dejean, F. Euzéby, C. Martinez, The interaction between reputation and information search: Evidence of information avoidance and confirmation bias, 22 J. Retail. Consum. Serv. (2019). https://doi.org/10.1016/j.jretconser.2019.03.014.
[93] P. Masset, Market segments and pricing of fine wines over their lifecycle, Econ. Model. 141 (2024). https://doi.org/10.1016/j.econmod.2024.106915.
[94] P. Masset, J.-P. Weisskopf, Wine indices in practice: Nicely labeled but slightly corked, Econ. Model. 68 (2018) 555–569. https://doi.org/10.1016/j.econmod.2017.03.025.
[95] W. Kwon, G. Easton, Conceptualizing the role of evaluation systems in markets: The case of dominant evaluators, Mark. Theory 10 (2010) 123–143. https://doi.org/10.1177/1470593110366907.
[96] B. Faye, E.L. Fur, S. Prat, Dynamics of fine wine and asset prices: Evidence from short- and long-run co-movements, Appl. Econ. 47 (2015) 3059–3077. https://doi.org/10.1080/00036846.2015.1011321.
[97] G. Teil, Wine Diversity: Paradox or Economic Innovation?, J. Cult. Anal. Soc. Chang. 6 (2021) 13. https://doi.org/10.20897/jcasc/11451.
[98] L. Jiao, Macroeconomic determinants of wine prices, Int. J. Wine Bus. Res. (2017). https://doi.org/10.1108/IJWBR-09-2016-0032.
[99] B. Faye, E.L. Fur, On the Constancy of Hedonic Wine Price Coefficients over Time, J. Wine Econ. 14 (2019) 182–207. https://doi.org/10.1017/jwe.2019.24.
[100] G. Gastaldello, I. Schäufele-Elbers, G. Schamel, Factors influencing wine ratings in an online

wine community: The case of Trentino–Alto Adige, J. Wine Econ. 19 (2024) 19–40. https://doi.org/10.1017/jwe.2024.2.
[101] J.-M. Cardebat, J.-M. Figuet, Estimation of a hedonic price equation for Alsace, Beaujolais and Provence wines, Appl. Econ. Lett. 16 (2009) 921–927. https://doi.org/10.1080/13504850701222145.
[102] S. Landon, C.E. Smith, The Use of Quality and Reputation Indicators by Consumers: The Case of Bordeaux Wine, J. Consum. Policy 20 (1997) 289–323. https://doi.org/10.1023/A:1006830218392.
[103] B.-H. Ling, L. Lockshin, Components of Wine Prices for Australian Wine: How Winery Reputation, Wine Quality, Region, Vintage, and Winery Size Contribute to the Price of Varietal Wines, Australas. Mark. J. (AMJ) 11 (2003) 19–32. https://doi.org/10.1016/S1441-3582(03)70132-3.
[104] G. Schamel, Individual and collective reputations indicators of wine quality, 2000.
[105] E. Parga-Dans, P. Alonso González, 'Marketing quality' in the food sector: Towards a critical engagement with the 'quality turn' in wine, Geoforum 85 (2017) 5–8. https://doi.org/10.1016/j.geoforum.2017.07.005.
[106] S. Castriota, M. Delmastro, The Economics of Collective Reputation: Evidence from the Wine Industry, Am. J. Agric. Econ. 97 (2015) 469–489. https://doi.org/10.1093/ajae/aau107.
[107] M.B. Beverland, An Exploration of the Luxury Wine Trade, Int. J. Wine Mark. 16 (2004) 14–28. https://doi.org/10.1108/eb008776.
[108] M. Dressler, The German Wine Market: A Comprehensive Strategic and Economic Analysis, Beverages 4 (2018) 92. https://doi.org/10.3390/beverages4040092.
[109] M.L. Barnett, T.G. Pollock, The Oxford Handbook of Corporate Reputation, OUP Oxford, 2012.
[110] C. Lamour, C. De La Robertie, Prescribed consumption and consumers' decision-making styles: A cross-cultural comparison between Europe and Asia, Int. J. Retail Distrib. Manag. 44 (2016) 266–283. https://doi.org/10.1108/IJRDM-02-2015-0018.
[111] I.M. Chaney, Opinion leaders as a segment for marketing communications, Mark. Intell. Plan. 19 (2001) 302–308. https://doi.org/10.1108/EUM0000000005647.
[112] T. Atkin, L. Thach, Millennial wine consumers: Risk perception and information search, Wine Econ. Policy 1 (2012) 54–62. https://doi.org/10.1016/j.wep.2012.08.002.
[113] R.L. Gluckman, A Consumer Approach to Branded Wines, Eur. J. Mark. 20 (1986) 21–35. https://doi.org/10.1108/EUM0000000004649.
[114] G. Franck, The economy of attention, J. Sociol. 55 (2019) 8–19. https://doi.org/10.1177/1440783318811778.
[115] G. Hsu, P.W. Roberts, A. Swaminathan, Evaluative Schemas and the Mediating Role of Critics, Organ. Sci. 23 (2012) 83–97. https://doi.org/10.1287/orsc.1100.0630.
[116] A. Hennion, Qu'est-ce qu'un bon vin? ou comment intéresser la sociologie à la valeur des choses..., 2015.
[117] D. Waibel, T. Peetz, F. Meier, Valuation Constellations, Valuat. Stud. 8 (2021) 33–66. https://doi.org/10.3384/VS.2001-5992.2021.8.1.33-66.
[118] A. Vlachvei, O. Notta, E. Koronaki, Effects of content characteristics on stages of customer engagement in social media: Investigating European wine brands, J. Res. Interact. Mark. 16 (2021) 615–632. https://doi.org/10.1108/JRIM-12-2020-0275.
[119] M. Dubois, et al., Did Wine Consumption Change During the COVID-19 Lockdown in France, Italy, Spain, and Portugal?, J. Wine Econ. 16 (2021) 131–168. https://doi.org/10.1017/jwe.2021.19.
[120] A.G. Parsons, A. Thompson, Wine recommendations: Who do I believe?, Br. Food J. 111 (2009) 1003–1015. https://doi.org/10.1108/00070700910992899.
[121] A. Adalja, F. Livat, B. Rickard, A. Susskind, Dissonant Opinions and the Home Bias: Consumer Response to Crowd Sourced Reviews for Wine, 2022.
[122] O. Kopsacheilis, et al., Crowdsourcing the Assessment of Wine Quality—Evidence from Vivino, SSRN Scholarly Paper 4355578, 2023. https://doi.org/10.2139/ssrn.4355578.
[123] E. Mazzoli, L. Palumbo, In Vivino Veritas: An Investigation on Consumers' Quality Perception and Wine Choice Determinants, SSRN Scholarly Paper 4114012, 2022. [Online]. Available: https://papers.ssrn.com/abstract=4114012.
[124] A. Rizo, A. Bartu, L. Laguna, A. Tarrega, Effect of an opinion app on expectations and emotional responses of young consumers toward white wines, Food Qual. Prefer. 103 (2023) 104706. https://doi.org/10.1016/j.foodqual.2022.104706.
[125] D. O'Brien, C.-M. Wellbrock, N. Kleer, Content for Free? Drivers of Past Payment, Paying Intent and Willingness to Pay for Digital Journalism – A Systematic Literature Review, Digit. Journal. 8 (2020) 643–672. https://doi.org/10.1080/21670811.2020.1770112.
[126] H. Subramanian, S. Mitra, S. Ransbotham, Capturing Value in Platform Business Models That Rely on User-Generated Content, Organ. Sci. 32 (2021)

804–823. https://doi.org/10.1287/orsc.2020.1408.
[127] D.S. Evans, Some Empirical Aspects of Multi-sided Platform Industries, Rev. Netw. Econ. 2 (2003). https://doi.org/10.2202/1446-9022.1026.
[128] J.M. Barnett, The costs of free: Commoditization, bundling and concentration, J. Inst. Econ. 14 (2018) 1097–1120. https://doi.org/10.1017/S1744137418000012.
[129] M.S. Malter, M.B. Holbrook, B.E. Kahn, J.R. Parker, D.R. Lehmann, The past, present, and future of consumer research, Mark. Lett. 31 (2020) 137–149. https://doi.org/10.1007/s11002-020-09526-8.

APPENDIX

Table 1a. Overview of all final papers within the scope of the integrative literature review.

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Abbal P, Sablayrolles JM, Matzner-Lober E, Carbonneau A	2019	A Model for Predicting Wine Quality in a Rhone Valley Vineyard	Agnonomy Journal	111	2	545	554
Adalja A, Livat F, Rickard B, Susskind, A	2022	Dissonant Opinions and the Home Bias: Consumer Response to Crowd Sourced Reviews for Wine.	13th Academy of Wine Business Research Conference - Working Paper				
Albright A, Pedroni P, Sheppard S	2018	Uncorking Expert Reviews with Social Media: A Case Study Served with Wine	Case Study - Williams University				
Ali H H, Nauges C	2007	The Pricing of Experience Goods: The Example of en primeur Wine	American Journal of Agricultural Economics	89	1	91	103
Ali HH, Lecocq S, Visser M	2005	The impact of gurus: Parker grades and en primeur wine prices	Journal of Wine Economics	5	1	22	39
Allen MP, Germov J	2011	Judging taste and creating value The cultural consecration of Australian wines	Journal of Sociology	47	1	35	51
Amédée-Manesme CO, Faye B, Le Fur E	2020	Heterogeneity and fine wine prices: application of the quantile regression approach	Applied Economics	52	26	2821	2840
Aqueveque C	2015	The Influence of Experts' Positive Word-of-Mouth on a Wine's Perceived Quality and Value: The Moderator Role of Consumers' Expertise	Journal of Wine Research	26	3	181	191
Arias-Bolzmann L, Sak O, Musalem A, Lodish L, Báez KR, De Sousa LJ	2003	Wine Pricing: The Influence of Country of Origin, Variety, and Wine Magazine Ratings	International Journal of Wine Marketing	15	2	47	57
Ariely D, Lynch JG	2001	Wine Online: Search Costs and Competition on Price, Quality, and Distribution	SSRN Electronic Journal				
Ashenfelter O	2007	Predicting the Quality and Prices of Bordeaux Wines	The Economic Journal	118	529	174	184
Ashenfelter O, Jones GV	2013	The Demand for Expert Opinion: Bordeaux Wine	Journal of Wine Economics	8	3	285	293
Ashenfelter O, Ashmore D, Lalonde R	1995	Bordeaux Wine Vintage Quality and the Weather	Chance	8	4	7-14	
Ashenfelter O, Quandt R	1999	Analyzing a Wine Tasting Statistically	Chance	12	3	16	20

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Ashton RH	2012	Reliability and Consensus of Experienced Wine Judges: Expertise Within and Between?	Journal of Wine Economics	7	1	70	87
Ashton RH	2017	Dimensions of Expertise in Wine Evaluation	Journal of Wine Economics	12	1	59	83
Ashton RH	2011	Improving Experts' Wine Quality Judgments: Two Heads Are Better than One	Journal of Wine Economics	6	2	160	178
Ashton RH	2013	Is There Consensus Among Wine Quality Ratings of Prominent Critics? An Empirical Analysis of Red Bordeaux, 2004-2010	Journal of Wine Economics	8	2	225	234
Ashton RH	2016	The Value of Expert Opinion in the Pricing of Bordeaux Wine Futures	Journal of Wine Economics	11	2	261	288
Atkin T, Nowak L, Garcia R	2007	Women Wine Consumers: Information Search and Retailing Implications	International Journal of Wine Business Research	19	4	327	339
Babin BJ, Bushardt C	2019	Third-Party Ratings and The US Wine Market	International Journal of Wine Business Research	31	2	151	162
Baciocco KA, Davis RE, Jones GV	2014	Climate and Bordeaux Wine Quality: Identifying the Key Factors that Differentiate Vintages Based on Consensus Rankings	Journal of Wine Research	25	2	75	90
Barbe P, Durrieu F	2005	Evaluation of the Quality of the Great Bordeaux Wines: Are There Significant Differences Between Critics?	International Journal of Wine Marketing	17	3	55	66
Barber N	2009	Wine consumers information search: Gender differences and implications for the hospitality industry	Tourism and Hospitality Research	9	3	250	269
Barbera S, Bossert W, Moreno-Ternero JD	2023	Wine Rankings and the Borda Method	Journal of Wine Economics			1	17
Barbos, A; Hartman, J	2023	Reputational effects on third-party agents: A study of the market for fine and rare wines	Journal of Economic Behavior & Organization	359	372	March	
Bazen S, Cardebat JM	2022	Why have Bordeaux wine prices become so difficult to forecast?	Economics Bulletin	42	1		
Beckert J, Rössel J, Schenk P	2014	Wine as a Cultural Product: Symbolic Capital and Price Formation in the Wine Field	Sociological Perspectives	60	1	206	222
Benfratello L, Piacenza M, Sacchetto S	2009	Taste or reputation: what drives market prices in the wine industry? Estimation of a hedonic model for Italian premium wines	Applied Economics	41	17	2197	2209
Beninger S, Parent M, Pitt L, Chan A	2014	A content analysis of influential wine blogs	International Journal of Wine Business Research	26	3	168	+
Benjamin BA, Podolny JM	1999	Status, Quality, and Social Order in the California Wine Industry	Administrative Science Quarterly	44	3	563	589
Bentzen J, Smith V	2008	Do expert ratings or economic models explain champagne prices?	International Journal of Wine Business Research	20	3	230	+
Berg EC, Mascha M, Capehart KW	2022	Judging reliability at wine and water competitions	Journal of Wine Economics	17	4	311	328

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Bessy C, Chauvin PM	2013	The Power of Market Intermediaries: From Information to Valuation Processes	Valuation Studies	1	1	83	117
Bicknell KB, MacDonald IA	2012	Regional reputation and expert opinion in the domestic market for New Zealand wine	Journal of Wine Research	23	2	172	184
Bitter C	2017	Wine Competitions: Reevaluating the Gold Standard	Journal of Wine Economics	12	4	395	404
Boatto V, Defrancesco E, Trestini S	2011	The price premium for wine quality signals: does retailers' information provision matter?	British Food Journal	113	5	669	679
Bodington JC	2015	Testing a Mixture of Rank Preference Models on Judges' Scores in Paris and Princeton	Journal of Wine Economics	10	2	173	189
Bodington JC	2017	Wine, Women, Men, and Type II Error	Journal of Wine Economics	12	2	161	172
Bodington JC	2017	Disentangling Wine Judges' Consensus, Idiosyncratic, and Random Expressions of Quality or Preference	Journal of Wine Economics	12	3	267	281
Bodington JC	2017	The Distribution of Ratings Assigned to Blind Replicates	Journal of Wine Economics	12	4	363	369
Bodington JC	2020	Rate the Raters: A Note on Wine Judge Consistency	Journal of Wine Economics	15	4	363	369
Bodington JC	2022	A maximum entropy estimate of uncertainty about a wine rating What can be deduced about the shape of a latent distribution from one observation?	Journal of Wine Economics	17	4	296	310
Bodington JC	2022	Stochastic error and biases remain in blind wine ratings	Journal of Wine Economics	17	4	345	351
Bodington JC, Malfeito-Ferreira M	2019	Should Ties Be Broken in Commercial Wine Competitions? When Yes, What Method Is Practical and Defensible?	Journal of Wine Economics	14	3	298	308
Bodington JC, Malfeito-Ferreira M	2018	Do Female and Male Judges Assign the Same Ratings to the Same Wines? Large Sample Results	Journal of Wine Economics	13	4	403	408
Bonn MA, Kim WG, Kang S, Choo M	2016	Purchasing Wine Online: The Effects of Social Influence, Perceived Usefulness, Perceived Ease of Use, and Wine Involvement	Journal of Hospitality Marketing & Management	25	7	841	869
Bonnet C, Hilger J, Villas-Boas SB	2020	Reduced form evidence on belief updating under asymmetric information-consumers' response to wine expert opinions	European Review of Agricultural Economics	47	5	1668	1696
Boon E, Foppiani O	2019	An exploratory analysis of cross-country biases in expert wine reviews	Journal of Wine Research	30	2	144	156
Bouzdine-Chameeva T, Galam S	2011	Experts versus word-of-mouth in the wine purchasing dynamics: a model from physics	6th AWBR International Conference - Working Paper				
Bouzdine-Chameeva T, Galam S	2011	Word-of-Mouth Versus Experts and Reputation in the Individual Dynamics of Wine Purchasing	Advances in Complex Systems	14	06	871	885

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Brand J, Panzeri V, Buica A	2020	Wine Quality Drivers: A Case Study on South African Chenin Blanc and Pinotage Wines	Foods	9	6		
Brien CJ, May P, Mayo O	1987	Analysis of Judge Performance in Wine-Quality Evaluations	Journal of Food Science	52	5	1273	1279
Brunel AA, Kernevez A, Leclere F, Trenteseaux J	2016	Quantitative Ranking Evaluation of Wine Quality	International Journal of Nutrition and Food Engineering	10	2	101	107
Buonanno P, Caggiano G, Galizzi MM, Leonida L, Vanin P	2008	Expert and Peer Pressure in Food and Wine Tasting: Evidence from a Pilot Experiment	Enometrica - Working Paper				
Burnham D, Skilleas OM	2012	The Aesthetics of Wine	John Wiley & Sons, Inc				
Cacchiarelli L, Carbone A, Esti M, Laureti T, Sorrentino A	2016	Assessing Italian wine quality and prices: de gustibus non disputandum est	British Food Journal	118	5	1006	1024
Caldas J, Rebelo J	2013	Portuguese wine ratings: An old product a new assessment	Wine Economics and Policy	2	2	102	110
Cao J, Stokes L	2010	Evaluation of Wine Judge Performance through Three Characteristics: Bias, Discrimination, and Variation*	Journal of Wine Economics	5	1	132	142
Cao J, Stokes L	2017	Comparison of Different Ranking Methods in Wine Tasting	Journal of Wine Economics	12	2	203	210
Cao J, Stokes L	2014	Quantifying Randomness Versus Consensus in Wine Quality Ratings	Journal of Wine Economics	9	2	202	213
Caracciolo F, Cembalo L, Pomarici E	2013	The Hedonic Price for an Italian Grape Variety	Italian Journal of Food Science	25	3	289	294
Carbone A	2021	From Flasks to Fine Glasses: Recent Trends in Wine Economics	Italian Economic Journal	7	2	187	198
Cardebat JM, Livat F	2016	Wine experts' rating: a matter of taste?	International Journal of Wine Business Research	28	1	43	58
Cardebat JM, Corsinovi P, Gaeta D	2018	Do Top 100 wine lists provide consumers with better information?	Economics Bulletin	38	2	983	+
Cardebat JM, Figuet JM, Paroissien E	2014	Expert Opinion and Bordeaux Wine Prices: An Attempt to Correct Biases in Subjective Judgments	Journal of Wine Economics	9	3	282	303
Cardebat JM, Figuet JM	2004	What explains Bordeaux wine prices?	Applied Economics Letters	11	5	293	296
Cardebat JM, Paroissien E	2015	Standardizing Expert Wine Scores: An Application for Bordeaux en primeur	Journal of Wine Economics	10	3	329	348
Carollo A, Fong S, Gabrieli G, Mulatti C, Esposito G	2022	To wine or not to wine? A scientometric approach to 65+years of wine preference and selection studies	British Food Journal	124	13	409	431
Castriota S, Corsi S, Frumento P, Ruggeri G	2022	Does quality pay off? Superstar wines and the uncertain price premium across quality grades	Journal of Wine Economics	17	2	141	158
Castriota S, Curzi D, Delmastro M	2013	Tasters' bias in wine guides' quality evaluations	Applied Economics Letters	20	12	1174	1177
Castriota S, Delmastro M	2008	Individual and Collective Reputation: Lessons from the Wine Market	SSRN Electronic Journal				
Chaney I	2000	A comparative analysis of wine reviews	British Food Journal	102	7	470	480
Charlin V, Cifuentes A	2023	The quality of the Argentinean Malbec and the weather in the Mendoza region	International Journal of Wine Business Research	35	3	487	503

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Charters S, Pettigrew S	2006	The relevance of the quality construct to wine consumption	European Advances in Consumer Research				
Charters S, Pettigrew S	2007	The Dimensions of Wine Quality	Food Quality and Preference	18	7	997	1007
Charters S, Pettigrew S	2003	I like it but how do I know if it's any good? Quality and preference in wine consumption	ECU Publications	5			
Chen KJ, McCluskey JJ	2018	Impacts of Expert Information on Prices for an Experience Good across Product Segments: Tasting Notes and Wine Prices	Journal of Agricultural and Resource Economics	43	3	388	402
Chern CC, Wei CP, Shen FY, Fan YN	2015	A sales forecasting model for consumer products based on the influence of online word-of-mouth	Information Systems and e-Business Management	13	3	445	473
Chivu-Draghia C, Antoce AO	2016	Consumer Preferences Regarding Sources of Information and Use of Technology for Wine Selection – A Survey of Millennials and Generation X Sample in Romania	Economic Engineering in Agriculture and Rural Development	16	2	10	
Chocarro R, Cortinas M	2013	The impact of expert opinion in consumer perception of wines	International Journal of Wine Business Research	25	3	227	+
Cicchetti D, Cicchetti A	2013	As wine experts disagree, consumers' taste buds flourish: how two experts rate the 2004 Bordeaux vintage	Journal of Wine Research	24	4	311	317
Cicchetti D, Cicchetti A	2009	Wine rating scales: Assessing their utility for producers, consumers, and oenologic researchers	International Journal of Wine Research			73	
Cicchetti D, Cicchetti A	2006	The Paris 1976 Wine Tastings Revisited Once More: Comparing Ratings of Consistent and Inconsistent Tasters	Journal of Wine Economics	1	2	125	140
Cicchetti D, Cicchetti A	2009	A Proposed System for Awarding Medals at a Major U.S. Wine Competition	Journal of Wine Economics	4	2	242	247
Cicchetti D, Cicchetti A	2014	Two enological titans rate the 2009 Bordeaux wines	Wine Economics and Policy	3	1	28	36
Cliff MA, King M	1999	Use of principal component analysis for the evaluation of judge performance at wine competitions	Journal of Wine Research	10	1	25	32
Cliff MA, King M	1996	A proposed approach for evaluating expert wine judge performance using descriptive statistics	Journal of Wine Research	7	2	83	90
Cliff MA, King M	1997	The evaluation of judges at wine competitions: the application of Eggshell plots	Journal of Wine Research	8	2	75	80
Colman T	2008	Wine Politics: How Governments, Environmentalists, Mobsters, and Critics Influence the Wines We Drink	University of California Press				
Combris P, Lecocq S, Visser M	1997	Estimation of a Hedonic Price Equation for Bordeaux Wine: Does Quality Matter?	The Economic Journal	107	March	390	402
Compés-López R, Font-Julian CI, Orduna-Malea E	2018	Has Robert Parker lost his hegemony as a prescriptor in the wine World? A preliminar inquiry through Twitter.	CARMA 2018 - 2nd International Conference on Advanced Research Methods and Analytics - Working Paper				

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Conrad JM, Gomez MI, Lamadrid AJ	2011	Wine in Your Knapsack?	Journal of Wine Economics	6	1	83	110
Corsi A, Ashenfelter O	2019	Predicting Italian Wine Quality from Weather Data and Expert Ratings	Journal of Wine Economics	14	3	234	251
Corsi A, Ashenfelter O	2001	Wine Quality: Experts' Ratings and Weather Determinants	71st EAAE Seminar - Working Paper				
Cosenza TR, Solomon MR, Kwon WS	2015	Credibility in the blogosphere: A study of measurement and influence of wine blogs as an information source: Credibility first: the influence of wine blogs	Journal of Consumer Behaviour	14	2	71	91
Croijmans I, Majid A	2016	Not All Flavor Expertise Is Equal: The Language of Wine and Coffee Experts	Plos One	11	6	e0155845	
Cruz C, Van CN, Gautier L	2018	Word Embeddings for Wine Recommender Systems Using Vocabularies of Experts and Consumers	Open Journal of Web Technologies (OJWT)	5	1	23	30
Cyr D, Kwong L, Sun L	2017	An Examination of Tail Dependence in Bordeaux Futures Prices and Parker Ratings	Journal of Wine Economics	12	3	252	266
Cyr D, Kwong L, Sun L	2019	Who Will Replace Parker? A Copula Function Analysis of Bordeaux En Primeur Wine Raters	Journal of Wine Economics	14	2	133	144
D'Alessandro S, Pecotich A	2013	Evaluation of wine by expert and novice consumers in the presence of variations in quality, brand and country of origin cues	Food Quality and Preference	28	1	287	303
Danner L, Johnson TE, Ristic R, MeiselmanHL, Bastian SEP	2017	I like the sound of that! Wine descriptions influence consumers' expectations, liking, emotions and willingness to pay for Australian white wines	Food Research International	99	1	263	274
Davis RE; Dimon RA; Jones GV; Bois B	2019	The effect of climate on Burgundy vintage quality rankings	Oeno One	53	1	60	74
Di Vita G, Caracciolo F, Brun F, D'Amico M	2019	Picking out a wine: Consumer motivation behind different quality wines choice	Wine Economics and Policy	8	1	16	27
Dong ZQ, Atkison T, Chen B	2021	Wineinformatics: Using the Full Power of the Computational Wine Wheel to Understand 21st Century Bordeaux Wines from the Reviews	Beverages	7	1		
Dong ZQ, Guo XW, Rajana S, Chen B	2020	Understanding 21st Century Bordeaux Wines from Wine Reviews Using Naive Bayes Classifier	Beverages	6	1		
Dubois P, Nauges C	2010	Identifying the effect of unobserved quality and expert reviews in the pricing of experience goods: Empirical application on Bordeaux wine	International Journal of Industrial Organization	28	3	205	212
Dunphy R, Lockshin L	1998	A contemporary perspective of the Australian wine show system as a marketing tool	Journal of Wine Research	9	2	107	129
Dunphy R, Lockshin L	1998	A history of the Australian wine show system	Journal of Wine Research	9	2	87	105

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Edwards F, Mort M	1991	The Expert Wine Taster	International Marketing Review	8	4		
Eyler R	2001	Competing in the US Wine Market: Australian Imports and Tasting Scores	International Journal of Wine Marketing	13	2	32	42
Ferro G, Amaro IB	2018	What factors explain the price of top quality wines?	International Journal of Wine Business Research	30	1	117	134
Fleming E, Mounter S, Grant B, Griffith G	2014	Can we explain variations in winery ratings in Victoria?	Australasian Agribusiness Review	22	1	1	13
Forbes SL	2008	The influence of individual characteristics, product attributes and usage situations on consumer behaviour: An exploratory study of the New Zealand, Australian, UK and US wine markets	PhD Thesis				
Friberg R, Gronqvist E	2012	Do Expert Reviews Affect the Demand for Wine?	American Economic Journal - Applied Economics	4	1	193	211
Frick B, Simmons R	2013	The impact of individual and collective reputation on wine prices: empirical evidence from the Mosel valley	Journal of Business Economics	83	2	101	119
Frick B, Simmons R	2020	The Legacy of Gurus: The Impact of Armin Diel and Joel Payne on Winery Ratings in Germany	Journal of Wine Economics	15	4	370	377
Fried HO, Tauer LW	2019	Efficient Wine Pricing Using Stochastic Frontier Models	Journal of Wine Economics	14	2	164	181
Galizzi MM	2013	Wine Judging and Tasting	Wine Economics: Quantitative Studies and Empirical Applications				
Gawel R, Godden PW	2008	Evaluation of the consistency of wine quality assessments from expert wine tasters	Australian Journal of Grape and Wine Research	14	1	1-8	
Gergaud O, Ginsburgh V, Moreno-Ternero JD	2022	Tracking the wines of the Judgment of Paris over time: The case of Stag's Leap Wine Cellars' Cabernet Sauvignon	Journal of Wine Economics	17	2	159	166
Gergaud O, Ginsburgh V, Moreno-Ternero JD	2021	Wine Ratings: Seeking a Consensus among Tasters via Normalization, Approval, and Aggregation	Journal of Wine Economics	16	3	321	342
Gergaud O, Livat F, Rickard B, Warzynski F	2017	Evaluating the net benefits of collective reputation: The case of Bordeaux wine	Food Policy	71	1	8	16
Gibbs M, Tapia M, Warzynski F	2009	Globalization, Superstars, and Reputation: Theory & Evidence from the Wine Industry	Journal of Wine Economics	4	1	46	61
Ginsburgh V, Monzak M, Monzak A	2013	Red Wines of Médoc: What is Wine Tasting Worth?	Journal of Wine Economics	8	2	159	188
Gokcekus O; Gokcekus S; Hewstone M	2023	A long-term archival analysis of social influence on online wine evaluations: Effects of consensus and expertise	Journal Of Community & Applied Social Psychology	33	4	970	984
Gokcekus O, Nottebaum D	2011	The buyer's dilemma – To whose rating should a wine drinker pay attention?	American Association of Wine Economists - Working Paper				

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Grifoni D, Mancini M, Maracchi G, Orlandini S, Zipoli G	2006	Analysis of Italian Wine Quality Using Freely Available Meteorological Information	American Journal of Enology and Viticulture	57	3	339	346
Grohmann B, Peña C, Joy A	2018	Wine quality and sensory assessments: do distinct local groups of wine experts differ?	Journal of Wine Research	29	4	278	289
Guidry JA, Babin BJ, GrazianoWG; Schneider WJ	2009	Pride and prejudice in the evaluation of wine?	International Journal of Wine Business Research	21	4	298	+
Haeger JW, Storchmann K	2006	Prices of American Pinot Noir wines: Climate, craftsmanship, critics	Agricultural Economics	35	1	67	78
Hay C	2010	The political economy of price and status formation in the Bordeaux en primeur market: The role of wine critics as rating agencies	Socio-Economic Review	8	4	685	707
Hekimoglu MH, Kazaz B	2020	Analytics for Wine Futures: Realistic Prices	Production and Operations Management	29	9	2096	2120
Herbst KC, Leary MR, McColskey-Leary CP	2013	Social-evaluative influences moderate the relationship between price and perceived quality	Social Influence	8	1	54	69
Herdenstam APF, Hammarén M, Ahlström R, Wiktorsson PA	2009	The Professional Language of Wine: Perception, Training and Dialogue	Journal of Wine Research	20	1	53	84
Higgins LM, Wolf MM, Wolf MJ	2016	Wine on Facebook: A Look at Millennials' Wine Information Search	Successful Social Media and Ecommerce Strategies in the Wine Industry				
Higgins LM, Wolf MM, Wolf MJ	2014	Technological change in the wine market? The role of QR codes and wine apps in consumer wine purchases	Wine Economics and Policy	3	1	19	27
Hilger J, Rafert G; Villas-Boas S	2011	Expert Opinion and the Demand for Experience Goods: An Experimental Approach in the Retail Wine Market	Review Of Economics and Statistics	93	4	1289	1296
Hodgson R; Cao J	2014	Criteria for Accrediting Expert Wine Judges	Journal of Wine Economics	9	1	62	74
Hodgson RT	2009	An Analysis of the Concordance Among 13 U.S. Wine Competitions*	Journal of Wine Economics	4	1	1-9	
Hodgson RT	2008	An Examination of Judge Reliability at a major U.S. Wine Competition	Journal of Wine Economics	3	2	105	113
Hodgson RT	2008	On Rating Wines with Unequal Judges	Journal of Wine Economics	3	2	226	227
Hodgson RT	2009	How Expert are "Expert" Wine Judges?	Journal of Wine Economics	4	2	233	241
Hommerberg C	2015	Bringing consumption reviews into relief by combining Appraisal and argumentation analysis	Text & Talk	35	2	155	175
Honoré-Chedozeau C.; Chollet S.; Lelièvre-Desmas M.; Ballester J.; Valentin D	2020	From perceptual to conceptual categorization of wines: What is the effect of expertise?	Food Quality and Preference	80	103806		
Honoré-Chedozeau C, Ballester J, Chatelet B, Lempereur V	2015	Wine competition: from between-juries consistency to sensory perception of consumers	BIO Web of Conferences				
Honore-Chedozeau C, Desmas M, Ballester J, Parr WV, Chollet S	2019	Representation of wine and beer: influence of expertise	Current Opinion in Food Science	27	1	104	114

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Horowitz DM	2012	"Cult" Wine?	Journal of Food Products Marketing	18	1	50	64
Horowitz I, Lockshin L	2002	What Price Quality? An Investigation into the Prediction of Wine-quality Ratings	Journal of Wine Research	13	1	7-22	
Horverak O	2009	Wine Journalism-Marketing or Consumers' Guide?	Marketing Science	28	3	573	579
Hsu G, Roberts PW, Swaminathan A	2007	Standards for quality and the coordinating role of critics	Enometrics XIII - Working Paper				
Huber A, Weiß C	2010	Quality, Reputation, and the Price of Wine	Enometrics XXII - Working Paper				
Hughson AL, Boakes RA	2001	Perceptual and cognitive aspects of wine expertise	Australian Journal of Psychology	53	2	103	108
Humphreys A, Carpenter GS	2018	Status Games: Market Driving through Social Influence in the U.S. Wine Industry	Journal of Marketing	82	5	141	159
Jackson RS	2017	Nature and Origins of Wine Quality	Wine Tasting		321	383	
Jaeger SR, Lee PY, Ares G	2018	Product involvement and consumer food-elicited emotional associations: Insights from emoji questionnaires	Food Research International	106	1	999	1011
Jaeger SR; Danaher PJ; Brodie RJ	2009	Wine purchase decisions and consumption behaviours: Insights from a probability sample drawn in Auckland, New Zealand	Food Quality and Preference	20	4	312	319
Jamerson H	2009	Intoxicators, educators, and gatekeepers: The enactment of symbolic boundaries in Napa Valley wineries	Poetics	37	4	383	398
James A	2018	How Robert Parker's 90+ and Ann Noble's Aroma Wheel Changed the Discourse of Wine Tasting Notes	ILCEA. Revue de l'Institut des langues et cultures d'Europe, Amérique, Afrique, Asie et Australie				
Jones GV, Storchmann K	2001	Wine market prices and investment under uncertainty: an econometric model for Bordeaux Crus Classes	Agricultural Economics	26	2	115	133
Kamakura WA, Moon S	2012	How to Speak 'Winese': Learning the Language of Wine Reviews	SSRN Electronic Journal				
Katumullage D, Yang CY, Barth J, Cao J	2022	Using Neural Network Models for Wine Review Classification	Journal of Wine Economics	17	1	27	41
Khalafyan AA; Temerdashev ZA; Akin'shina VA; Yakuba YF	2021	Study of consistency of expert evaluations of wine sensory characteristics by positional analysis	Heliyon	7	2		
King A	2008	Wine quality uncorked	Chemistry & Industry	24	1	20	22
Kopsacheilis O, Pipergias Analytis P, Kaushik K, Herzog S, Bahrami B, Deroy O	2023	Crowdsourcing the Assessment of Wine Quality—Evidence from Vivino	SSRN Electronic Journal				
Kotonya N, De Cristofaro P, De Cristofaro E	2018	Of Wines and Reviews: Measuring and Modeling the Vivino Wine Social Network	2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) - Working Paper				
Kozierkiewicz-Hetmańska A	2017	The analysis of expert opinions' consensus quality	Information Fusion	34	1	80	86

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Kwak YS, Nam YJ, Hong JW	2021	Effect of Online Collective Intelligence in Wine Industry: Focus on Correlation between Wine Quality Ratings and On-Premise Prices	Sustainability	13	14		
Kwong LMK, Sun L	2018	On linear wine score aggregators and the preservation of group preferences	International Journal of Wine Business Research	30	3	265	276
Lallement J, Dejean S, Euzéby F, Martinez C	2019	The interaction between reputation and information search: Evidence of information avoidance and confirmation bias	Journal of Retailing and Consumer Services	53			
Landon S, Smith CE	2018	Quality Expectations, Reputation, and Price	World Scientific Handbook in Financial Economics Series	2	1	3	31
Landon S, Smith CE	1997	The Use of Quality and Reputation Indicators by Consumers: The Case of Bordeaux Wine	Journal of Consumer Policy	20	3	289	323
Langlois J, Dacremont C, Peyron D, Valentin D, Dubois D	2011	Lexicon and types of discourse in wine expertise: The case of vin de garde	Food Quality and Preference	22	6	491	498
Le Fur E, Outreville JF	2022	Do vintage scores by regions matters? The case of French wine regions	Applied Economics Letters	29	14	1243	1247
Lecocq S, Magnac T, Pichery MC, Visser M	2005	The Impact of Information on Wine Auction Prices: Results of an Experiment	Annales d'Économie et de Statistique		77	37	
Lecocq S, Visser M	2006	What Determines Wine Prices: Objective vs. Sensory Characteristics	Journal of Wine Economics	1	1	42	56
Lee FS	2012	Wine and the Consumer Price-perceived Quality Heuristics	International Journal of Marketing Studies	4	3	p31	
Lefever E, Hendrickx I, Croijmans I, van den Bosch A, Majid A	2018	Discovering the Language of Wine Reviews: A Text Mining Account	Proceedings Of The Eleventh International Conference On Language Resources And Evaluation (Lrec 2018)				
Li M, Liu L, Li CB	2011	An approach to expert recommendation based on fuzzy linguistic method and fuzzy text classification in knowledge management systems	Expert Systems with Applications	38	7	8586	8596
Ling BH, Lockshin L	2003	Components of Wine Prices for Australian Wine: How Winery Reputation, Wine Quality, Region, Vintage, and Winery Size Contribute to the Price of Varietal Wines	Australasian Marketing Journal	11	3	19	32
Lockshin L, Jarvis W, d'Hauteville F, Perrouty JP	2006	Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice	Food Quality and Preference	17	3-4	166	178
Loose SM, Szolnoki G	2012	Market price differentials for food packaging characteristics	Food Quality and Preference	25	2	171	182
Luxen MF	2018	Consensus between Ratings of Red Bordeaux Wines by Prominent Critics and Correlations with Prices 2004-2010 and 2011-2016: Ashton Revisited and Expanded	Journal of Wine Economics	13	1	83	91

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Malfeito-Ferreira M, Diako C, Ross CF	2019	Sensory and chemical characteristics of 'dry' wines awarded gold medals in an international wine competition	Journal of Wine Research	30	3	204	219
Malorgio G, Grazia C	2007	Quantity and quality regulation in the wine sector: the Chianti Classico appellation of origin	International Journal of Wine Business Research	19	4	298	+
Marks D	2020	Erring Experts? A Critique of Wine Ratings as Hedonic Scaling	Journal of Wine Economics	15	4	386	393
Marks D	2015	Seeking the Veritas about the Vino: fine wine ratings as wine knowledge	Journal of Wine Research	26	4	319	335
Marks D	2014	"In Vino Veritas"—But What, In Truth, Is In the Bottle? Experience Goods, Fine Wine Ratings, and Wine Knowledge	Academy of Wine Business Research Conference - Working paper				
Masset P, Mondoux A, Weisskopf JP	2023	Fine wine pricing in a small and highly competitive market	International Journal of Wine Business Research	35	1	164	186
Masset P, Mondoux A, Weisskopf JP	2021	The Pricing of an Experience Good in a Competitive and Opaque Market	SSRN Electronic Journal				
Masset P, Weiskopf JP, Cardebat JM	2023	Efficient pricing of Bordeaux en primeur wines	Journal of Wine Economics	18	1	39	65
Masset P, Weisskopf JP	2018	Wine indices in practice: Nicely labeled but slightly corked	Economic Modelling	68	1	555	569
Masset P, Weisskopf JP, Cossutta M	2015	Wine Tasters, Ratings, and En Primeur Prices	Journal of Wine Economics	10	1	75	107
Mazzoli E, Palumbo L	2022	In Vivino Veritas: An Investigation on Consumers' Quality Perception and Wine Choice Determinants	American Association of Wine Economists Conference - Working Paper				
McCannon BC	2020	Wine Descriptions Provide Information: A Text Analysis	Journal of Wine Economics	15	1	71	94
Moon S, Kamakura WA	2017	A picture is worth a thousand words: Translating product reviews into a product positioning map	International Journal of Research in Marketing	34	1	265	285
Moussa S, Touzani M	2008	The perceived credibility of quality labels: a scale validation with refinement	International Journal of Consumer Studies	32	5	526	533
Mueller S, Lockshin L, Louviere JJ	2010	What you see may not be what you get: Asking consumers what matters may not reflect what they choose	Marketing Letters	21	4	335	350
Neuninger R, Mather D, Duncan T	2017	Consumer's scepticism of wine awards: A study of consumers' use of wine awards	Journal of Retailing and Consumer Services	35	1	98	105
Neuninger R, Mather D, Duncan T	2016	The Effectiveness of Extrinsic Cues on Different Consumer Segments: The Case of Wine Awards	Universal Journal of Management	4	11	628	638
Neuninger R, Mather D, Duncan T, Aitken R	2016	Questioning the Way That We Measure Consumers' Product Involvement Levels: How Wine Awards Exposed Differing Involvement Levels	Universal Journal of Management	4	11	615	620
Nishiyama Y	2023	Wine quality and pricing in the global wine export market: the case of Chilean wines	Applied Economics Letters	30	7	986	990

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Noparumpa T; Kazaz B; Webster S	2015	Wine Futures and Advance Selling Under Quality Uncertainty	M&Som-Manufacturing & Service Operations Management	17	3	411	426
Oczkowski E	2018	Modelling prices and the reputation of individual named wines	Applied Economics	50	32	3464	3476
Oczkowski E	2016	The Effect of Weather on Wine Quality and Prices: An Australian Spatial Analysis	Journal of Wine Economics	11	1	48	65
Oczkowski E	2016	Identifying the Effects of Objective and Subjective Quality on Wine Prices	Journal of Wine Economics	11	2	249	260
Oczkowski E	2017	The preferences and prejudices of Australian wine critics	Journal of Wine Research	28	1	56	67
Oczkowski E	2016	Hedonic wine price functions with different prices	Australian Journal of Agricultural and Resource Economics	60	2	196	211
Oczkowski E	2001	Hedonic wine price functions and measurement error	Economic Record	77	9	374	382
Oczkowski E, Doucouliagos H	2015	Wine Prices and Quality Ratings: A Meta-regression Analysis	American Journal of Agricultural Economics	97	1	103	121
Oczkowski E, Pawsey N	2019	Community and Expert Wine Ratings and Prices	Economic Papers	38	1	27	40
Odorici V, Corrado R	2004	Between Supply and Demand: Intermediaries, Social Networks and the Construction of Quality in the Italian Wine Industry	Journal of Management & Governance	8	2	149	171
Oleksy P, Czupryna M, Jakubczyk M	2021	On Fine Wine Pricing across Different Trading Venues	Journal of Wine Economics	16	2	189	209
Onur I, Bruwer J, Lockshin L	2020	Reducing information asymmetry in the auctioning of non-perishable experience goods: The case of online wine auctions	Journal of Retailing and Consumer Services	54	102060		
Orth U	2001	Quality signals in wine marketing: the role of exhibition awards	The International Food and Agribusiness Management Review	4	4	385	397
Outreville JF, Le Fur E	2020	Hedonic Price Functions and Wine Price Determinants: A Review of Empirical Research	Journal of Agricultural & Food Industrial Organization	18	2		
Paroissien, E; Visser, M	2020	The Causal Impact of Medals on Wine Producers' Prices and the Gains from Participating in Contests	American Journal of Agricultural Economics	102	4	1135	1153
Parr WV, Green JA, White KG	2006	Wine judging, context and New Zealand Sauvignon Blanc	European Review of Applied Psychology-Revue Européenne de Psychologie Appliquée	56	4	231	238
Parr WV, Green JA, White KG, Heatherbell DA	2004	Exploring the nature of wine expertise: what underlies wine experts' olfactory recognition memory advantage?	Food Quality and Preference	15	5	411	420
Parr WV, Mouret M, Blackmore S, Pelquest-Hunt T, Urdapilleta I	2011	Representation of complexity in wine: Influence of expertise	Food Quality and Preference	22	7	647	660
Parsons AG, Thompson AM	2009	Wine recommendations: who do I believe?	British Food Journal	111	9	1003	1015
Pelet JE, Lecat B	2014	Smartphones and wine consumers: a study of Gen-Y	International Journal of Wine Business Research	26	3	188	207

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Penagos-Londoño GI, Ruiz Moreno F, Sellers Rubio R, Del Barrio-García S, Casado-Díaz AB	2022	Consistency of expert product reviews: An application to wine guides	Wine Economics and Policy	11	1	51	60
Priilaid D, Feinberg J, Carter O, Ross G	2009	Follow the leader: How expert ratings mediate consumer assessments of hedonic quality	South African Journal of Business Management	40	4	51	58
Priilaid D, Hall D	2016	Price-quality heuristic correlation with rates of product consumption	British Food Journal	118	3	541	559
Ramirez CD	2008	Wine Quality, Wine Prices, and the Weather: Is Napa Different?	Journal of Wine Economics	3	2	114	131
Reuter J	2009	Does Advertising Bias Product Reviews? An Analysis of Wine Ratings	Journal of Wine Economics	4	2	125	151
Ribeiro T, Corsi A, Lockshin L, Louviere J, Loose S	2020	Analysis of Consumer Preferences for Information and Expert Opinion Using a Discrete Choice Experiment	Portuguese Economic Journal	19	1	67	80
Rihn A, Jensen KL, Hughes D	2023	Quality assurance program provider's influence on wine purchases among Tennessee and US consumers: a multiple indicators multiple causes model analysis	International Journal of Wine Business Research	35	1	142	163
Rizo A, Bartu A, Laguna L, Tarrega A	2023	Effect of an opinion app on expectations and emotional responses of young consumers toward white wines	Food Quality and Preference	103	104706		
Roberts PW, Reagans R	2007	Critical Exposure and Price-Quality Relationships for New World Wines in the U.S. Market	Journal of Wine Economics	2	1	84	97
Rössel J, Beckert J	2012	Quality Classifications in Competition: Price Formation in the German Wine Market	MPIfG Discussion Paper 12/3				
Saenz-Navajas MP, Avizcuri JM, Echavarri JF, Ferreira V, Fernandez-Zurbano P, Valentin	2016	Understanding quality judgements of red wines by experts: Effect of evaluation condition	Food Quality and Preference	48	1	216	227
Santos JF	2011	Promoting Wine on the Internet: An Exploratory Study of the Portuguese Wine Blog Community	International Journal of Online Marketing	1	4	48	63
Sauvageot F, Urdapilleta I, Peyron D	2006	Within and between variations of texts elicited from nine wine experts	Food Quality and Preference	17	6	429	444
Scaman CH, Dou J, Cliff MA, Yuksel D, King MC	2001	Evaluation of wine competition judge performance using principal component similarity analysis	Journal of Sensory Studies	16	3	287	300
Schamel G	2000	Individual and collective reputations indicators of wine quality	CIES Working Paper No. 10				
Schamel G	2004	An Empirical Analysis of Online Auction Prices for Bordeaux Wine	Zeuthen Workshop 2004 - Working Paper				
Schamel G, Anderson K	2003	Wine quality and varietal, regional and winery reputations: Hedonic prices for Australia and New Zealand	Economic Record	79	246	357	369

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Schamel G, Gastaldello G	2022	Exploring online community wine ratings: are more popular wines rated higher?	Book of Abstracts of First Conference of the EuAWE - European Association of Wine Economists, Vila Real, Portugal, May 2022	1	1	156	158
Schamel G, Ros A	2021	Indicators of Individual Wine Reputation for Friuli Venezia Giulia	Italian Economic Journal	7	2	323	339
Schiefer J, Fischer C	2008	The gap between wine expert ratings and consumer preferences: Measures, determinants and marketing implications	International Journal of Wine Business Research	20	4	335	+
Schnabel H, Storchmann K	2010	Prices as Quality Signals: Evidence from the Wine Market	Journal of Agricultural & Food Industrial Organization	8	1		
Shapin S	2016	A taste of science: Making the subjective objective in the California wine world	Social Studies of Science	46	3	436	460
Smith B	2019	Getting More Out of Wine: wine experts, wine apps and sensory science	Current Opinion in Food Science	27	1	123	129
Spence C, Wang QJ	2019	Wine expertise: perceptual learning in the chemical senses	Current Opinion in Food Science	27	1	49	56
Steinberger M	2008	Every One a Critic The Future of Wine Writing	World of Fine Wine	18	1	130	135
Stuen ET; Miller JR; Stone RW	2015	An Analysis of Wine Critic Consensus: A Study of Washington and California Wines	Journal of Wine Economics	10	1	47	61
Thode SF, Taylor LW, Maskulka JM	2002	Information Asymmetries in the Pricing of Fine Wines	International Journal of Wine Marketing	14	1	5-13	
Thompson GM, Mutkoski SA	2011	Reconsidering the 1855 Bordeaux Classification of the Medoc and Graves using Wine Ratings from 1970-2005	Journal of Wine Economics	6	1	15	36
Thrane C	2019	Expert reviews, peer recommendations and buying red wine: experimental evidence	Journal of Wine Research	30	2	166	177
Tiwari P, Bhardwaj P, Somin S, Parr WV, Harrison R, Kulasiri	2022	Understanding Quality of Pinot Noir Wine: Can Modelling and Machine Learning Pave the Way?	Foods	11	19		
Tsai CW	2014	The specialized wine language: Comparitive study of tasting reviews	Revue Francaise De Linguistique Appliquee	19	1	116	130
Uniyal X, Barthwal P	2017	Wine Quality Evaluation Using Machine Learning Algorithms	Asia-pacific Journal of Convergent Research Interchange	3	4	1	9
Vaamonde A, Sanchez P, Vilarino F	2000	Discrepancies and consistencies in the subjective ratings of wine-tasting committees	Journal of Food Quality	23	4	363	372
Veale R	2008	Sensing or knowing?: Investigating the influence of knowledge and self-confidence on consumer beliefs regarding the effect of extrinsic cues on wine quality	International Journal of Wine Business Research	20	4	352	366
Veale R, Quester P.	2009	Tasting quality: the roles of intrinsic and extrinsic cues	Asia Pacific Journal of Marketing and Logistics	21	1	195	207

(Continued)

Table 1a. (Continued).

Author(s)	Publication year	Article title	Source title	Volume	Issue	Start Page	End Page
Vigar-Ellis D, Pitt L, Caruana A	2015	Does objective and subjective knowledge vary between opinion leaders and opinion seekers? Implications for wine marketing	Journal of Wine Research	26	4	304	318
Villas-Boas SB, Bonnet C, Hilger J	2021	Random Utility Models, Wine and Experts	American Journal of Agricultural Economics	103	2	663	681
Visalli M, Dubois M, Schlich P, Ric F, Cardebat JM, Georgantzis N	2023	A dataset on the sensory and affective perception of Bordeaux and Rioja red wines collected from French and Spanish consumers at home and international wine students in the lab	Data in Brief	46			
Visalli M, Mahieu M, Dubois M, Schlich P	2023	Hedonic valence of descriptive sensory terms as an indirect measure of liking: A preliminary study with red wines	Food Quality and Preference	108	104861		
Vogiatzis D, Pierrakos D, Paliouras G, Jenkyn-Jones S, Possen BJHHA	2012	Expert and community based style advice	Expert Systems with Applications	39	12	10647	10655
Ward DL	2012	A Graphical and Statistical Analysis of the Judgment of Princeton Wine Tasting	Journal of Wine Economics	7	2	155	168
Wei PS, Lu HP	2013	An examination of the celebrity endorsements and online customer reviews influence female consumers' shopping behavior	Computers in Human Behavior	29	1	193	201
Werdelmann T	2014	Quality and Value Creation on the Premium Wine Market	Journal of Applied Leadership and Management	3	1	47	72
Yang CY, Barth J, Katumullage D, Cao J	2022	Wine Review Descriptors as Quality Predictors: Evidence from Language Processing Techniques	Journal of Wine Economics	17	1	64	80
Zhao W, Zhou XG	2011	Status Inconsistency and Product Valuation in the California Wine Market	Organization Science	22	6	1435	1448

Finito di stampare da
Logo s.r.l. – Borgoricco (PD) – Italia

WEP
Wine Economics and Policy

Table of contents